LAPPEENRANTA-LAHTI UNIVERSITY OF TECHNOLOGY LUT
School of Engineering Science
Degree Programme in Industrial Engineering and Management

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DEVELOPMENT OF KNOWLEDGE MANAGEMENT AND SUPPLIER & STAKEHOLDER COLLABORATION IN THE PROJECT-BASED SUPPLY CHAIN

Master's Thesis

Examiner: Professor Timo Pirttilä

ABSTRACT

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Development of knowledge management and supplier & stakeholder collaboration in the project-based supply chain

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The goal of the study was to create a general view about current state of the case organization's project knowledge management in connection with stakeholder collaboration. The second goal was to find development areas and suggest ideas to develop more systematic processes and practices related to the focus area suppliers. The study examined the questions: what is the current status of project knowledge management in the case organization, and how can the supply chain management and profitability of the business be improved by developing the project knowledge management and supplier & stakeholder collaboration? The study was carried out as a qualitative case study and the data was collected through semi-structured interviews. Regardless of possible connections to IT and knowledge management tools, the study was not made from the IT point of view.

As a result, the general view provides a basic understanding of the characteristics and scale of the project specific interaction with the supply organization's stakeholders. In was found, that the case organization has a substantial amount of interaction with its internal and external stakeholders in the course of the projects. The external interaction is based on an efficient internal knowledge management, so it can be said that attention must be paid both to the internal and external knowledge exchange. The early phases of the project are important, because more than 50 % of the interaction takes place prior to the purchasing phase. That can be seen as a difference between project-based and non-project-based businesses. According to the findings and the literature, the project-based businesses have distinctive characteristics when it comes to stakeholder interaction and knowledge management.

As a result of the focus area analysis, 16 proposals for 15 development areas were formulated. As for feasibility, the proposals are concrete and incremental, and most of them are rather simple to put in practice. No radical change management would be needed. However, the proposals can help the case organization in improving the prerequisites for the project knowledge management, and the project stakeholder interaction and collaboration. Additionally, they can help to reduce the supply chain costs. In the long term, lower costs enable more competitive sales prices and hence the company can gain its competitive advantage on the market.

TIIVISTELMÄ

Lappeenrannan-Lahden teknillinen yliopisto LUT
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Tuotantotalouden koulutusohjelma

Sami Luukkonen

Tietämyksenhallinnan sekä toimittaja- ja sidosryhmäyhteistyön kehittäminen projektiliiketoiminnan toimitusketjussa

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Tämän diplomityön tavoitteena oli luoda yleiskuva kohdeorganisaation projektitiedon ja projektitietämyksen hallinnasta sidosryhmien kanssa käytävään yhteistyöhön liittyen. Toinen tavoite oli syventyä fokusalueeseen, löytää sieltä kehityskohteita ja muodostaa ehdotuksia, joiden avulla voidaan kehittää systemaattisempia prosesseja ja käytäntöjä suorien toimittajien kanssa käytävään yhteistyöhön liittyen. Tutkimuksessa perehdyttiin nykytilan lisäksi siihen, miten toimitusketjun hallintaa ja liiketoiminnan kannattavuutta voidaan parantaa projektitiedon ja projektitietämyksen hallintaa sekä toimittajayhteistyötä kehittämällä. Tutkimus tehtiin kvalitatiivisena tapaustutkimuksena ja tiedonkeruumenetelmänä käytettiin puolistrukturoitua haastattelua. Vaikka tutkimuksessa puhutaan tiedosta ja tiedonhallinnasta, niin sitä ei tehty informaatioteknologian (IT) näkökulmasta.

Tutkimuksen tuloksena saatu yleiskuva antaa käsityksen kohdeorganisaation projektisidosryhmien kanssa käytävän vuorovaikutuksen laajuudesta ja sen erityispiirteistä. Keskeisiä havaintoja ovat mm. se, että kohdeorganisaation eri toiminnoilla on projektin eri vaiheiden aikana paljon vuorovaikutustilanteita eri sidosryhmien kanssa. Jotta toiminta ulkoisien sidosryhmien kanssa olisi tehokasta, niin organisaation sisäiseen tietämykseen liittyvän toiminnan on oltava tehokasta. Tärkeää oli myös huomata se, että yli 50 % vuorovaikutuksesta tapahtuu ennen ostotilausvaihetta, mikä tarkoittaa sitä, että projektin ensimmäisillä vaiheilla on suuri merkitys projektin toteutuksen kannalta. Tämä voidaan myös nähdä erona standardituotevalmistukseen. Sekä tutkimustulosten ja kirjallisuuskatsauksen perusteella voidaan sanoa, että projektiliiketoiminnassa tietämyksenhallintaan ja sidosryhmien väliseen vuorovaikutukseen liittyy huomioon otettavia erityispiirteitä. Fokusalueanalyysin tuloksena 15 kehityskohteelle muodostettiin 16 toiminnan kehittämiseen liittyvää ehdotusta. Toteutettavuudeltaan ehdotukset ovat paitsi konkreettisia, myös inkrementaalisia. Niiden toteuttaminen ei vaadi radikaaleja muutoksia organisaatiossa. Ehdotukset voivat kuitenkin auttaa kohdeorganisaatiota luomaan edellytykset tehokkaammalle ja systemaattisemmalle projektitietämyksen hallinnalle ja sidosryhmien väliselle vuorovaikutukselle. Pitemmällä aikavälillä ne voivat auttaa alentamaan toimitusketjunhallintaan liittyviä kustannuksia ja tätä kautta yrityksen kannattavuutta ja kilpailukykyä.

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Järvenpää, 31 of May 2021

Sami Luukkonen

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ABBREVIATIONS

ATO	Assemble to Order
ERP	Enterprise Resource Planning
KM	Knowledge Management
MTS	Make to Stock
OC	Order Confirmation
OEM	Original Equipment Manufacturer
PM	Project Management
PMO	Project Management Office
PO	Purchase Order
PR	Purchase Requisition
RFQ	Request for Quotation
S&OP	Sales and Operations Planning
SCM	Supply Chain Management

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1. INTRODUCTION

Efficient supply chain management (SCM) is based on information exchange between stakeholders in the supply network. Supply chain stakeholders can be divided into three basic entities: a producer, a supplier and a customer. All three entities have their own roles: the supplier is responsible for the delivery of the materials to the producer, who respectively produces the final products and sales them to the customer. These three entities are connected by four basic flows of supply chain: information flow, product/service flow, cash flow, reverse product flow. This basic arrangement applies to both enterprise internal and external supply chains. (Ross 2018, 20) The objective of today's supply chain model is to enhance the competitive advantage of the whole supply network. It can be achieved by close stakeholder collaboration in the areas of coordination, lowering costs, improving the lead-times, eliminating bottlenecks and eliminating quality problems. In principle, individual companies do not compete against each other, but it rather comes down to competition of supply chain against supply chain. The competitiveness is based on success of the network and partnership. (Waters & Rinsler 2014, 3)

1.1. Background

SCM strive to ensure that a project organization has adequate knowledge, tools and skills to deliver the product or service in time, on budget and at acceptable level of quality (Basu 2019, 19). Supply chain in project-based business has some distinctive characteristics in comparison to other type of businesses that purely focus on less project-based strategies, such as MTS or ATO manufacturing. They have specific relational context, perspective of value creation, type of complexity and they involve a high degree of uncertainty. In addition there are limited possibilities for standardization (Wikström et al. 2010, 833). Especially large projects involve a very large number of purchase orders and correspondingly a lot of supplier coordination and interaction. Time issues are one of the complex and challenging characteristics in a project business. During the project execution, managing of material flows is critical in order to keep the project schedule and also, to ensure efficient use of resources, site labour and equipment (Lundesjö 2015, 14-18). Knowledge integration between upstream and downstream partners is a source of competitive advantage (Jayaram & Pathakb 2012, 1958).

It is likely that logistics in the construction business is not as advanced as in some other businesses due to characteristics of the business, unique location of the project, possible

constraints of the site and cultural barriers. In addition, legislation and regulations are different in different countries (Lundesjö 2015, 71). The port crane business is comparable to the construction business in this respect, as it involves similar characteristics.

Today's project business environments can be quite complex which means that it can be very challenging to link external sources of information to other systems involved in SC processes. It has also been recognized that companies do not always properly integrate the information that they have at their disposal into their own operations. It is possible that companies collect information for development purposes, but they do not actually use the information to steer their day-to-day operations (Holweg et al. 2005, 171). Material flows in a supply chain are managed using information that can be divided in different categories. It can be for example commercial, technical, or it can be related to schedules or quality. It can be implicit or explicit. There are also many ways to share information across the supply network. Therefore it is important for organizations to "know what they know, know where they put their information, where to find it and who to ask". They must also know "what they allowed to do with their information" (Schopflin & Walsh 2019, 8). For that reason, project knowledge management is important in project management.

The case organization belongs to a fully project-based business unit focusing on serving customers in ports, terminals and shipyards. The main products portfolio comprises manned and fully automated container and shipyard cranes. The case organization is responsible for the supply operations. The business of the business unit has grown considerably during the last years through organic growth and acquisitions. In consequence, the number of projects and delivered cranes as well as the need for different delivery and manufacturing concepts have increased a lot. The supply network is truly global and crane projects involve large volume of purchasing activity. The business unit has many internal and external component suppliers and subcontractors. In addition to direct suppliers, the network consists of companies that are considered indirect suppliers, for example insurance companies, different service providers and forwarding companies.

Actual collaboration is often extended to tier 2 suppliers. The end-customers are located in different countries and the project execution is always based on the performance of global supply chain networks. The sourced materials and fully erected cranes must be shipped to their destinations safely, timely and cost efficiently, before the cranes can be handed over to the customer. As a result of acquisitions, the company has merged several new business entities

within the material handling business in which the case organization operates. That has brought not only great opportunities, but also challenges related to the internal and external stakeholder collaboration. At the same time, the case company seeks to improve competitive advantage and profitability through supply chain management.

These factors create the underlying motivation for this study. The case company has initiated development programs in many areas, for example implementation of lean practices, and developed systems for information exchange with suppliers. However, the project stakeholder collaboration and the project knowledge management have not been previously studied to such an extent that there would be a holistic and up-to-date understanding about them.

1.2. Objectives, limitations and research questions of the study

The goal of the study is first to create a general view about the current state of the supply organization's project knowledge management in connection with stakeholder collaboration. After the general view, the focus of the study would be narrowed down to direct suppliers. The objective is to find development areas and suggest ideas to develop more systematic processes and practices related to the focus area suppliers. However, the objective is not to initiate any suggested development projects. Instead, the results and the conclusions of the study could be used as a groundwork for planning of further development projects in the supply organization and help other functions within the enterprise (e.g. IT) better understand the supply organization's perspective and distinctive characteristics. Regardless of possible connections to information and knowledge management tools, the study is not made from information technology (IT) point of view.

Research questions of the study:

1. What is the current status of the project knowledge management in the supply organization?
2. How can the supply chain management and the profitability of the business be improved by developing the project knowledge management and supplier and stakeholder collaboration?

1.3. Structure of the study

The structure of the study consists of a theoretical part and an empirical part. The latter one is divided into two parts called the general view and the focus area analysis. In total there are six main phases in the study, named respectively as: Study scope, Literature review, 3 Empirical part 1, Empirical part 2, Analysis and finally Conclusions & practical implications. They are discussed in detail in chapter 4. The study is carried out as a qualitative case study and the data is collected through semi-structured interviews. In addition, the case company's internal documents, data bases, process descriptions as well as support from the supervisor of the study are utilized.

In order to enable a smooth starting for this study, a particular pre-study was carried out in advance by the author of this study in collaboration with the case organization. The pre-study provides valuable background knowledge about the case organization's internal and external project stakeholders. The pre-study is illustrated in appendix 1.

1.4. Structure of this report

This report includes seven chapters. The chapter 1 is an introduction, in which the motivation, background, objectives, limitations and research questions of the study are discussed. The chapter 2 and 3 are theory chapters, consisting of the literature review of the underlying SCM, KM and PM theories. The synthesis of these disciplines creates the basis for the theoretical framework for this study. In the chapter 4 the framework of the study is discussed and research structure including the main process phases and the research methodology are explained in writing and visualized in a complementary figure. The case company and organization are briefly presented as well. The chapter 5 is focused on the analysis of the findings. First phase of the empirical part is called the general view, and the findings are explained and illustrated in figures. The second phase of the empirical part is the focus area analysis. In this part, the selection criteria for the focus area is discussed, the findings are explained and illustrated in figures, and finally the development proposals are presented. In the chapter 6 the conclusions from the findings and the research process are discussed. In addition, the research questions are answered. Finally, in the chapter 7 the study is summarized.

2. SUPPLY CHAIN MANAGEMENT

Supply chain can have many different definitions depending on the perspective of the organization or the person answering the question. Ayers, for example, says that there is a ”definition problem” related to supply chain terminology (2006, 3). Some logistics practitioners might say that it is about transportation and warehousing because these people have typically focused on moving and storing goods. On the other hand, those who are working on manufacturing might say that the definition relates to manufacturing technologies or lean approaches that improve internal productivity. Perhaps the broadest interpretation would suggest that supply chain starts when minerals and raw materials are mined from the Earth, and ends with the disposal of the product after is used (Ayers 2006, 4).

2.1. Definition of supply chain management

It is commonly acknowledged that supply chain can include the physical movement of goods, information and financial movement as well as the creation and deployment of intellectual capital, or knowledge. Despite its importance, the knowledge is sometimes considered less important than the physical flow in the supply chain discussion. Ayers (2005, 5) however says that they all can be equally important in many supply chains. Supply chain does not take a stand on direction of flow, because it does not only mean a one-way flow from suppliers to end-users. In supply chain there are backward flows as well, for example for product returns, repairs, payments and other reasons. In other words, it is a two-way process of physical products, information, money and knowledge. The primary mission of supply chains is to match supply and demand. (Ayers 2006, 5)

One conception of logistics management is that it helps in coordination, optimization and integration of logistics activities across the organization’s functions such as marketing, sales, manufacturing, finance and information technology (Lundesjö 2015, 11-12). The management of logistics and the management of supply chain are cognate subjects, but they are considered separate critical functions (Ross 2018, 4). Logistics is part of supply chain management. Together they enable companies to create competitive value by optimizing operation costs and productivity as well as resource utilization. The prerequisite for all that is a close collaboration and integration with partners within the supply chain system.

When logistics management is understood more broadly, so that it covers all flows upstream to suppliers and downstream to end-customers, the concept can be considered supply chain management (Waters & Rinsler 2014, 2). Supply Chain Management is therefore a broader approach than logistics management, as it focuses on interaction of stakeholders within the supply chain. In practice, the question is, how to develop collaboration so that all parties involved can perform more efficiently and how these parties could work better together. Collaboration and communication are in the focal point (Lundesjö 2015, 10-12). Supply chain management integrates process capabilities and marketplace objectives on tactical and strategic level in collaboration with suppliers, customers and other trading partners (Ross 2018, 9) and the philosophy of supply chain management is based on partnership and linkages between entities in supply chain network, as Water & Rinsler suggest (2014, 3).

According to Ross (2018, 5) the role of supply chain management is:

> "*to generate unique sources of customer value through the creation of collaborative partnerships that leverage the resources, capabilities, and competencies of channel members to increase the competitive advantage of the entire channel system.*"

He continues with following definitions (Ross 2018, 38):

> *"Supply chain management enables channel businesses to function as an integrated, customer-centric supply ecosystem that delivers goods and services to the marketplace at the lowest possible cost. By leveraging the resources and competencies of channel partners, supply chains function as a seamless supply system focused on total customer satisfaction."*

Kawa & Maryniak have yet another viewpoint to the discussion and they suggest that supply chain management could also be seen as demand chain management because the chain is driven by the customer demand. In that approach, the customer is not at the end of supply chain but in the start of it. In a way, the supply chain is turned the other way around. However, Kawa & Maryniak complement other researchers' opinions and state that effective SCM requires integration so that the whole potential can be utilized. Supply chain integration is basically alignment, linkage and coordination of people, processes, information and knowledge between all parties in the supply chain. The objective is to respond to customer needs and effectively as

well as efficiently manage the flows of material, money, information, and knowledge. (Kawa & Maryniak 2019, 4)

According to Ross (2018, 10) SCM consists of six strategic competencies in figure 1:

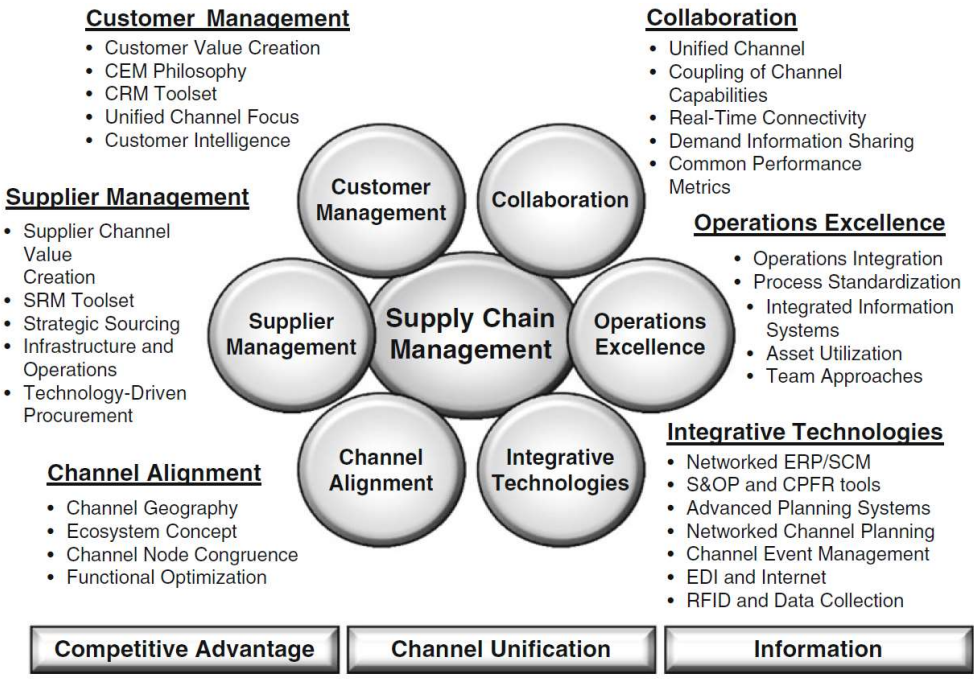

Figure 1: Supply chain management competencies

The Customer Management per se is out of the framework of this study, but remaining five strategic competencies are explained as follows Ross (2018, 10-14):

- Supplier Management:
    - In the context of collaboration, it focuses on the real-time synchronization the requirements of buyers with capabilities of the suppliers, cost reductions and quality
    - Technology toolset enables the real-time communication within the global network by using integrative tools for simultaneous synchronization of demand and supply
    - Integrated procurement infrastructures: establishment of an infrastructure that can integrate new service providers and support partners (e.g. payment, logistics, shipping and other procurement-related)

- Channel alignment:
    - Structure of supply chain should be composed of supply and delivery nodes and linkages that connect them, instead of series of separate trading dyads (dyadic partnerships). Without that, the network will lose its potential for cost management objectives, resource synergies, and overall competitiveness
    - SCM should focus on congruence of network nodes and all stakeholders must ensure that their strategy and operational objectives simultaneously provide competitive advantage for the company and the collective network
- Integrative technologies:
    - Information technologies that enable a transparent single view of the supply chain. They enable companies to synchronize channel resources and competencies to deliver superior customer service
- Operations excellence:
    - At its best, operation excellence requires every company in the network to optimize their performance and contribute so that it helps to act as a single integrated team
    - Utilization of standard processes and shared information technologies makes it possible to access a wider range of competencies, than what an individual company could access by acting on its own
- Collaboration:
    - There are different levels of intensity of collaboration, but it is always crucial that partners have willingness to engage and continuously enhance the collaborative relationships

2.2. Integrated supply chain framework

Notwithstanding the exact structure, the supply chain network can be divided in two segments: the process value chain and value delivery network, as illustrated in figure 2. The first segment consists of materials, components and resource suppliers that are used to produce the product. In this segment, information of product requirement is first received and then translated into the products and services that customer demand. After that stage, the second segment is entered. The objective now is to structure supply channels that enable effective delivery of the products

and the services to the customer. The exact structure of the supply channel should be based the nature of demand and capabilities of the channel stakeholders. (Ross 2018, 21)

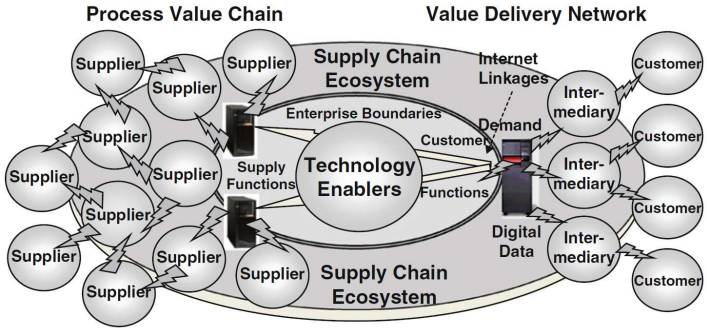

Figure 2: Integrated supply chain framework (Ross 2018, 21)

2.3. The rationale behind today's supply chain management from collaborative perspective

The importance of SCM has not always been axiomatic until the end of the 1990s. Thereafter the business environment change was determined by the acceleration of globalization, rapid development of Internet technologies, increased outsourcing, reengineering of business processes and increasing power of customer. Companies realized that their core competencies were no longer a guarantee for success, and they had to look to the resources and capabilities of their external supply partners. The role of external partners had been rather informal, short-term and tactical. In this stage, however, companies begun to adopt a different approach. They wanted to optimize and synchronize the productive competencies of the entire supply chain, and they began to create strategies that were based on close collaborative partner relationships. That can be considered a dramatic paradigm shift towards supply chain management. The boundaries of internal departments become blurred and previously isolated partners now comprise unified virtual supply chain system that consists of three identifiable elements (Ross 2018, 19):

1. Expanded view of logistics operations management. Previous stages of logistics focused on optimization of internal logistic operations whereas SCM shifts the emphasis to close integration of all enterprise functions. The orientation is external instead of internal. Logistics functions are still in a key position

2. Extension of integrated logistics management to encompass opportunities for competitive advantage occurring outside company boundaries. External integration helps companies seek productivities and competitive space with their external stakeholders and alliances. Utilization of networking technologies enable companies to integrate their business strategies with their supply chain partners
3. New strategic view of channel management. Understanding the value of strategic dimensions. The combination of external orientation and networking capabilities enables companies to create a shared competitive vision, construct co-evolutionary channel alliances and manage complex supply channel relationships. In addition, order-of-magnitude advances can be achieved

2.4. Competitive advantages through supply chain management

In the 1980s it was often highlighted that competitive advantage can only come from either though cost leadership or differentiation in the market. Many researchers, for example Waters & Rinsler and Spanos & Lioukas refer to Porter, who suggested that a company can be a low-cost producer, differentiated supplier (Waters & Rinsler 2014, 1) or focused supplier (Spanos & Lioukas 2001, 909). The traditional model at that time was based on the perspective of individual companies that were focusing on means that could best serve their own benefits and give them an opportunity to maximize their revenues and minimize their costs. These companies were not interested in impact on other companies in the supply network. Later on companies have realized that it is not only product price or differentiation but the company's core capabilities that can make it possible for company to maintain and gain its competitive advantage. For example, logistics can be considered a core capability. Objective of today's supply chain model is to enhance the competitiveness of the whole supply network. It can be achieved by close coordination, lowering costs, improve the lead-times, eliminating bottlenecks and eliminating quality problems. In principle, individual companies do not compete against each other, but it is a question of the competition between supply chains. (Waters & Rinsler 2014, 2-3)

So, the competitiveness is based on the success of the network and partnership. When companies focus on lowering supply chain costs and enhancing the competitiveness, the topic can be viewed through a model that divides the costs into six areas: manufacturing cost, administration cost, warehouse cost, distribution cost, capital cost and installation cost. The

administration costs are interesting from the viewpoint of SCM because they include administrative costs such as order handling, purchasing, handling of claims and cost for managers and support functions for supply chain (Pettersson & Segerstedt 2013, 359-360). An improvement in this area alone can help companies reduce costs and, for its part, enhance the competitive advantage.

The context can be taken yet another step further when all support systems and activities are incorporated to improve and manage primary activities through utilization of the company's human, financial, material, and informational resources. That coherent combination is called supply chain systems (SCS). The purpose of SCS is not only to ensure that products are purchased, manufactured and delivered to right place at the right time in the right quality. Instead, Martel & Klibi suggest that SCS is one of the most important tools to create sustainable competitive advantage. In the end, SCS is destined for creating value for the company and its stakeholders (Martel & Klibi 2016, 21).

2.5. Supply chain in projects

The importance of supply chain management to any major project is discussed in the literature. For example Basu (2011, 19) says that *"supply chain management contributes a critical knowledge and tool set for any project management team. The adequate application of the knowledge base, tools and skill sets can assist the project team's delivery of the product or service in time, on budget and at acceptable level of quality".*

Supply chain in the project business has some distinctive characteristics. Especially large projects involve a very large number of purchase orders and correspondingly a lot of supplier coordination (Lundesjö 2015, 18). Time issues are one of the complex and challenging characteristics in project businesses. During a project execution, managing of material flows is critical for two reasons. Firstly, to keep the project schedule and secondly, to ensure efficient use of resources, site labour and equipment (Lundesjö 2015, 14). It is likely that logistics in the construction business is not as advanced as in some other businesses due to characteristics of the business, unique location of the project, possible constraints of the site and cultural barriers. In addition, legislation and regulations are different in different countries (Lundesjö 2015, 71). Responsibilities of SCM vary depending on industry but especially in the businesses where site operations are involved, SCM has support roles alongside with their primary purpose. That may

include for example security, cleaning, safety, welfare, site accommodation, community relations, emergency evacuation and first aid (Lundesjö 2015, 64). A main contractor (OEM) also needs skills and capability to efficiently manage and supervise the process relying on different on-site subcontractors. When this is done well, the operational excellence i.e. efficiency, quality and safety are improved. However, if things are not properly managed, they will develop in the opposite direction (Lundesjö 2015, 78).

According to evidence there are many harmful consequences of poor management of supply chain (Lundesjö 2015, 17-18):

- Additional costs: on average 10 % of the working day of site personnel can be lost due to waiting for materials, or collecting materials and tools
- Poor quality: if materials are late, the work is interrupted. Also, it is unlikely that working on site will produce the same quality as what could have been achieved if the products were made in factory (that is, if the job must be done on site to avoid further delays)
- Poor image of the industry: excessive non-value adding unskilled jobs done by skilled people is not encouraging and do not enhance good image
- Increased project time: due to unnecessary interruptions and late materials

Despite well-working and efficient collaboration and SCM, it is likely that there will be unforeseen shortages and material requirements due to component failures, poor quality or another emergency demand (Lundesjö 2015 s. 29). In connection to the scope of coordination, it has been increasingly recognized that supply chain management needs to be extended beyond the tier 1 subcontractors and suppliers so that the entire supply chain can be kept in continuous control (Lundesjö 2015, 84). Improvement actions can be taken on a strategic and an operational level. The strategic activities involve, for example, more integration and collaboration between the logistics function on site and procurement function (given, that procurement is considered a strategic function). Operationally it would be better communication and coordination with stakeholders (Lundesjö 2015, 71).

According to the Guide to the Project Management Body of Knowledge (PMBOK Guide), which is published by The Project Management Institute (PMI), a project is defined as "*a temporary endeavor undertaken to create a unique product, service, or result*" (PMI 2017, 4).

A Temporary endeavour means that each project has a definite beginning and end, but it does not take a stand on duration of a project (PMI 2017, 5).

A unique product refers to project deliverables, for example components, items or a combination of several products (PMI 2017, 4), accomplishment of events, replacement of machinery (Eskerod & Jepsen 2016, 5). There may be repetitive elements in projects or activities that are used to execute projects, which means that certain basics and unique procedures and teams may remain unchangeable, and the same materials can be used. However, each project has its unique characteristics, for example design, location, environment, situation and people involved (PMI 2017, 4). A location can be unique in terms of an end-customer's location or different manufacturing (subcontractor or factory) locations.

Repetitive elements also refer to an organization. Despite the temporary nature of projects, the organizations that are undertaking projects, can be permanent to certain extent. There are often permanent departments, even if individual people within these departments can change. Therefore it is possible for permanent organizations to identify possible inefficiencies in the course of time, and improve their processes accordingly (Eskerod & Jepsen 2016, 11).

Project-based companies make majority of products against bespoke designs for customers. There are three types of project-based companies (Ajmal & Koskinen 2008, 8):

1. Stand-alone companies that make products for external customers
2. Subsidiaries of larger firms that produce for internal or external customers
3. Consortiums of organizations that collaborate to serve third parties

Stand-alone companies often are "general contractors". According to Backhaus & König (2019, 217) in the "general contractor model" there is only one company having direct contractual relationships with the end-customer. The model is illustrated in figure 3. The general contractor also has contractual relationships with the suppliers so that the contract with the end-customer can be fulfilled. These suppliers do not have liabilities for the delivery of complete project defined in the contract with the end-customer. Backhaus & König (2019, 220-221)

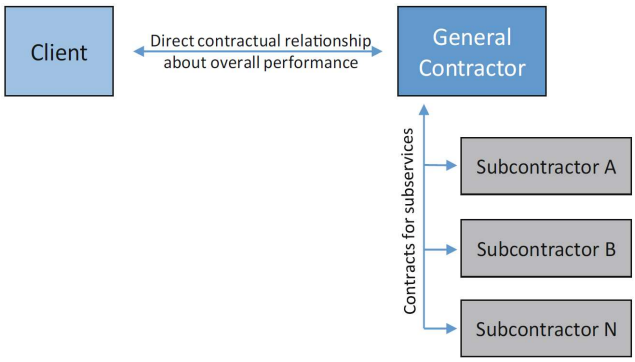

Figure 3: General contractor model (Backhaus & König 2019, 217)

According to the PMBOK (PMI 2017, 16) operations management is not in the scope of formal project management in this context. Operations management aims at ensuring that the processes that transform inputs into outputs, are efficiently managed. Inputs are for example materials, components, energy, and labor. Outputs in turn are products and services. Based on that description, and the definitions of supply chain management (Waters & Rinsler 2014, 43, 45; Ayers 2001, 9-10), it can be said that operations management is to certain extent in the scope of supply chain management. Thus, there is a close interaction between project management and supply chain management. Furthermore, interaction between these activities is operated through common project knowledge management activities. The knowledge areas are interconnected with the operations in the scope of project SCM. In this context, the PMI (2017, 23-24) defines the interrelated project knowledge areas that are used in most projects as follows:

- *Project Schedule Management. Includes the processes required to manage the timely completion of the project.*
- *Project Cost Management. Includes the processes involved in planning, estimating, budgeting, financing, funding, managing, and controlling costs so the project can be completed within the approved budget.*
- *Project Quality Management. Includes the processes for incorporating the organization's quality policy regarding planning, managing, and controlling project and product quality requirements, in order to meet stakeholders' expectations.*
- *Project Resource Management. Includes the processes to identify, acquire, and manage the resources needed for the successful completion of the project.*
- *Project Communications Management. Includes the processes required to ensure timely and appropriate planning, collection, creation, distribution, storage, retrieval, management, control, monitoring, and ultimate disposition of project information.*

- *Project Procurement Management. Includes the processes necessary to purchase or acquire products, services, or results needed from outside the project team.*
- *Project Stakeholder Management. Includes the processes required to identify the people, groups, or organizations that could impact or be impacted by the project, to analyze stakeholder expectations and their impact on the project, and to develop appropriate management strategies for effectively engaging stakeholders in project decisions and execution*

2.6. Building blocks of collaboration in project supply chain

Sometimes development of SCM may result in partial solutions to optimizing customer value. That may happen if all effort is focused on conventional practices of SCM without a holistic comprehension of the supply chain and its processes in connection with stakeholder collaboration. One way to create a better understanding is to view the topic though following building blocks (Basu 2011, 22-23).

Customer focus and stakeholders

The customer focus is important, because the demand is always created by the customer. From planning point of view, forecasts are crucial. According to Basu one prerequisite for supply chain process is knowledge and planning for the future demand. All ”pull” processes are put into practice in response to customer demand, but it is not possible to plan capacity and have enough resources and third-party services to respond to demand without forecasting. It is also important for project success to define success criteria with the with key stakeholders. (Basu 2011, 24)

Resources and time management

One of the main objectives of SCM is to optimize supply capacity because resources are not infinite, they are not available at short notice and they are expensive. In real life, this challenge may result in the situation where a company must balance between the cost of excessive capacity against the risk of losing business due lack of capacity (Basu 2011, 25). That process is often closely linked with the Sales and Operations Planning (S&OP) and results of the process are communicated with stakeholders (Martel & Klibi 2016, 114).

Procurement and supplier focus

Procurement and supplier focus refer to a typical process of buying of materials and strategic sourcing, such as placing agreements with suppliers. A company can also supplement its own capacity by buying external resources and capacity. It is important to improve the level of cooperation with suppliers and learn from them. A mutual trust, highly developed commercial relationship and efficient system for knowledge exchange enable success for all parties. (Basu 2011, 25-26)

The objective of project procurement is to obtain products, services, or results to the project. These project items are purchased or rented from outside the project team (Sanghera 2019, 228). The objective project procurement management is to manage and control the processes that are needed to develop and maintain contracts and operative purchasing for projects (PMI 2017, 459). Procurement can be managed so that there is a separate purchasing department responsible for these processes in an organization (PMI 2017, 459). From the perspective of project management, the procurement may seem to be a detached process. However, procurement processes involve many interactions with other, sometimes overlapping, project knowledge areas. The PMBOK Guide presents an overview of the Project Procurement Management processes in figure 4 below (PMI 2017, 460).

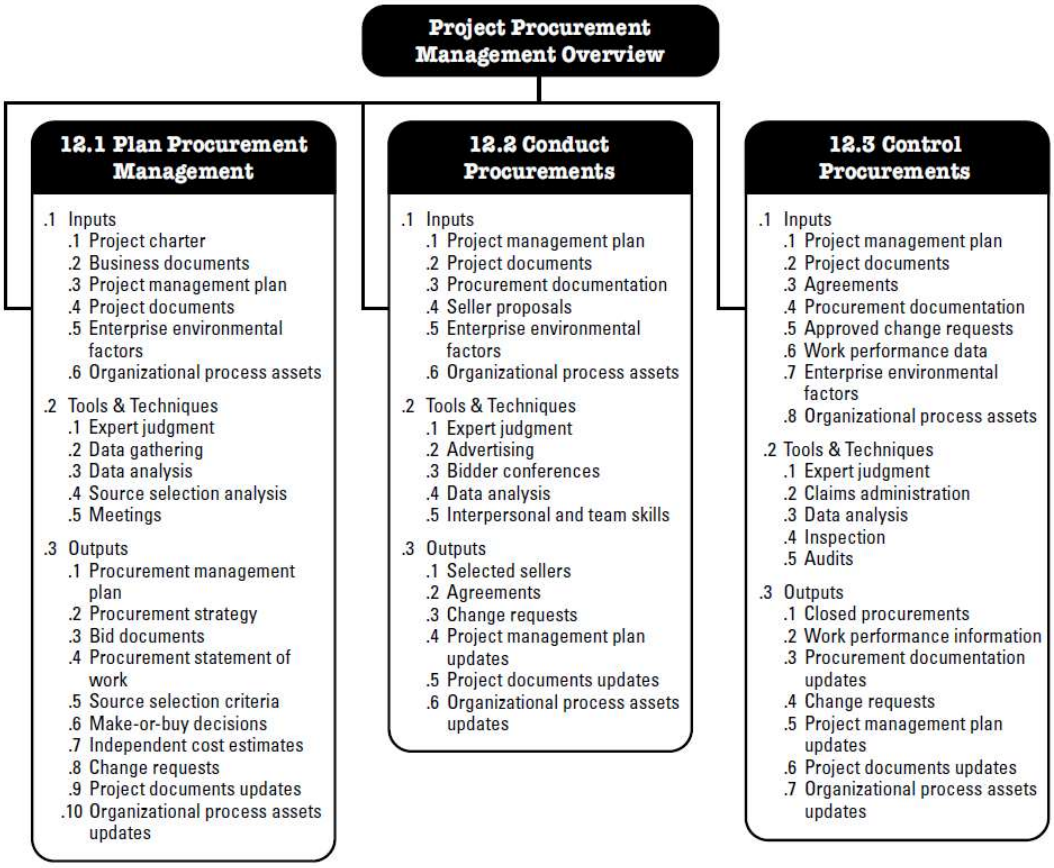

Figure 4: PMBOK Project Procurement Management processes (PMI 2017, 460)

Systems and processes

This area defines the three cross-functional processes that are used to integrate the building blocks. The first of which is external regulatory and internal standards. There are national and international regulatory requirements for example on packing, pallets, vehicles, forwarding and tariffs. In addition to being restrictive, they also enhance the effectiveness of collaboration between global stakeholders because the they do not allow culture-bound conceptions. (Basu 2011, 29) According to Martel and Klibi, the technologies must be based on international standards to be effective. For instance Legal Entity identifiers (LEI), labelling technologies, data sharing messages and Information highways enable efficient transactions and communication (Martel & Klibi 2016, 105).

The merger of EAN International and Uniform Code Council (UCC) in 2005 created GS1 (Global Standards 1) which is a single global body for standards. It is a non-profit organization which is serving businesses in 150 countries (Martel & Klibi 2016, 105). In Finland, for

example, its national organization is GS1 Finland. GS1 focuses on Supply chain in four core sectors: retail, healthcare, transport and logistics & foodservice. The sector ”Transport and logistics” is split in focus areas such as: Rail, Customs and Maritime & Ports. In the area Maritime & Ports the SC standards are (GS1 2020):

- Vessel identification, managed by the International Maritime Organisation (IMO) under the International Convention for the Safety of Life at Sea (SOLAS)
- Container identification, managed by the Bureau International de Containers (BIC), using the BIC code defined in ISO standard 6346
- Transport unit identification, using the GS1 Serial Shipping Container Code (SSCC), compliant with ISO/IEC 15459-1
- Shipment identification, using the GS1 Global Shipment Identification Number (GSIN), compliant with ISO/IEC 15459-6

In international business the customs formalities require that cross-border transaction and documents are in due form. For example, a commodity code must be declared for goods when they are imported or exported. A commodity code consists of six, eight or ten digits. Finnish Customs (Suomen Tulli) determines the codes as follows:

“Six-digit commodity codes are HS codes. They are used worldwide in monitoring trade volumes and applying international trade measures to goods. The HS nomenclature forms the basis for the 8-digit Combined Nomenclature and the 10-digit Taric Nomenclature” (Tulli 2020)

“Eight or ten-digit commodity codes are used in import and export declarations and in statistics declarations on internal trade between EU countries (Intrastat declarations).” (Tulli 2020)

The customs tariffs determine a fixed percentage of tax collected in goods, and they also define possible restrictions and prohibitions of the goods. If the commodity code is incorrect, the importer may be obligated to pay the not levied taxes retroactively (Tulli 2020). Discrepancies in commodity codes may also result in delays in transportation due to additional clarifications required by the local customs authorities. That in turn may cause severe project delays, and at worst liquidated damages. The information is required in global shipping when for example forwarding and transportation documents are prepared. In some organizations it involves collaboration with internal stakeholders, such as operative purchasing and project logistics.

Some countries have simplified the import-export formalities with free trade zones or foreign trade zones (FTZ), as called for example in the United States. They are areas where foreign goods are received, stocked, repacked and shipped to other countries without tariff payment formalities and with less bureaucracy. Typically, these areas are located around airports, sea terminals or multimodal hubs. These concessions may streamline the SCM practicalities in project shipping, but they still must be understood and taken into account. (Martel & Klibi 2016, 344) In conclusion, despite the existence of external and internal standards, it can be said that global import-export transactions are more complex that domestic transaction, because there are often two legal systems, two cultures and two currencies involved. In addition, geographical distances require ocean grossing and a use of multimodal transportation network. (Martel & Klibi 2016, 339)

The second cross-functional integrative process is comprised of financial and accounting procedures. Companies might lose sight of improving profitability if they myopically emphasize the short-term financial performance in response to stakeholder's expectations, or they are under pressure to participate in myopic fashionable improvement activities that do not support long-term development plans. (Basu 2011, 29)

The third cross-functional integrative process is Information and communication technology. IT solutions are nowadays an integral part of any supply chain. They enable communication, exchange, interpretation and use of information in many forms, such as data but also images and even voice and video. In the context of SCM, the data and its management cannot be over emphasized. In addition to conventional systems, concepts like e-supply chain, Internet of Things (IoT), smart factory, and industrial internet have been developed. They can be implemented within a single company, all entities within the global corporation or they can cover the whole supply network (Kawa & Maryniak 2019, 4-5). The data volumes are increasing, and it can even be said that the supply networks are competing with the information (Kawa & Maryniak 2019, 10). Companies, for example Konecranes, often promote they have integrated IoT features into their products or services to create more customer value, but IoT can also be seen as part of supply chain management (Konecranes 2020; Konecranes 2021).

Despite the large-scale investments on applications and technology in many companies, there are challenges involved, and things that should be taken into a consideration. However, they can be considered opportunities for development. It is suggested (Ben-Daya et al. 2019) that IoT will play an important role in supporting the supply chain management and it will have

certain benefits, for example real-time and item-level traceability through RFID, but many companies are not hurrying to implement or adopt it until they face external pressure such as regulations or strong requirement from customer. The reason for the reluctance according to research is, that despite perceived benefits, there are also doubts related to costs, trust of technology and significant risks concerning regulatory, cybersecurity, privacy, legal, standards and scalability (Kawa & Maryniak 2019, 10). Ben-Daya et al. refer to perceived risks of less security and privacy as well, but they consider these issues not only technical but also managerial barriers. They also mention that there is no solid framework that could provide model for IoT adoption in a supply chain context (Ben-Daya et al. 2019, 4734). In addition, IoT has great demands for the supply chain structure. The structure and processes should enable access and use of data throughout the network. Basically, the same features that are required in Smart Supply Chain (Kawa & Maryniak 2019, 10).

Today's companies have access to very large volume of information, but the volume, as such, or sharing all information always with everyone does not really result in desired outcome. There is the risk that no one will get the right information when it is needed (Kawa & Maryniak 2019, 4). The applications that support sequential information flow (for example EDI) are often separate from other applications and the implementation of these applications has often been done without changes to processes as it has been assumed that the software as such will support the actual physical processes and flows. The collaboration must take place in both virtual SC and physical SC (Kawa & Maryniak 2019, 8-9).

2.7. Collaboration with stakeholders in supply chain management

Good supply chain management is ideally based on long-terms partnerships, because they give the parties confidence in future and willingness to pay attention to development of processes. The parties can invest, not only in equipment, resources or capacity but also in standardized processes, procedures and better collaboration, beyond the scope they are contractually agreed to deliver. The success of a project requires effective processes, explicit obligations and capability to communicate a shared understanding with stakeholders. (Lundesjö 2015, 84, 92) Kawa & Maryniak suggest that the competence of the company is greatly dependent on its relationships. Business social relationships are handled by individuals with different interpersonal roles. Social relationships are important because they develop and maintain shared trust and confidence (Kawa & Maryniak 2019, 79-80). Lean culture also includes a

general principle whereby supplier relationships are based on mutual trust and commitment. Supplier commitment must be guaranteed (Barbosa et al. 2017, 120).

In project-based businesses, especially in large project businesses, a typical reason for collaboration has been the possibility to combine project-specific competences, such as process and product know-how from various areas. A single company does not have required know-how to manage projects alone. A local manufacturing can be technically or financially beneficial, but there can also be legal reasons to produce parts in the customer's country. It is also possible that the customer requests to use certain supplier in the project. Because of these reasons, projects often involve suppliers and stakeholders from many countries, which makes collaboration more complex. (Backhaus & König 2019, 210) Regardless of the nature of a project, typical reasons for failure are not ineffective project management practices, but instead lack of appropriate social interactions between the project stakeholders (Missonier & Loufrani-Fedida 2014, 1108).

Companies may have vertical and horizontal relationships with internal and external partners. Together they form a network of the company. According to Martel & Klibi, the expression networked company is "*a metaphor used to designate firms with non-negligible external networks aiming to achieve sustainable value creation by leveraging the resources of their partners and by continually seeking the best balance between their internal and external networks.*" (Martel & Klibi 2016, 208). Lundesjö emphasizes the importance of collaboration and suggest that in the development of collaboration, the company-centric focus should be switched to the mentality that the company is part of an external supply chain. In addition, the revenue becomes secondary to value creation. The collaboration becomes a key factor in order to fulfil the demand profitably through the end-to-end supply chain (Lundesjö 2015, 57). Holweg et al. suggest that supply chain can exist in many forms but in general it all comes down to transparency and visibility. To substantiate their point they add that collaborative supply chains and the close integration to suppliers are considered important factors in the success of Japanese production models (Holweg et al. 2005, 171).

In connection with the discussion on vertical and horizontal relationships, vertical relationships refer to partners within the value chain, such as suppliers and subcontractors. However, there are differences depending on the terms and perspectives. Vertical integration within a single company is related, but still a distinctive concept, that takes place when a company expands its expertise downstream or upstream in its value chain. For example, if a company has its own

manufacturing, it is vertically integrated. If a company decides to outsource certain function, for example manufacturing to its subcontractor, the company in question is vertically less integrated (Heikkilä & Ketokivi 2013, 47, 139-140). Horizontal organization, in turn, refers to integration and coordination between different functions or business units of a company (Heikkilä & Ketokivi 2013. 203, 255-266).

Supply chain collaboration has been discussed and promoted by consultants since mid-1990s and it has been broadly acknowledged that creating a synchronized and seamless supply chain has many undisputable advantages to companies. However, implementation of initiatives that aim at improving collaboration, has not been always successful (Holweg et al. 2005, 170). Lundesjö says that collaboration is essential but despite the advanced technology and collaboration tools, the level of integration between stakeholders may be low (Lundesjö 2015, 91). One possible reason according to Holweg et al. is, that despite their superficial simplicity, collaboration practices are not well defined, and thus not understood. For somebody, supply chain collaboration may mean placing a purchase order, whereas for another it may mean a complete philosophy on how to control a network across multiple tiers of their respective supply chain systems. Another reason for less successful collaboration is that companies have diverging views which causes conflict of interests and eventually decreased commitment to supply chain collaboration (Holweg et al. 2005, 170, 171).

Today's business environments can be quite complex which means that it may be extremely challenging, if not nearly impossible, to link external sources of information to other systems involved in SC processes. Furthermore, one finding in the literature is, that companies do not integrate the existent information that they have at their disposal into their own operations. Companies effectively just collect information for process development and performance measurement studies but do not actually use the information to steer their day-to-day operations (Holweg et al. 2005, 171). On the other hand, information exchange is essential but that alone is not quite enough, because planning decision structures should be changed as well to meet the needs in a given situation. If the structure of supply chain, the product characteristics and the type of collaboration do not match, it causes frustration in companies, because they do not get a financial return on supply chain collaboration. (Holweg et al. 2005, 176, 178) In case this is not properly understood, attempts to collaboration may be judged as being worthless.

It may be understood in companies that the success of projects requires effective and explicit communication with stakeholders, but sometimes, according to Lundesjö (2015, 92), the

processes seem to favour the ”silo mentality” which means that all stakeholders isolate themselves from others and focus on their own tasks trying to achieve local optimization. In addition, Waters & Rinsler (2014, 9-10) mention, that a typical problem in collaboration is an organizational structure, especially vertical organizations, because separate functions with clear identified tasks create narrow functional ”silos”, such as procurement, manufacturing, distribution. Efforts are then mostly focused on the use of resources instead of creating outputs, although the outputs (that is, customer satisfaction and profit) can only be achieved as a result of horizontal, cross-functional coordination and cooperation of these operations. According to Wikström et al. an example of internal barriers is lack of internal coordination between separate divisions and functions of the company. Each concentrating on a narrow part of the project. Deficiencies in this area cause disruption, conflicts and misunderstandings, if for instance certain functions are not involved early enough. (Wikström et al. 2010, 837)

Ross (2018, 15) also refers to indisputable benefits of collaboration, and according to his studies there are three barriers that may prevent companies from implementation. First, there are existing corporate cultures, that uphold tradition of internal silos. They are difficult to overcome, and they hinder creating an environment where openness and communication are highly valued. Second barrier is trust, which is quite widely discussed in the literature (for example Kawa & Maryniak 2019; Martel & Klibi 2016). Companies are not confident that their proprietary information will not be unfairly used against them, for example in negotiations, or that their information does not find its way to competitors. Third and perhaps the biggest barrier is today’s technology. Companies find it a real deterrent to shared collaboration if the computer systems are incompatible with other systems in the supply chain. Furthermore, it is perceived that it normally takes years of goodwill, investments in resources and proof of mutual benefit (Ross 2018, 15). In spite of the fact that the incompatibility of various software solutions or their interfaces is quite a common phenomenon, the cost of this problem is often underestimated (Backhaus & König 2019, 220-221). According to Reich et al. investments in information technology and in the professionalization of IT project managers have increased, but their effect on productivity gains have declined. Most companies have found it challenging to achieve considerable business value from their IT investments. (Reich et al. 2012, 663) There are general types of communication techniques that are applicable to various companies and businesses but there are also techniques that are associated with certain industry requirements. Some companies have their own systems, and these companies may require their suppliers to join to these systems, which may improve the collaboration between these particular companies,

but at the same time, it may complicate the supplier's processes with other customers (Kawa & Maryniak 2019, 80).

2.7.1. Levels of collaboration

Supply chain collaboration can be divided into four levels based on their collaborative intensity. The first level in figure 5 is basically focusing on internal functions and achieving of the local objectives. The second level means that collaboration is focusing on optimizing supply chain operations by linking inter-channel stakeholder logistic functions. On the next level, partners strive for linking core competencies and resources by developing collaborative strategies. On the fourth and final level, web-based interoperability technologies are utilized to create a completely integrated supply chain, which executes a common business strategy. When this level is successfully achieved, the customers can be provided with a "seamless supply engine". When stakeholders in a successful collaborative network utilize strengths of each other, they can create a superlative supply and delivery processes, and above all, provide total customer value (Ross 2018, 9, 14).

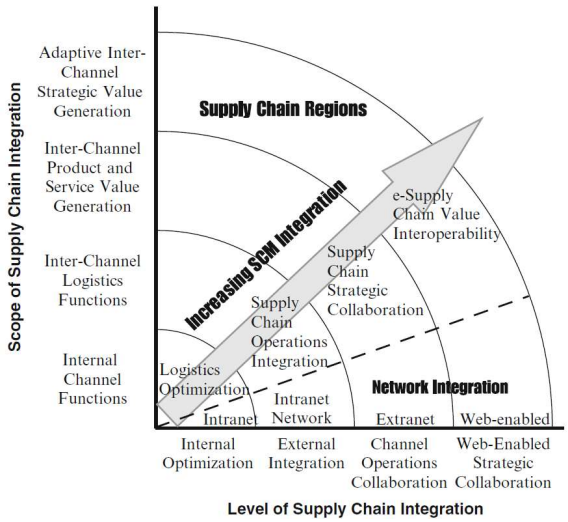

Figure 5: Span of collaboration in supply chain management (Ross 2018, 14)

Regardless of different frameworks and guidelines, there is not one-fits-all solution for collaboration, as businesses with different geographical fragmentation and distances, lead-times, products and demand characteristics require different type of collaboration. There are questions to be considered when choosing the most suitable approach. For example

geographical dispersion: the greater the number of individual nodes between supplier and customer, the greater effort it takes to synchronize them, and the less benefit can be achieved through individual collaboration. Holweg et al. take an example from customer collaboration in Cloetta Fazer's consumer business. They suggest that it might be justified to focus on implementing collaboration with a few main customers according to a pareto curve of customer demand in terms of volume. That is found to yield greater benefits than making great effort trying to collaborate with all customers. (Holweg et al. 2005, 178) However, this is just one example and does not serve all situations, especially collaboration upstream to suppliers.

2.7.2. Stakeholder management

In the literature there are many definitions for stakeholders, such as "i*ndividuals and constituencies that contribute, either voluntarily or involuntarily, to its wealth-creating capacity and activities, and who are therefore its potential beneficiaries and/or risk bearers.*" (Eskerod & Larsen 2018, 164). A project stakeholder can be defined as "*any individual or group who can affect or be affected by the project process or the project outcomes*" (Eskerod & Larsen 2018, 162), or "*an individual or an organization that can affect or be affected by the project execution*" (Sanghera 2019, 5). If a stakeholder is an organization, it typically involves several persons or entities (Eskerod & Jepsen 2016, 6). Project stakeholders can be internal or external. According to PMI there are for example following internal stakeholders: sponsor, resource manager, project management office (PMO), portfolio steering committee, program manager, project managers of other projects and team members. An external stakeholder can be for example a customer, an end user, a supplier, a shareholder, a regulatory body or a competitor. (PMI 2017, 550) In addition to the definitions internal and external, project members can be divided into another two groups (Ajmal et al. 2010, 156):

1. "visible members" are members of the organization and are involved with the project
2. "invisible members" are not necessarily members of the project organization but they are involved with the project as stakeholders, such as subcontractors and suppliers

The visible members are either permanent or temporary members of the project, which may result in the situation that there is lack of mutual social awareness or commitment to common goals and performance norms (Ajmal et al. 2010, 156). Project stakeholder management can be

challenging, and so Eskerod & Jepsen (2016, 3) have adopted a motto "*Easy to Understand, Difficult to Master*".

The basic idea of stakeholder management in project organizations is that the people who are responsible for stakeholder management, are influencing to stakeholders to enhance the project success. The stakeholders bring about financial and non-financial resources and contributions such as workforce, expertise, good ideas, approvals, reputation and compliance. Basically, all productive actions that are needed by the project. Stakeholder relationships hence involve a multiplicity of exchange processes. (Eskerod & Larsen 2018, 161, 162, 164) A supplier in the context of stakeholder management is an external party that receives payments from the company for the services or products. There are basically five supplier categories in SCM:

- Facilities and equipment builders or vendors
- Contract manufacturers
- Logistics service providers
- Material vendors
- MRO supplies vendors

The MROs can be defined as indirect and often non-repetitive maintenance, repair, and operating suppliers. The nature and the level of collaboration is dependent on whether the purchases for products or services are repetitive or not. Sometimes external suppliers are only needed once, they are one-off suppliers, which obviously means that there are no established means of communication nor knowledge management. That may usher in the risk of misapprehension regardless of the value of the purchase. At the worst, only a low-valued product may cause delays to the supply chain or at least require excessive work. (Martel & Klibi 2016, 218, 219)

Managing partnership is comparable to managing activity of a company. Mater & Klibi (2016, 235-236) refer to a situation in which any activity is outsourced to an external partner, which typically means that it is no longer needed to manage this activity by the company. That does not however set the company free from responsibility, because the partnership must be managed by monitoring, evaluating, motivating and rewarding the partners. That obviously requires consistent communication. The main difficulties in partnerships include the following (Martel & Klibi 2016, 236):

- Pressures during negotiation: a company may have internal problems and partnerships are formed to solve these issues. Serious problems may force companies to find quick solutions which often results in deficient outcome and understanding about underlying factors
- Poorly stated expectation: realistic performance standards and evaluation mechanisms are not established due to lack of time
- No continuous improvement: pricing and service levels may be well established but mechanisms for continuous improvement and knowledge transfer are missing
- Lack of confidence: companies are not confident to share strategic or tactical plans and goals to partner
- Conflicting cultures and strategies: differences in cultural background may cause misunderstandings, mistrust, and inefficiencies
- Lack of flexibility: in the contract if to rigid, it may become inapplicable to an evolving business environment and unanticipated changes. That may cause dissatisfactions among parties.
- Opportunistic behaviour: parties have a tendency to optimize their own operations instead of paying attention to mutual benefit.
- Key employee transfer: performance and understanding of the partnership decrease if knowledgeable key employees are transferred or they leave the company
- Poor relationship manager: time and effort are underestimated, or at the worst, the responsibility of relationship management is given to the supplier

2.7.3. Stakeholder management analysis

Stakeholder management analysis within a project-oriented organization has a slightly challenging history because the project management theory has originated from the Scientific Management. Due to its origin, project management has based on reductionism, which has led to the tendency to simplify the description of a complex phenomenon. As a consequence the stakeholder conceptualization is simplified, and certain details, such as stakeholder behaviour, are ignored. That is in sharp contrast to the idea that project stakeholders must be understood so that it is possible to effectively manage them. (Eskerod & Larsen 2018, 161)

Therefore Eskerod & Larsen propose a wider approach to stakeholder analysis to fill in the missing elements of the narrow reductionist approach. This concept is called ”shadows of the

context” and it is based on understanding the stakeholders’ perceptions of the relevant past, present and future. This approach suggests that a single project is not what should be analysed, but instead a more extensive view should be analysed so that stakeholders’ subjective views, such as perception of experience and expectations of future are taken into a consideration. Also, stakeholders’ other relationships and involvements in the networks should be comprehended. (Eskerod & Larsen 2018, 161)

The concept ”Shadows of the context” can be operationalized through ”rich pictures” method, which simply brings complementary elements such as pictures, colours and symbols into stakeholders’ communication. There is a risk however that the situation turns the other way around, in case it becomes exhausting by data overflow. Therefore it is important to find the right balance between richer, more holistic understanding about the stakeholders and data overflow. (Eskerod & Larsen 2018, 161-162)

Another method of the ”shadows of context” to generate more holistic, profound and richer view, is the ”systemic constellation” approach. Its underlying idea is to create a viable model of reality by mapping a spatial representation of relations between stakeholders. That should help to understand the complexity and dynamics of organizations but also turn sensitive and implicit knowledge into explicit. (Eskerod & Larsen 2018, 166) The advantages and disadvantages of the ”shadows of the context” in comparison to the reductionism are illustrated in table 1.

Table 1: Advantages and disadvantages of reductionism versus ”shadows of the context” (adapted Eskerod & Larsen 2018, 167)

	Stakeholder analysis based on	
	Reductionism	**Shadows of the context**
Advantages	Keeps the parties focused on few parameters—and therefore doesn't overburden our cognitive capacity and risk paralyzing us.	Gives a richer, more holistic and profound insights and is therefore helpful for predicting the stakeholder's coming behavior.
	To do the stakeholder analysis is not so time consuming because only a few parameters are included.	If circumstances are changing during the course of the project, the detailedunderstanding and communication between the stakeholder in question and the project representatives may be helpful for an appropriate response.
Disadvantages	Gives us a picture that is too simple and therefore not helpful for sufficiently predicting the stakeholder's coming behavior.	Challenges our cognitive capacity to deal with the complexity of the motives and circumstances influencing stakeholder's behavior—and increases the risk of paralyzing
	If the project representatives don't perceive the stakeholder analysis as helpful, they may have very limited motivation to undertake it carefully.	The project representatives need to learn new tools to create the richer pictures.
		The process of creating richer insights requires efforts from both the project representatives and the stakeholder, and it may be very time consuming.

Eskerod & Larsen also propose that project stakeholder management can consider implementing ”the concept of contextual embeddedness” that examines the entire organization, the levels of organizational units, networks and organizational fields. In this concept the actions of stakeholders and the structures of social systems are in a close interdependence with each other. In addition to temporary organizations, the concept is applicable to all kinds of organizations that collaborate with their stakeholders. (Eskerod & Larsen 2018, 163)

2.7.4. Behavioural attributes of stakeholder

Stakeholders have the power of choice to contribute, or not to contribute to the project, and therefore the project representatives must make sure that the stakeholders really want to provide the project with needed contributions. They can find it worthwhile to take part or not. They can also withdraw their contributions which may put the project in a risk. It comes then down to the question about stakeholder behaviour and how to predict it. That is valuable because effective stakeholder management is easier, if it is possible to predict the stakeholder’s willingness to contribute to the project as needed. Are there any holdbacks? That is tricky because it is never possible to fully predict the human behaviour, and due to the simplicity of the stakeholder conceptualization, there can be many things that are not known or understood about the project stakeholders. (Eskerod & Larsen, 164)

Eskerod & Larsen quite frankly argue that “*the very concept of project management is constraining the (conceptual) understanding of the stakeholders more than necessary*” (Eskerod & Larsen 2018, 163). Therefore, it is important to change the mindset from the traditional simplified, reductionism-based approach to a more profound and more holistic view when undertaking stakeholder analysis. Or at least, it would be valuable to understand and communicate, that there is an alternative to the reductionistic approach. Once it is possible to understand the circumstances and motives that affect the stakeholder’s behaviour, it is then possible to analyse and predict the stakeholder’s willingness or reluctance to contribute to the project. It is also easier to choose the right ways to interact with each of them. (Eskerod & Larsen 2018, 163) Missonier & Loufrani-Fedida (2014, 1110) have a similar view and they suggest, it may be more worthwhile to pay attention to stakeholder characteristics and behaviours rather than focusing on stakeholder attributes alone.

A typical assumption is that stakeholder's behaviour is interest-based, and only economic aspects (that is to say, maximizing profit) are considered relevant. That assumption can be challenged because the stakeholder's behaviour can also be identity-based, meaning that it is based on particular person's identity. That is commonly comprehended among those doing research within social sciences. It might be straightforwardly easy to make an assumption that the stakeholder's behaviour is purely interest-based but that would result in too narrow understanding about the situation and consequently weaker outputs of contribution. A stakeholder theorizing typically endorses fixed assumption about stakeholder behaviour, but some researchers suggest that there are many other possible motives to be taken into consideration as well, such as self-interest, identity and trust. In addition, these motives are fickle. (Eskerod & Larsen 2018, 163)

According to the classical economic theory the stakeholders will continue the cooperation if they find it beneficial from their own self-interest point of view. One might ask: what's in it for me?. Answers depend on persons answering the question; representatives of a supplier might want desirable references, payments and new contracts, an investor seeks for return-on-investment, project team members might see an opportunity to salary, interesting tasks, career development and customers want for sure new and better product or service. These things are advantages, but projects might also have harmful impacts. They can make stakeholders avoid contributing, for instance because they do not want to allocate limited resources from other, possibly competing projects or due to resistance from other parties such as environmental organizations. The project might be considered over-demanding and stressful for the team members. Evaluations are more or less based on stakeholder's assumption about possible consequences. In other words, they are interested if they believe that consequences of contribution will maximize their self-interest. Their behaviour qualifies as ”logic of consequentiality” and some researchers call this an interest-based perspective. There is an alternative perspective to this paradigm, and it is called the ”identity-based perspective”. That is based on different implication whereby the stakeholder will presumably act in a way that will be best for his or her social identity. Some researchers suggest that behaviour like this follows the ”logic of appropriateness”. In addition to ”logic of consequentiality” and ”logic of appropriateness”, today's theory on organizational behaviour proposes that the ”fairness of treatment” is yet another factor influencing the stakeholder's motives and behaviour. Stakeholders must perceive fairness to exist in distribution of benefits among the parties involved, procedures and ways of interacting. The impact can be quite strong indeed, as

stakeholders may be willing to hold back from pursuing their maximum self-interest if they are treated fairly over long period of time. (Eskerod & Larsen 2018, 164)

Project organizations are by nature temporary and the project management theory, due to its origins, define a project as temporary endeavour. It has neither history nor future. That paradigm is interestingly conflicting with the theory of stakeholder management, because a project is not just a project from continuity point of view. Instead, there might be many other projects in progress, or at least there will be new projects in near future to be undertaken with the same stakeholders. That underlines the importance of fairness over long period of time. (Eskerod & Larsen 2018, 165)

A structured and analytical approach for stakeholder interaction is in the end beneficial for the both parties. For example, it is possible to better respond to changes that emerge during the project lifecycle (Eskerod & Jepsen 2016, 2). Therefore, in project-based organizations it is valuable to remember, that despite the fact that a single project is a temporary endeavour and it involves a temporary project team, short-term stakeholder thinking is not the best approach (Eskerod & Jepsen 2016, 10). However, changing the mindset or perspectives might be challenging due to possible conflict of interests. Wikström et al. found in their business model study, that at a project level long-term partnership between the key suppliers is considered less essential. Instead, the key supplier selections were based on prices (Wikström et al. 2010, 836). In any case, the project lifecycle does not end at the time of handover of the project, but it continues until the end of warranty period. Sometimes, until the moment when the product has reached the end of its lifetime and the materials have been recycled. However, during that period of time, the project organizations operate continuously in a social context with the stakeholders.

2.7.5. Standardization in collaboration

According to Barbosa et al. global standardized processes are traditionally developed to achieve the best economies of scale, which means that the whole organization must follow the same common workflow and global processes. That tendency has resulted in the development of different Shared Service Centres and centralized functions that handle all needs related to certain processes. That approach does not allow individualized customizations to the processes, even though it might be reasonable at least to consider allowing certain latitude. The rationale

behind this is, that a global procedure ensures economies of scale and enhance internal communication. That is obviously correct, but according to Barbosa et al. (2017, 17) it can be argued that there is the trade-off between the economies of scale and the economies of scope. The Economies of scale aim to efficiency whereas the idea of the economies of scope strives for effectiveness and adaptability. These endeavours are conflicting in case the company's sustainable competitive advantage is based on dynamic capabilities, agility and adaptability. These features are typically desirable in project businesses. (Barbosa et al, s. 17)

Standardization of the Unique

"Standardization" does not mean that everything is the same nor all processes in the company are homogenous. Furthermore, it does not mean that different variants of process are out of the question. Barbosa et al. refer to the Capability Maturity Model (CMM) and suggest that the process is standardized if it is based on certain previously agreed notation and nomenclature. In other words, it is not needed to use only certain predetermined application or technology but instead, comply with certain rules, regulations in the systems and applications. (Barbosa et al. 2017, 16)

Commoditization of Processes

Some manufacturers have sought to turn their customized products into commodities so that they can reduce the costs and shorten the lead-time that is required to deliver the product. From customer's point of view, the commoditization process gives a chance to easily change supplier without excessive costs or noticeable change of characteristics of the product. The commoditization of services has not as highly evolved as the commoditization of products, but it offers basically comparable benefits. The first step in this is to describe processes through a common nomenclature, language and standards which enables all potential vendors on the market to understand the processes. The process can be considered a commodity that is comparable to any other on the market. In the literature this type of commoditization refers to outsourcing of processes rather than to an underlying process of stakeholder collaboration such as information exchange. (Barbosa et al. 2017, 18)

2.7.6. International distance attributes

The discussions on international business often focus on the term "distance". Most commonly that refers to geographical distances and the notion, that it is much more difficult to do business

with distant countries, than with those that are relatively closer. However, the conception of distance is not only geographical as there are also other distance attributes, such as cultural, administrative (institutions, governance), and economic dimensions. The International distance attributes in four categories are listed in table 2. (Martel & Klibi 2016, 335) Most international companies do not consider distances an unsurmountable difficulty as they do global business on a daily-basis, but the attributes of distance must be understood and taken into consideration when developing stakeholder collaboration.

Table 2 : International distance attributes (adapted Martel & Klibi 2016, 335)

<table>
<tr><th>Geographic</th><th>Cultural</th><th>Administrative</th><th>Economic</th></tr>
<tr><td>Physical distance</td><td>Language</td><td>Colonial ties</td><td>Economic freedom</td></tr>
<tr><td>Physical area</td><td>Ethnicity</td><td>Trading block</td><td>Economic development</td></tr>
<tr><td>Ease of access</td><td>Religion</td><td>Currency</td><td>Per-capita income</td></tr>
<tr><td>Common border</td><td>Education</td><td>Political system</td><td>Factor endowment</td></tr>
<tr><td>Time zone</td><td>Social structures</td><td>Legal environment</td><td>Industry concentration</td></tr>
<tr><td>Climate</td><td>Values</td><td>Regulations</td><td rowspan="5"></td></tr>
<tr><td rowspan="2">Inter-country transportation</td><td>Norms</td><td>Home bias</td></tr>
<tr><td>Business customs</td><td rowspan="3">International organizations membership</td></tr>
<tr><td rowspan="2">Inter-country communications</td><td>Criminality</td></tr>
<tr><td>Ethics</td></tr>
</table>

2.8. Lean from supply chain collaboration point of view

The principles of Lean are briefly discussed in this context. The case company is initiating the lean management activities within the group level. Lean supply chains strive for achieving high levels of customer value at minimized cost by real-time synchronization of customer needs with the optimum channel suppliers. Lean supply chains may contain following levels associated with the supply chain and cross-enterprise collaboration. The general intensity of cross-enterprise collaboration is proportional to the level of commitment of network partners. There are four levels of collaboration. (Ross 2018, 26)

- At the lowest lever, channel partners focus mostly on lean initiatives that reduce their internal costs and cycle times.
- The second level is more collaboration-oriented and companies take measures/action to monitor common performance metrics and they normally use extended value-stream mapping to discover possible process flows with the channel/network partners and

quantify improvement areas. Channel partners at this level focus on lean initiatives that reduce wastes in cross-channel functions.

- The level three takes yet another step towards more deeply integrated lean initiatives by for example creating cross-channel project teams. They seek to improve the common performance and planning processes.
- Finally, at the fourth level, partners will elevate the joint strategy and marketplace collaboration, compliance and transparency, performance and risk management as well as sustainability to whole new dimensions. The overall performance of the supply chain can be determined by means of / using cross-channel lean practices and metrics.

All businesses may have the same axiomatic objectives for supply chain management, but different businesses require different approaches. Lean and agile supply chains both strive for customer value and competitive advantage, but the underlying ideas are different. Therefore it is worthwhile to evaluate the differences and their advantages in this context. Basu, for example, highlights that lean focus on efficiency and "doing more with less" whereas agile supply chains are characterized by "responsiveness and flexibility" (Basu 2011, 31).

3. KNOWLEDGE MANAGEMENT

The basis for the knowledge management theory became more important in the 1970s when it was realized by researchers that the true value of organizations was actually in their intellectual capital. Theorists from Stanford and MIT suggested that employees could achieve more, if knowledge were shared across organizations Schopflin & Walsh (2019, 3). The distinction between knowledge management and information management is sometimes unclear, but basically knowledge management includes mechanisms, that enable the use of tacit information, whereas information management involves the organization, distribution and storage of recorded knowledge (Schopflin & Walsh 2019, 2).

3.1. Knowledge management framework

Knowledge management (KM) as an academic discipline focuses on questions how knowledge is created, developed, retained and applied in organizations (Syed et al. 2018, 2). Knowledge management in organizations can be characterized as a domain that focuses on identifying and leveraging the collective knowledge of the organization and provide that with competitive advantage (Kayas & Wright 2018, 131). It gives tools for an organizational learning. The linkage between competitive advantage emerges, for example, from the benefits that organization can gain through reducing the operating costs and creating added value to customers by significantly increasing product quality (Ofek & Sarvary 2001, 1441). Organizations can strengthen their efficiency and productivity by improving business processes, generating greater revenues, enhancing user acceptance as well as increasing competitiveness (Ajmal et al. 2010, 157). According to Grossman knowledge management is an important strategic imperative. It can be viewed through multiple overlapping disciplines such as organizational development, innovation, competitive intelligence and perspectives such as business, cognitive science and technology. (Grossman 2007, 31)

Sometimes KM is overlooked in organizations due to organizational culture or simply because employees in a hurry do not want their day-to-day work being interfered. Some work cultures may reward individual effort though incentives, some individuals do not want to share knowledge because they are concerned with security or just because of allegiance to the culture or own habits. It is also surprisingly recognized that some people in an organization live in the belief that those who have time to participate in organizational knowledge projects, do not have anything else to do. Historical barriers may form challenges for KM. Organizations typically

run more than one system, and sometimes it is challenging to incorporate these systems with new workflows. Business acquisition and mergers most likely bring along legacy systems and working procedures (Schopflin & Walsh 2019, 8). Many companies have had challenges to develop a viable strategic knowledge management system. The knowledge flow may be continuous but it is unsystematic and information processing resources may vary in companies (Carneiro 2000, 87).

Knowledge management can be compacted into a few essential sentences. Schopflin & Walsh (2019, 8) suggest that today's organizations need to:

- know what they know
- know where they put their information
- know where to find it and who to ask
- know what they allowed to do with their information (whether contractually or through legislation) and feel safe making choices about deleting or keeping it
- know where to find previously recorded knowledge, so that they do not have to repeat work, and can learn from previous mistakes
- encourage the exchange of diverse and creative ideas to ensure that whatever they, they do it as well as they can

It is widely discussed in the literature that knowledge integration is a source of competitive advantage, but there are also potential drawbacks, if there is too much supplier or other stakeholder integration. According to Jayaram & Pathakb (2012, 1958) there might be for example excessive overheads, inefficient resource usage, intellectual property infringements and potential mismatch of management styles that could lead to sub-optimal outcomes. In addition, given, that knowledge integration is a strategic and selective process, it is possible that companies do not achieve success if the partner or conditions are wrong (Jayaram & Pathakb 2012, 1958-1959). In addition to the definitions and characteristics of Knowledge, geography can also influence knowledge. It is not always direct, but it is related to the fact that geographical distances typically increase cultural, social and psychological differences. Different locations have different social, cultural and economic circumstances. Learning is done through site- and location-specific ongoing process of work, for example on the factory shop floor (Howells 2001, 873).

3.2. Data, information, knowledge and wisdom

It has been recognized in the theory that there are many interpretations for the terms data, information and knowledge. These concepts are not interchangeable. It is important for organizations to know which one of these they need, which they have and what they can do with each. Sometimes organizational success and failure can depend on that. In addition to data, information, knowledge, there are another higher-level concepts, such as wisdom (Davenport & Prusak 1998, 1-2).

Data

Data can be defined as a discrete and objective fact about events or structured records of transactions (Davenport & Prusak 1998, 2). According to Schopflin & Walsh (2019, 2-3) data can be defined as ”*points of information without meaning beyond themselves*”. Tuomi (1999, 105) suggests that data becomes information when it is structured, and information becomes knowledge when it is put into context or it is understood – meaning is added to it.

Metadata is ”data about data”, or it can be ”data that describes data (or information)”. Metadata can be used in database, programming and information resource management systems. Metadata is associated with different types of information resource, for example documents or books. It enables retrieval and management of information resources. A book catalogue in a library can be considered a collection of metadata. (Haynes 2019, 9)

Information

According to Schopflin & Walsh (2019, 2-3) information can be defined as ”*where date is interpreted and thus provide new meaning*”. Information is data which can be understood by its receiver. It can even be said that information is completely meaningless if it is not understood. For example, music staves are negligible to one who does not understand them, but to a musician, who can read music staves, they are information (Ståhle & Grönroos 1999, 49). Information is data with relevance and purpose, and information is meant to make some difference in outlook or insight of the person who gets it (Davenport & Prusak 1998, 2-3). In this context, it can be said that it is the receiver, not sender, who decides whether a message he or she gets is information. For example, minutes of meeting may be considered information by the sender but deemed noise by the recipient.

Knowledge

Schopflin & Walsh suggest (2019, 2-3) that knowledge is defined as "*where the context of information is understood and can be internalised*". Bertschi et al. (2011, 330) frame knowledge as "*information that has been made part of a specific context*" as well as "*is not about knowing the facts, but knowing the causal factors and context in which the facts have come about*". Ståhle & Grönroos (1999, 49) present a notion that the word "knowledge" is often used (in Finnish language) as a synonym for information, but they say that knowledge is more personal, and it is a broader notion than information. According to Davenport & Prusak (1998, 1) knowledge is related to both data and information. They define knowledge as follows:

"a fluid mix of framed experience, values, conceptual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines processes, practices, and norms" (Davenport & Prusak 1998, 3).

Knowledge can appear in a form of complex accumulated expertise that is mostly, if not completely, inexpressible or it can be formal, structured and explicit content (Davenport & Prusak 1998, 70). Knowledge can be divided in tacit and explicit, or codified, knowledge. Explicit knowledge can be codified and transmitted in formal systematic language, whereas tacit knowledge cannot be codified or easily transmitted, because it involves disembodied know-how, innate values such as skills, learned behaviour and procedures. On the other hand, tacit and explicit knowledge can be seen as a continuum, because tacit knowledge is needed in order to interpret explicit knowledge. (Howells 2002, 872, 873)

Wisdom

Wisdom can be defined as "*where the long-terms acquisition of knowledge enables decisions, insight and strategy*" (Schopflin & Walsh 2019, 2-3). Some descriptive terms for wisdom can be found in the KM literature, such as experienced, intuitive, introspective, pragmatic, understanding, gentle, empathetic, intelligent, peaceful, knowledgeable, sense of humor, and observant (Liew 2013, 53).

DIKW hierarchy model

Based on the view, that knowledge is more than information, and information is more than data, it can be said that data becomes gradually refined in the hierarchy of knowledge. The conventional view of the knowledge hierarchy is illustrated in figure 6. DIKW hierarchy model describes interrelationships of the terms data, information, knowledge and wisdom. In addition to these four terms, some researchers add a fifth level, intelligence, into the hierarchy, when the acronym would be renamed DIKIW. Intelligence in this context involve for example ability to sense the environment. (Liew 2013, 60)

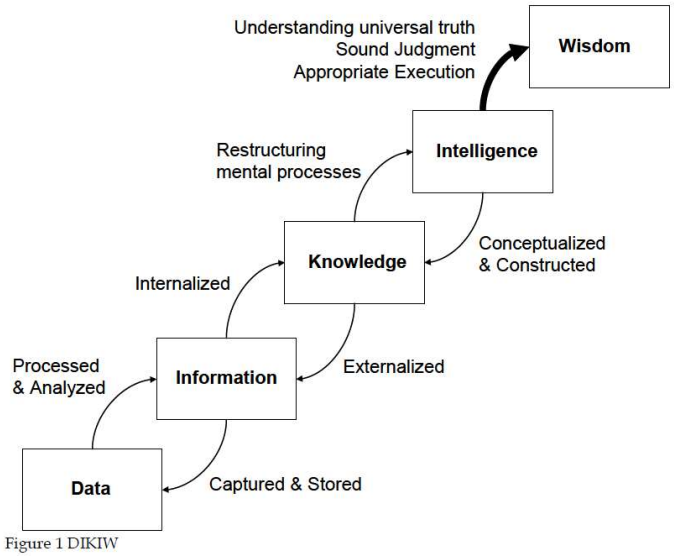

Figure 6: DIKIW hierarchy (Liew 2013, 60)

3.3. Knowledge management in project-based organizations

According to Lech, project Knowledge management can be defined as *"the application of principles and processes designed to make relevant knowledge available to the project team. Effective knowledge management facilitates the creation and integration of knowledge, minimizes knowledge losses, and fills knowledge gaps throughout the duration of the project*" (Lech 2014, 552).

Successful project management is based on systematic and effective knowledge management as well as individual and collective competences. Still, project organizations may find it challenging to identify and effectively use critical knowledge. Lack of these abilities results in

knowledge fragmentation and loss of organisational learning (Kasvi et al. 2003, 571). Project-based industries often have difficulties in interaction in interorganisational projects. As a result, they fail to extract, distribute and apply embedded and practice knowledge across structural and organisational boundaries (Bosch-Sijtsema & Henriksson 2014, 1432). Project team members can simultaneously work in multiple projects in social system that may have fluid borders (Bosch-Sijtsema & Henriksson 2014, 1432).

Project-based organizations should identify the different knowledge types that are involved in an effective knowledge management system. According to Ajmal & Koskinen (2008, 8) Project knowledge can be divided in three types:

1. An organization knowledge base, which includes the knowledge specific to organizations and environments in which the projects are implemented
2. A project-management knowledge base, which includes the knowledge of the theory and application of project management
3. A project-specific knowledge base, which includes specific knowledge acquired within the implementation of a particular project

In addition to the above division, the third type, project-specific knowledge, can be divided into three categories as follows (Ajmal & Koskinen 2008, 9-10):

1. Technical knowledge, which relates to the techniques, technologies, work processes, costs, etc., that are involved in discipline-specific issues of the project
2. Project management knowledge, which relates to the methods and procedures required for managing the implementation of projects
3. Project-related knowledge, which refers to knowledge about the customer and other people or entities that are of significance for the future business of the company

Information systems that are developed to support project collaboration and reuse of previously experienced project knowledge should not only be used for document sharing, because every project involve a variety of outputs in addition to actual product (or service) that is delivered to a customer. In this respect there is project knowledge related to the product, production of the product and use of it (Kasvi et al. 2003, 571):

- Technical knowledge concerning the product, its parts and technologies
- Procedural knowledge concerning producing and using of the product and acting in a project

- Organisational knowledge concerning communication and collaboration

Project-based businesses have characteristics that affect KM. One of which is the precondition for any project. That is, project organizations must collaborate with suppliers, customers and other stakeholders. Since a project-based supply chain is based on collaboration with external and internal stakeholders, it takes inter-organizational knowledge sharing, which is more difficult than intra-organizational. One of the reasons is, that there is no specific administrative organization or department in charge of promoting the knowledge sharing activities (Yang et al. 2019, 6434).

Another reason is the project team itself as people involved are both geographically and organizationally dispersed. They often speak several languages and they have different cultural backgrounds. It is possible that people change during the project, and sometimes the people who have been involved from the beginning, are no longer available (Kasvi et al. 2003, 572). Different professions typically have adopted their own cultures which may cause friction between other professions (Ajmal & Koskinen 2008, 12) and there might be people who have never worked together, and it is possible that they will not work together again (Ajmal & Koskinen 2008, 7). Key persons and lessons learned may be dispersed when the project ends. Kasvi et al. (2003, 572) actually highlight the importance of lessons learned, because organizations must understand what happened and why. If knowledge from the past is brought to bear on present activities, it can help organizations deliver future projects. They call this inter-project approach as ”Project Memory”. The concept of project memory is based on the idea that the organization defines its present knowledge and the processes that are used to manage the knowledge (Kasvi et al. 2003, 572).

Bryde et al. (2018, 540) also point out that project organizations often fail to learn lessons and they have the tendency to repeat the same mistakes on future delivery of projects. Typical reasons for overlooking lessons learned is for example lack of employee time, lack of resources, lack of clear guidelines and lack of senior management support (Bryde et al. 2018, 548). According to Ajmal et al. many project-based companies have failed in most of their knowledge management initiatives due to lack of expertise and technological, cultural, knowledge content, and project management reasons. Especially when it comes to assets gained from experience of previous projects (Ajmal et al. 2010, 156). Piraquive et al. refer to lessons and previous projects as they mention that knowledge management aim at supporting project management to achieve

good results optimally and timely, *”based on the experience acquired during planning, execution, follow up, and control and close of previous projects*” (Piraquive et al. 2015, 236).

A key element of the concept project memory is to recognize that there are two distinctively different types of knowledge. Most often technical and procedural knowledge is managed well, but organizational knowledge, the understanding on how the results were obtained, may be ignored or at least it is not properly stored. In that case only documents are stored but the context and processes are lost. Therefore it is needed to systematically manage not only project knowledge but also meta-knowledge so that other projects can benefit from that knowledge (Kasvi et al. 2003, 572).

Although there are solutions for the deficiencies relating to lessons learned, and there are formal processes for project memory in place, it is still possible to have difficulties in managing project knowledge due to psychological, managerial or team-based barriers. Psychological barriers are, for example, an inability to reflect or cognitive memory bias, whereas managerial barrier can refer to time or bureaucratic constraints (Bryde et al. 2018, 548). Bureaucracy is based on technical rationality and it has obvious benefits, and it enables effective way of organizing repetitive work. However, as a hierarchic, strictly-defined and rule-governed approach it has many weaknesses in today’s management of self-organizing expert organizations. For example, if independent decision-making from individual employees is required, it then might be reasonable to loosen strict rules (Eskola 2008, 1,3). Bureaucracy is also discussed in the context of formal and informal approaches. Knowledge is disseminated formally when a defined framework or set of rules are used. Informal dissemination means ”unmanaged” and conversational text (Kingston 2012, 160). Still, it is possible to choose dissemination techniques that allow people to share knowledge verbally and informally, but within a structured context. These techniques also enable peer assists (Kingston 2012, 167). Regardless of their ”waste of time” nature, they can help organizations reduce the number of mistakes, shorten the dissemination lead-times and eventually achieve better results. Team-based barriers refer for example to lack of internal communication structures. In addition, post-project meetings can be forums where the project team members are reluctant to blame others for something that went wrong (Bryde et al. 2018, 548). The fourth barrier is epistemological, and it refers to an assumption that project knowledge is explicit, codifiable, generalisable and it can be articulated, transferred and easily managed. That assumption ignores the fact that knowledge can be highly

personal and can be based on personal judgements and tacit commitments. (Bryde et al. 2018, 548-549)

In addition to lessons learned, Bryde et al. (2018, 540) identify four other factors that may complicate the delivery of a project. The first complexity is the multidimensionality of measures of project success. Traditionally there has been a small number of success criteria: time, cost and quality, but in addition to those, today's project management has many other important performance indicators that determine the project success, such as health and safety, stakeholder satisfaction, sustainability and quality assurance through adherence to defined processes and procedures (Bryde et al. 2018, 541). Not all of these are related, or are under the responsibility of supply chain management, but they emphasize the complexity of knowledge management involved in project management.

The second complexity is the diverse and often conflicting perspectives and even competing values of project stakeholders. At the worst, project stakeholders may pursue their own goals and agendas that may be conflicting with the aligned project goals. (Bryde et al. (2018, 540) A conflict of interests may arise for example, if a component delivery from a supplier is delayed, and in order to mitigate project delays the supplier should work overtime or pay for more expensive transportation. Shared project goals increase not only the level of mutual understanding and motivation to share knowledge, but also anticipated value that can be obtained through collaboration (Yang et al. 2019, 6435) and willingness to act from the supply chain's perspective (Li et al. 2012, 415).

The third complexity in project management is the fact that projects form a temporary organizations that often comprise multiple organisations. These temporary structures bring along challenges to knowledge management because the same project team work together only as long as the project is being executed. Especially in case of more complex projects that are delivered in collaboration with multiple companies, it is very important to ensure that the knowledge developed and acquired is managed in the course of the project. The temporary nature of these organizations may also cause certain boundaries that impact on effective and efficient knowledge management. There are for example the apportionment of cultures, organisational climate, knowledge, fields of expertise, practices, resources, roles, organisational types, group and individual functions (Bryde et al. 2018, 543). Sometimes it may be difficult to find appropriate ways, opportunities and even willingness to pay attention to successfully manage knowledge. Sometimes the reason might be the fact that team members do not

understand the other project team members' profession and thus do not know which knowledge (or information) the other project team members need (Bryde et al. 2018, 543).

The fourth complexity is relating to three different dimensions of complexity. They take a stand on the complexities inside and outside the project. The structural complexity comes from the temporary nature and the number of stakeholders of the project organization. It is not only a single organization or company. In addition there are, for example, large number of individuals, time zones, locations, the financial scale and the number of interdependencies. Secondly, there is a perspective of socio-political complexities, and thirdly, previous experience and changes of the project (Bryde et al. 2018, 543).

Inefficiencies in knowledge management are not necessarily linked to profit-maximization principles, because it is not always the matter of costs, but instead it can be due to socio-political factor, such as trust and non-coercive power. Power in this context refers to the company's relative dependence on other companies and power to influence them. (Ke & Wei 2008, 225-227) Trust between supply chain partners has positive effects on relationship commitment, information sharing, and operation performance (Xia & Kamoshida 2015, 122). However, Yang et al. (2019, 6441) point out that although mutual trust is important, it cannot be contractually enforced. It can be achieved through long-term communication.

Given that there are multiple complexities and different dimension of complexity, the context in which knowledge management is practiced in projects is often very different from the one in which operations or business-as-usual activities are undertaken (Bryde et al. 2018, 544). Therefore, the perspective in fully project-based business, such as ETO typically, is different compared to less project-based businesses, such as MTS production. Knowledge is embedded in activity and procedures. It is ”*an ongoing social accomplishment in everyday practice*” (Bosch-Sijtsema & Henriksson 2014, 1432). Kuster et al. (2015, 3) summarize that ”*Projects need exceptional resources in terms of knowledge, personnel, and finance.*”

Despite the fact that knowledge management in project-based businesses can be a complex task, Ajmal & Koskinen (2008, 7) interestingly argue that many non-project businesses are adopting the approaches that typically used in project-based business.

3.4. Managing of project knowledge uncertainties and creating of emergent knowledge

Traditional project management practices focus on planning rather than learning. However, managing of complex projects might find it beneficial to pay attention to implicit learning, because it is not possible to completely specify complex projects in advance. There will be unforeseen situations and uncertainties in the course of the project. Complex project management can be seen as a form of complex problem solving. Ahern et al. raise a question that ”*if complex projects cannot be completely specified, how can they be completely planned in advance of their delivery?”* (Ahern et al. 2014, 1374). Therefore, the challenge concerning this topic can be called a specification problem (Ahern et al. 2014, 1373) or ”*unforeseeable and unimaginable multiplying effects of small changes*” (Enberg et al. 2010, 762).

In this connection the distinction between two project types is presented in the literature. The first type represents projects that can be completely specified in advance. They are called ”complicated” projects. The second type in turn represents projects that cannot be completely specified in advance (except in outline or in part) and they are called ”complex” projects. Complex projects are challenging from project knowledge management point of view, because they must be able to manage intrinsic knowledge uncertainty. Pre-given knowledge is incomplete which means that new knowledge must be created during the project life cycle. Hence, there are two types of knowledge involved in projects. Firstly, static ”known” knowledge (such as plans, designs) and secondly, there is dynamic, contextual ”knowing” knowledge (such as know-how) that is unspecifiable in advance. (Ahern et al. 2014, 1372, 1375)

Based on that, Ahern et al. (2014, 1373) argue, that the traditional project management paradigm, with its assumption of total planning, is no longer tenable in complex projects. It often relies on the assumption, that knowledge is always ”known” and projects can be completely specified in advance. This approach has the tendency to ignore the inherent incompleteness of knowledge and the reality of complex project settings, where ”as-built” drawings often end up deviating from the initial project specifications. An alternative approach however is based on the thought, that knowledge management in complex projects is basically the management of knowledge uncertainty and incomplete knowledge. (Ahern et al. 2014, 1378) It means that new, emergent knowledge must be created during the project life cycle, and that emergent knowledge must be effectively coordinated within the project management organization. For that purpose there is an example of a distributed approach to knowledge

management. Effectively, this approach strives for solving the shortcomings that are involved in knowledge management of the traditional project management.

The distributed approach suggests that planning includes plans to learn the project, documented procedures enable creating emergent knowledge and project goals promote common will of mutual interest to coordinate knowledge. This approach can be construed so that complex projects can only be limitedly planed in advance. Projects like this can to some extent be compared to a prototype, which is a one-off complex project. All the details and possible complexities cannot be completely comprehended or specified beforehand. But when the static ”known” knowledge (such as plans, designs) are combined with the possibility to generate dynamic, contextual ”knowing” knowledge (such as know-how), it is possible to leverage both types of the project knowledge, including their tacit dimension. Moreover, this approach enables a convergence on the project coals. In other words, it is not needed to choose between ”known” knowledge and ”knowing” knowledge but, instead, it would be recommended to choose a synthesis of these. (Ahern et al. 2014, 1375, 1376) A conversion of knowledge is not needed because the interplay between the knowledge types would provide better results. However, regardless of the potential benefits of a distributed approach, it is worthwhile to note, that this approach, as an alternative to the traditional project management, may be more applicable to organizations, where project management is a core supporting competence rather than a core competence. Ahern at al. (2014, 1378)

”Learning the project” is an approach, in which the project team is considered a community of learners. It creates missing emergent knowledge during the project cycle by the means of problem solving and using tacit knowledge (Ahern et al. 2014 ,1374). Emergent knowledge is created according to documented procedures and project goals are used to foster and pace a common will of mutual interest (Ahern et al. 2014, 1375). It is understood that expert knowledge is embodied in those individuals that are practitioners of the expertise in question, and this expert knowledge enables to fill up possible gaps in documented procedures. In a sense a common will of mutual interest is considered a ”team spirit” or ”we’re in this together” thinking that strengthen mutual interest and respectively promotes achieving common project goals (Ahern et al. 2014, 1377, 1378). Moreover, Kogut & Zander (1992, 384) suggest ”*that organizations are social communities in which individual and social expertise is transformed into economically useful products and services*”. Therefore It is reasonable to argue that the distributed perspective has a strong socio-technical dimension.

3.5. Codification and personalization of knowledge

Kasvi et al. (2003, 572) suggest that knowledge management consist of two basic strategies. Codification strategy takes a stand on codifying and storing the knowledge in artefacts and databases, whereas personalisation strategy relates to knowledge that is shared by personal interaction. According to Enberg et al. (2006, 146) the personalization strategy is based on face-to-face coordination and the codification strategy in turn is based on people-to-document integration.

Organizations often value both documents and interaction with colleagues. Thus, they could use both the codification and the personalisation strategies, but in reality, that is not always the case. Kasvi et al. (2003, 579) are of the opinion that events where personal interaction is facilitated, the codification strategy may not be applied as systematically. In other words, no proper electronic codification is done, different tangled computer files are used to accumulate and store knowledge. Management of these files is unsystematic and consequently, the files are often accessible only to some people.

3.5.1. Personalisation of knowledge

Personalisation strategy promotes the dialogue among the people, and it takes into account that knowledge can be interconnected with the activities of the people. The basic idea of this approach is to recognize that knowledge management is part of wider complex adaptive system, in which the project organization involves not only systems-related elements such as technology, processes and infrastructure, but also people-related elements such as learning, culture and social elements. (Bryde et al. 2018, 549)

As a matter of fact, the importance of people-related elements is highlighted in the literature. For example, Bryde et al. (2018, 551) suggest that despite the widespread prevailing practice where projects are often focusing on time, cost and quality, there is some emerging tendency in companies to pay attention to social networks. They aim at knowledge and knowledge sharing within and across project teams because it has been recognized that increasingly more complex projects in today's dynamic and fast-changing business environment require more collaboration between different stakeholders, more short-term contracts and the need for tacit knowledge of experienced people. In this respect, social networks are important as they can enable efficient teamwork, participation and cohesion as well as the sharing of tacit knowledge. (Bryde et al.

2018, 551) Knowledge is associated with cognitive structures and the process of learning, and therefore it is a socially constructed process (Howells 2001, 872). The personalization strategy is presumably effective in case of highly customized solutions, whereas the codification strategy is in favour of the repeatable solutions (Enberg et al. 2006, 146).

3.5.2. Codification of knowledge

The purpose of knowledge codification in an organization is to transform the knowledge into accessible and applicable formats and to make the knowledge accessible to all people who need it. Knowledge is turned into a code, which does not have to be a computer format, so that it becomes organized, explicit, portable and easy to understand. (Dave & Prusak 1998, 68) As Codification makes knowledge explicit so that it is possible to transfer it across projects (Bryde et al. 2018, 549). Codification can be challenging because companies may have problems to decide how to codify knowledge without losing too much of its content or distinctive properties. There is the risk of turning knowledge into information or even data if codification is too structured. In addition, codification does not have to cover all knowledge, since better results are most likely obtained if relevance is considered more important rather than completeness. (Davenport & Prusak 1998, 68)

An important part of codification is to create global definitions for key terms that the company is using. It may seem that certain usual words are so simple, that they do not need exact definition, but in fact, in many organizations these key terms may have multiple and even contradictory meanings, which complicates the knowledge consolidation. Knowledge cannot be shared efficiently if familiar terms do not have common meanings across a company. On the other hand, it is possible that the local conception of idiosyncratic terms gets lost when a global standard is adopted. That may cause tensions between local and global needs. Therefore companies must balance the value of particularity of knowledge against the value of making it comprehensible to all people. (Daveport & Prusak 1998, 68)

Tacit knowledge is developed and internalized by an individual person, and therefore it is almost impossible to reproduce it in a document or database. Codification is not possible, but it is possible to locate a person with knowledge and encourage the seeker and the knower to interact (Davenport & Prusak 1998, 68). That is part of organizational culture. Especially in case of urgency it is more efficient to have access to, and interact with people with tacit

knowledge than trying to get that knowledge from electronic systems or on paper. One way to find the correct sources of knowledge is a knowledge map. It is not a knowledge repository but a guide that defines the location important of important knowledge. That helps people in an organization find certain expertise and knowledge without spending excessive time doing it. Organization charts do not typically provide knowledge seeker with a satisfactory help. A knowledge map can point to the right people, documents or database. (Davenport & Prusak 1998, 72-73) Limitations involved in a textual or a verbal communication can be overcome through spatial distribution, which is based on both textual and visual communication. That should better leverage cognitive abilities of the brain, with reference to the Dual Coding Theory (Bertschi et al. 2011, 331).

3.6. Knowledge transfer, exchange and sharing

In the literature the terms knowledge sharing, knowledge exchange and knowledge transfer are used and discussed in the same context. The term knowledge dissemination is also used. However, these terms may have different meanings. For example according to Davenport & Prusak (1998, 101) transfer of knowledge should consist of two parts: the transmission and the absorption. The former simply means sending or presenting knowledge to a potential recipient. Fazey et al. (2013, 205) suggest that knowledge exchange is a concept that involves the process of generating, sharing and/or using knowledge. Exchange methods should be suitable for the context, purpose and participant. Joubert & Paraponaris (2018, 326) define knowledge transfer in organizations as ”*the process through which one unit, e.g., group, department, or division, is affected by the experience of another*”.

Knowledge exchange can be conducted through various methods, such as a simple transfer of knowledge or complex multi-way interactions. The methods can be intentional and formal, or they can be informal implicit processes like social media (Fazey et al. 2013, 206). Kingston contribute to the discussion through knowledge dissemination, which according to his definition is ”*a crucial part of knowledge management because it ensures knowledge is available to those who need it*” (Kingston 2012, 160). When an employee asks a colleague a question regarding his or her job, he or she is requesting a transfer of knowledge (Davenport & Prusak 1998, 88). Spontaneous and unstructured knowledge exchange can take place at the coffee machine or in the company cafeteria. This type of interaction is considered both waste of time but also part of knowledge exchange in some companies, because it enhances the

transfer of tacit information. Unstructured personal conversations may be beneficial to some extent, and some scholars even suggest that they are vital to company's success, but today's organizational structures and the tendency to move towards virtual offices and remote work reduce the frequency of informal knowledge exchange. (Davenport & Prusak 1998, 90-91)

Observations of Kasvi et al. (2003, 572) support the proposition that physical proximity in the office environments has its benefits, especially in case knowledge management concentrates on ITC tools, when face-to-face interaction needs to be strengthened. Perhaps one of the most extreme examples comes from Japan, where some companies had "talk rooms" that were used purely for informal unstructured conversations. No organized meetings were held in these rooms (Davenport & Prusak 1998, 91).

Companies of different sizes have different challenges. The larger and more complex the company is, the more likely it is that certain knowledge or expertise exists in the company. On the other hand, the larger the company is, the less likely it is that the employees know how and where to find knowledge or expertise they need. (Dave & Prusak 1998, 89). The way knowledge is exchanged is depending on how different people conceptualize sharing or transfer of knowledge. In the positivist perspectives it is a norm that knowledge exchange is carried out through didactic and structured one-way approaches. The subjectivist perspectives in turn are based on the idea, that knowledge can be understood in many ways depending on individual perspectives, experiences and cultural background. These perspectives can be useful in multi-stakeholder interactions as they often lead to knowledge exchange methods that enhance mutual learning. Knowledge exchange is not just simple linear one-way activity. When knowledge exchange methodologies are evaluated, it is therefore important to understand how knowledge is comprehended and how knowledge exchange is practiced. (Fazey et al. 2013, 206) When knowledge is being shared between individuals, it must be remembered, that although all individuals will obtain the same contents, all individuals can filter and interpret it differently based on the individual's former experience (Howells 2001, 874) or education (Bertschi et al. 2011, 329). That results in different knowledge between each person or group of persons.

Knowledge exchange methodologies can be evaluated for example through summative or formative methods, as well as participatory or non-participatory methods. Summative methods are used at the end of the project to validate the success of the activity, for example knowledge exchange of the project. They have limitations because they mainly focus on outcomes rather than the understanding how the outcomes were obtained. Formative methods, in contrast, focus

on evaluating activities throughout the project cycle. That enables better understanding about the processes that have led to outcomes. Participatory methods involve multiple stakeholders in evaluations, and they enable for example sharing perspectives among other benefits. It is also possible to challenge or reduce dominance of particular knowledge types and flatten the hierarchies that may create barriers to knowledge production and learning. In addition, participatory approach can be found helpful in equalizing possible power inequities between knowledge ”producers” and ”end users”. Since participatory methods are often formative and they involve close collaboration of stakeholders, they resemble the adaptive co-management of knowledge exchange, in which participants have an opportunity to learn and collaborate more deeply with knowledge exchange. In comparison, the ”adaptive management” of knowledge exchange can also involve iterative learning, but mostly among those who are managing knowledge exchange. Formative and participatory methods can encourage the knowledge management process because they can increase ownership, responsibility and motivation for knowledge exchange. (Fazey et al. 2013, 206)

Knowledge exchange methods can be evaluated through four dimensions. Fazey et al. (2013, 207) highlight following dimensions:

- The knowledge exchange may result in changes in understanding, e.g. increased knowledge, change in attitudes, and changes in thinking
- There can be changes in practice or policy
- Actual impacts of changes in practices/policies can be evaluated, such as improvements in business performance or human or ecological health
- Diversity of knowledge exchange process-oriented outcomes can be assessed. These can include how knowledge exchange was conducted (e.g. leadership, methods used, communication patterns) and the quality of the processes (e.g. quality of information, levels of engagement, cost effectiveness, barriers)

Fazey et al. point out that, despite the evidence-based approach and considerable efforts made by organizations, their knowledge exchange may still not work as planned on paper. Their decision-making is still social, and it is based on dynamic patterns of collective sense-making. It involves tacit and experiential knowledge and group dynamics that affects collective processing of knowledge. Therefore it is important to understand not only quantity but also quality of knowledge exchange outcomes. Especially in a multi-stakeholder collaboration it is crucial to focus on social processes that create trust, mutual respect and collaborative capacity.

Social capital can be considered even more important than using standard technological tools for knowledge exchange. (Fazey et al. 2013, 217) Carneiro (2000, 88) suggests, that companies should consider developing human attributes, also in knowledge management, because they are one of the most important assets in many companies.

In social transactions it is important to pay attention to equal amount of attention among the project team members. Otherwise it is likely that members that perceive lack of attention, will also lose their commitment. In addition, it has been recognized in the literature that project members have the tendency work in their own discipline. They work in silos. That, in turn, results in less integration and it complicates coordination of knowledge (Bosch-Sijtsema & Henriksson 2014, 1439). Project members may gather in silos on the grounds of their age or gender as well as the project phase. That may happen when a certain sub-team of the project has finished its work, and another team should be responsible for the next phase. The members may be no longer interested once the project has been thrown ”over the fence” to another sub-team (Lehmann 2019, 10).

There is another interesting viewpoint, why the efforts to intangible factors such as social capital, mutual trust and tacit knowledge can be beneficial. Li et al. (2012, 399) namely found in their study, that although some suppliers are simultaneously involved in multiple competing supply chains, it is not easy for them to copy the knowledge exchange routines from the supply chain to another. With respect to knowledge sharing it has been found that people may have a different notion of their own projects than what other people have. In a study it was discovered that people who felt they that they could improve the distribution of knowledge in their own project, also felt that other partners might be lacking in the same competence (Kasvi et al. 2003, 577). In any case, it is important for all people to understand that knowledge sharing is a collective action and nobody should fall into free riding. Collaborative knowledge management practices are not successful unless all people adhere to the collective procedure in which they make their own knowledge is accessible to all other people (Li et al. 2012, 415).

Knowledge integration in collaborative supply chains with upstream suppliers can be divided in two mechanisms: knowledge sharing and knowledge enrichment. In this context the former means mainly short-term knowledge sharing, whereas the latter is considered a long-term and iterative approach. The benefits of knowledge enrichment are obtained over a longer period of time as collaborative supply chain gradually evolves through repeated interactions with internal and external stakeholders. For instance, quality improvement programs can be improved over

the time through iterative knowledge development when also supplier involvement becomes deeper (Jayaram & Pathakb 2012, 1960). In addition, it is important to note, that knowledge sharing and knowledge enrichment have different influence on manufacturing capabilities of a company. According to studies, sharing knowledge with suppliers is not enough, but knowledge enrichment seems to be necessary to enhance manufacturing capabilities (Jayaram & Pathakb 2012, 1968).

Knowledge is often shared in regular meetings, but in the project business in particular it is likely that unexpected events and problems occur. That is partly due to the temporary nature of projects (Bryde et al. 2018, 543), but also due to the fact that complex projects cannot be completely specified in advance (Ahern et al. 2014, 1372). Time-limited regular meeting are not appropriate forums for in-depth problem-solving that occasionally becomes inevitable during the project lifecycle. These situations require ad hoc interactions and often extensive face-to-face meetings (Enberg et al. 2006, 157-158). In terms of organizational structures of communication, there are basically two options. Communication through the line hierarchy according to predefined reporting channels, or communication through direct channels of information. The latter involves channels that are as short and as they can possibly be, and therefore they are preferred in projects. (Kuster et al. 2015, 187)

In conclusion, knowledge exchange methods should be appropriate for the organizational culture (Dave & Prusak 1998, 91), the knowledge that is being shared as well as the structure and business goals of the organization (Kingston 2012, 160). In addition, according to Ajmal et al. the workflow processes, the integration of group members' knowledge and potential internal opposition from organisational members should be taken into consideration. Support from senior management is also needed. (Ajmal et al. 2010, 157)

3.7. Knowledge enablers

The knowledge barriers can be considered knowledge enablers depending on how these factors are managed. For example, technology or culture can be "success factors" if they are managed well, or "failure factors" respectively, if they are poorly managed (Ajmal et al. 2010, 161).

In the context of knowledge barriers and enablers, Ajmal et al. (2010, 161) present a conceptual model of six distinctive factors that influence the success of knowledge management initiatives. The factors are presented in figure 7 and explained as follows:

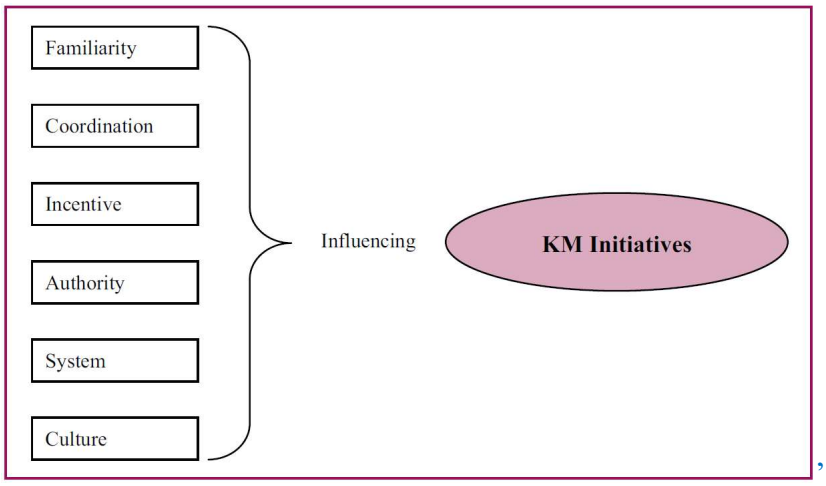

Figure 7: Conceptual model of factors influencing KM initiatives (Ajmal et al. 2010, 161)

Familiarity with KM

When KM initiatives are being initiated, it is essential for any organization to make sure that all members of project team are familiar with KM and they have a clear understanding of contribution strategy to given KM initiative. Otherwise the KM initiative will most likely fail to achieve its goals. (Ajmal et al. 2010, 162)

Coordination among employees and departments

A KM initiative can achieve success if all people are encouraged to communicate and share their knowledge and best practices with other team members, and when all this is done in a coordinated fashion. (Ajmal et al. 2010, 162)

Incentive for knowledge efforts

Incentive programs can enhance the success of KM initiatives. Incentives can be financial or non-financial but they can motivate people to adopt a particular action. Incentives can be divided in three categories (Ajmal et al. 2010, 162)

1. Remuneration – material rewards (especially money) for acting in a particular way
2. Moral – adopting a particular choice because it is considered to be the ‘”right’’ (or admirable) thing to do, or because a failure to act in a certain way is likely to be condemned as improper

3. Coercive – adopting a particular course of action because a failure to act in this way will result in adverse consequences (or ‘’punishment’’)

Incentives can be either extrinsic, which means that they are external to the work, or intrinsic when people derive personal satisfaction out of doing the work. Intrinsic incentives are found more motivational from knowledge creation and participation point view.

Authority to perform knowledge activities

This factor distinguishes between the terms power and authority. A person may have the power to achieve a certain objective, but no the legitimacy of exercising that power. That refers to personal knowledge authorizations within the organization. (Ajmal et al. 2010, 162)

System for handling knowledge

Knowledge requires appropriate systems so that the value of knowledge can be maximized. The knowledge management systems consist of various parts and these parts must be functionally and structurally connected. A well-managed knowledge management system in particular can be an enabler, as it facilitates the communication and all knowledge activities in a project-based organization. However, knowledge management system can turn out to be a barrier if it is poorly managed. (Ajmal et al. 2010, 163)

Cultural support

Project-based organizations consist of professionals from various cultural backgrounds. Members of one group be distinguished from another group by organizational cultures. Cultures also determine the effectiveness and the type of knowledge, but also the way it creates competitive advantage for the organisation. An appropriate organisational culture fosters knowledge management activities. (Ajmal et al. 2010, 163)

Organizational culture consists of values, beliefs, assumptions and norms of the organization, but It also includes visible elements, artefacts, such as processes, procedures, structures and for example dress codes. They form the way how the organization is supposed to work. It can be very difficult to change organizational culture, which can be seen as a positive thing because organizational culture is often a major empowering factor in knowledge. On the other hand, it can be a major obstacle for it (Kayas & Wright 2018, 134). Therefore it is important to understand that organizational culture influences the knowledge transfer. There can be many

cultural inhibitor that impede knowledge transfer within or between organizations. According to Davenport & Prusak (1998, 97) the most common frictions are:

- Lack of trust
- Different cultures and vocabulary
- Lack of time and meeting places: narrow idea of productive work
- Status and rewards go to knowledge owners
- Lack of absorptive capacity in recipients
- Belief that knowledge is prerogative of particular groups
- Intolerance for mistakes or need for help

The first two frictions can be improved though relationships and face-to-face meetings, education, discussions and teaming. Lack of time can be eased by establishing time and place for knowledge transfer. Status and rewards can be shared with incentives that are based on knowledge sharing and belief in prerogative knowledge would require a non-hierarchical approach to knowledge. The quality of ideas should be more important than the status of source. (Davenport & Prusak 1998, 97)

Knowledge management systems (KMS), also known as enterprise systems, have significant impact on organizational culture and knowledge management. These systems effectively determine how organizations implement the knowledge management initiatives. People tend to respond to introductions of these systems, and for obvious reasons, there is close interaction involved between people and technologies (Kayas & Wright 2018, 134). However, new information technology alone does not solve knowledge problems, because it is basically only a pipeline and a storage for knowledge. New software does not generate knowledge nor does it guarantee that knowledge is generated, transferred or shared, if the organizational culture does not support these activities (Davenport & Prusak 1998, 18). The success of knowledge transfer is not depending on how sophisticated or efficient technology is being used, but in the end, it comes down to organizational culture (Davenport & Prusak 1998, 96). Kasvi et al. (2003, 578) refer to similar finding in their study, which suggests that the people working in technology programmes thought that technology is just one area of knowledge, whereas new organizational practices were considered the most important new knowledge area.

Regardless of organizational culture, the KMS and information systems have limitations in connection with knowledge transfer, because these systems are often lacking the ability to share tacit knowledge (Kayas & Wright 2018, 135). However, companies with a strategic focus on

supply chain optimization can find tacit knowledge significantly more influential than explicit knowledge. Therefore different priorities of different industries should be taken into consideration when developing knowledge capabilities (Chapman & Macht 2018, 646-647).

If project-based organizations are viewed through the differences between organizational and professional cultures, it can be said that professional cultures can cross the boundaries of organizational cultures, because certain professionals can work for many organizations. It is possible, that these cultures are not in perfect harmony. Still, it is possible to achieve harmony by a strong directional culture, if various cultures can form a synthesis of cultures, as illustrated in figure 8. This culture defines appropriate procedures for cooperation and communication. (Ajmal & Koskinen 2008, 12)

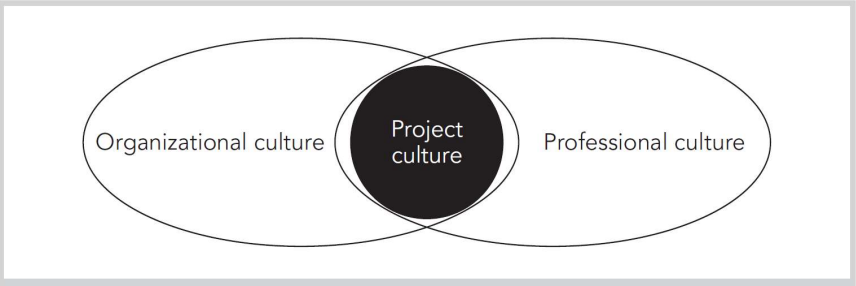

Figure 8: Project culture (Ajmal & Koskinen 2008, 12)

3.8. Digitalization of supply chain and knowledge management in brief

ERP systems typically have modules for SCM and they are designed to improve the collaboration between stakeholders. Typically that is related to strategic network planning, S&OP, demand planning, production planning, supply planning, purchase order processing and transportation execution (Martel & Klibi 2016, 100). ERP systems can be considered a backbone of value creation in most companies, as they are an integral part of the infrastructure. They enable but also constrain processes such as SCM (Barbosa et al. 2017, 12).

The digitalization of industry is reshaping many processes in supply chain management. Large amount of data can be collected, recorded, shared and processed by utilizing novel approaches, robotics and artificial intelligence. Digitalization not only makes it possible to share data throughout the supply chain network between downstream and upstream stakeholders, but it also enables communication between machines. Digitisation technologies can assist routines that support knowledge management practices, and labour-intensive tasks in purchasing,

invoicing, accounts payable and even customer service can be automated. Less human labour will be needed in these areas. The current research mainly focusses on technologies such as cloud computing, internet of things (IOT), e-commerce, big data, radio frequency identification (RFID), as well as blockchain and artificial intelligence (Schniederjans et al. 2020, 6).

Despite the tremendous amount of opportunities, there are still challenges involved. For example, companies and communities must understand how to implement and utilize the vast amount of data in connection with the strategic vision of the supply chain network. How to extract knowledge from data and how to implement the new technologies within supply chains? Knowledge management plays an important role in the process wherein large amount of data is converted to knowledge. In addition, individuals are needed in optimizing the use of new technologies for supply chain network performance. (Schniederjans et al. 2020, 1) Thus, it can be said that digitalization per se, does not resolve the fundamental questions involved in knowledge management in companies. According to Kuster et al. (2015, 192) face-to-face interaction and verbal communication together are the most effective method in any collaboration. That is, because it involves words, images, non-verbal communication, immediate feedback as well as social integration. All other means of communication, including the videoconference, do not have this advantage.

The theory of knowledge management creation suggests that face-to-face meetings are actually needed in order to exchange tacit knowledge within members of organisations. Therefore, according to that theory, an essential part of knowledge creation process is based on human interaction. That is challenging from technological point of view in supply chain digitalization (Schniederjans et al. 2020, 2). The aspects of social dynamics are important, because they consist for example of groups and meetings, learning from others, developing skills, the value of intuition, accessing relevant resources, and passing on the knowledge of departing staff. Therefore, in connection with information technology, it is important that information professionals adopt a broad understanding of the information and knowledge processes of the working environment. Understanding of the information processes and the information that is needed by the users are not enough. The analysis focusing on information alone, cannot approach all aspect of the complex of information and knowledge processes. (Southon et al. 2002, 1056-1058) Nonetheless, it is obvious that in global business environment it is not reasonable nor possible to arrange frequent face-to-face meetings. Therefore virtual teams are gaining ground across companies (Kuster et al. 2015, 120) and they can be considered

alternative forms to conventional organizations, or even the backbone of collaboration (Backhaus & König 2019, 221).

4. RESEARCH PROCESS AND METHODOLOGY

In this chapter the theoretical framework, the research methodology and the research structure are discussed and the case company is briefly introduced.

4.1. Theoretical framework

The theoretical framework of the study is based on three disciplines: supply chain management (SCM), knowledge management (KM) and project management (PM). Each discipline is viewed through the viewpoint of stakeholder collaboration and information/knowledge management theories. The theoretical framework is illustrated in figure 9 below.

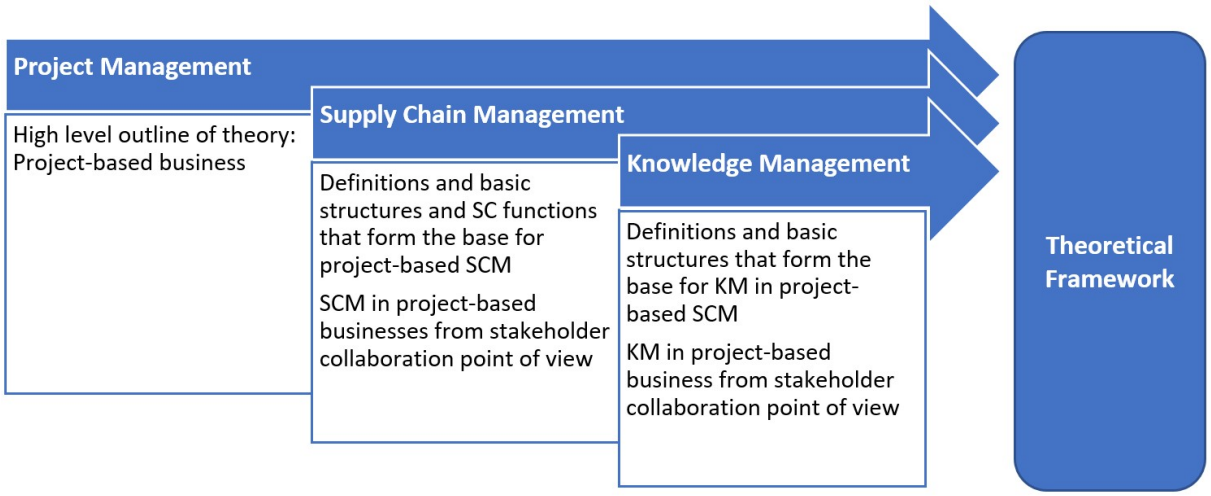

Figure 9: Theoretical framework of the study

The theory of SCM determines business functions that are involved in this context. It also explains why SCM is important for companies, and what is the role of SCM in effective project execution, and the competitive advantage of a company. How supply organizations (and companies in general) collaborate with stakeholders and what are the basic structures of collaboration.

Stakeholder collaboration from PM point of view suggests that only project knowledge (for example product specification, purchase orders, project schedules) is taken into a consideration in this study. In addition, the knowledge that is closely connected to projects (for example S&OP), is in the scope of the study. Other knowledge areas that have no connection to project SCM and are not directly involved in end-customer projects (for example development projects, annual planning, frame agreement negotiations) are excluded.

The KM theory explains the basic terminology and how knowledge is defined in literature. It is also discussed what processes and practices are used to identify, create, store and utilize the knowledge in general and in a project organization. The topic is viewed from both knowledge content and infrastructure point of view.

The framework is comprised of following rather large themes, that are complemented with other relevant interconnected areas studied in the literature review:

1. Project-based business has distinctive characteristics
2. PM theory has deficiencies in this context
3. Trust
4. Social interaction
5. Organizational culture
6. Organizational learning, lessons learned
7. Methods, processes and standardization
8. Managing project uncertainties

These essential themes are discussed in this chapter hereinafter. The first obvious high-level observation is that KM in project-based SCM indeed have distinctive characteristics in comparison with non-project-based businesses (Wikström et al. 2010, 833; Yang et al. 2019, 6434). However, despite this thesis is limited in the project-based business, it is valuable to identify the deficiencies of the PM theory in terms of stakeholder interaction and collaboration. The traditional project management theory does not provide a profound understanding on stakeholder interaction, because it is based on reductionism. As a consequence the stakeholder conceptualization is simplified, and certain underlying details such as stakeholder behaviour is ignored. That is in sharp contrast to the idea that project stakeholders must be understood so that it is possible to effectively manage them. (Eskerod & Larsen 2018, 161) The findings of this literature review support that argument, because for example the PMBOK does not explicitly take into consideration the social interaction, stakeholder motives nor behaviour. Furthermore, in the global business environment there are multiple distance attributes, that may have some effect on project stakeholder collaboration. The conception of distance is not only geographical because there are about 30 other distance attributes, that should be understood (Martel & Klibi 2016, 335).

Trust is one of many important social elements of stakeholder collaboration. It is discussed both in the SCM and the KM theories. Lean principles suggest that supplier relationships are based

on mutual trust and commitment (Barbosa et al. 2017, 120) and according to Ross (2018, 15), lack of trust is one of the barriers in KM. Trust between supply chain partners has positive effects on relationship commitment (Xia & Kamoshida 2015, 122). Trust, on the other hand, is related to social interaction which is considered an important ingredient in KM, because social relationships develop and maintain shared trust and confidence (Kawa & Maryniak 2019, 79-80). It can even be argued, that lack of appropriate social interactions between the project stakeholders is a typical reason for a project failure (Missonier & Loufrani-Fedida 2014, 1108). This is interesting, because there is often the belief that the reason is ineffective project management practices. Social networks are important as they can enable efficient teamwork, participation, cohesion and the sharing of tacit knowledge (Bryde et al. 2018, 551). In addition, efforts to social capital can be viewed from the perspective, that although some external stakeholders (e.g. suppliers) are simultaneously involved in multiple competing supply chains, it is not easy for them to copy the knowledge exchange routines from the supply chain to another (Li et al. 2012, 399). The benefits obtained from these efforts can be sustainable.

Organizational cultures should not be forgotten in KM, because people's behaviour is influenced by the cultures. There are many perspectives involved in cultures, and they can be a "failure factors", if they are poorly managed. Culture can uphold tradition of internal silos, and different professions often have their own cultures which may cause friction between other professions. IT systems do not guarantee that knowledge is generated, transferred or shared, if the organizational culture does not support these activities. The success of KM is not depending on sophistication or efficiency of the technology, but in the end it comes down to organizational culture (Davenport & Prusak 1998, 18, 96). An appropriate organisational culture fosters knowledge management activities (Ajmal et al. 2010, 163). Therefore it is important to understand how the organizational culture influences the knowledge transfer, and how to develop the culture in the right direction, so that it better supports the development of KM in the project-based organization. At the same time, the knowledge exchange methods should be appropriate for the organizational culture (Dave & Prusak 1998, 91).

Organizational learning and lessons learned are the topics that are discussed quite broadly in the literature (Kasvi et al. 2003, 571; Bryde et al. 2018, 540; Ajmal et al. 2010, 156; Piraquive et al. 2015, 236; Ahern et al. 2014, 1374; Howells 2001, 873). For instance, organizational learning is important from KM point of view, because knowledge integration is a source of competitive advantage, but if lack of organizational learning restrains knowledge integration,

the benefits cannot be achieved. In the PM, lessons learned are important inputs in the project procurement activities (PMI 2017, 484).

That leads the discussion to methods and processes. How to avoid mistakes, align the practicalities and make people working similarly without maverick traits? Companies often strive for standardization or harmonization in order to achieve the best economies of scale. The intention obviously is to implement the same common workflow and global processes in the whole organization. However, in project-based businesses, where competitive advantage is based on dynamic capabilities, agility and adaptability, it might be more reasonable to pursue economies of scope instead, because that approach strives for effectiveness and adaptability (Barbosa et al, s. 17). How could that approach be utilized in the KM of the project SCM? The question is interesting, because standardization does not mean that everything is the same nor all processes in the company are homogenous. Quite the contrary, the process is standardized if it is based on certain previously agreed notation and nomenclature. Moreover, it is not needed to use only certain predetermined application or technology but instead, comply with certain rules, regulations in the systems and applications. (Barbosa et al. 2017, 16) That approach would allow for some freedom to adapt the common procedures and methods with a given organizational need and contribute for its part to the company's competitive advantage.

Standardization is also relating to the knowledge personalization and codification strategies. Personalization has benefits, if it can help filling the knowledge caps that are inevitably inherent in the codification, because for example tacit knowledge cannot be easily codified. In addition, if codification is too structured, the knowledge may turn into information or even data. It is possible that the local conception of idiosyncratic terms gets lost if too tight global standards are unproperly adopted. (Daveport & Prusak 1998, 68)

Project uncertainties also form challenges to the SCM and the KM, because complex projects cannot always be completely specified in advance (except in outline or in part). The pre-given knowledge is incomplete, and when the project is handed over, the "as-built" specification may be deviating from the initial project specifications. (Ahern et al. 2014, 1372-1375) Other project details, such as the delivery addresses and schedules may also change. Therefore, new emergent knowledge must be created during the project life cycle, and that knowledge must be appropriately coordinated within the project SCM.

4.2. Research methodology

There are different approaches to carry out a research. Saunders et al. (2016, 162) suggest that the first methodological decision is about selecting between qualitative research, quantitative research or combination of these, a mixed design. There is no exact definition for qualitative research, but instead it can be characterized by many different features (Flick 2010, 2). It is also possible that different guides and handbooks concerning different disciplines refer to different notions of the word qualitative research. Therefore uncritical combining of all definitions and characteristics from different guides may result in misleading conclusions (Tuomi & Sarajärvi 2009, 17).

Qualitative research is interested in a holistic understanding about the phenomenon in its natural settings, humans are used as instrument of data collection instead of gauges or measuring devices, and data (findings) are mostly presented in a verbal instead of numerical form. It seeks to comprehend the perspectives of the participants (for example interviewees), daily practices, processes and their relations as well as knowledge related to the research topic. Qualitative research allows some flexibility while research is carried out, and its primary objective is not to test hypotheses but explore the research material (Hirsjärvi et al. 2009, 164; Flick 2010, 2). Qualitative research can be carried out though several interpretive methods, such as field notes, interviews, conversations and memos (Flick 2010, 2; Tuomi & Sarajärvi 2011, 71). A typical distinction in the literature is that quantitative research focusses mostly in numeric whereas qualitative relies on non-numeric form. Quantitative findings should be convertible to a form that enables statistical analysis. Quantitative research is considered more structured than qualitative research. (Hirsjärvi et al. 2009, 135, 140, 158) However, this distinction can be narrow, or even problematic because in reality many researchers tend to combine elements both quantitative and qualitative elements (Saunders 2016, 165).

Research can also be viewed from a wider perspective through a philosophical lens, which means that research methodologies are interpret through their associations to philosophical assumptions. Qualitative research has associations with an interpretative philosophy because the research is based on interpretation of subjective meanings about the phenomenon that is being studied. However, association with other, such as realist and pragmatist philosophies, are also possible. (Saunders et al. 2016, 168) Quantitative research is typically associated with positivism, which is one of the research philosophies, but it can also include qualitative

elements, such as data that is based on opinions, when the research can be partly associated with an interpretivist philosophy (Saunders et al. 2016, 166).

Research Strategy

The term research strategy refers for example to the distinction between experimental research, quantitative survey research and qualitative research. Some other loose interpretations identify the first two but replace the third term with case study (Hirsjärvi et al. 2009, 135). Saunders et al. list for example following strategies: Experiment, Survey, Case Study and Action Research (2016, 178). Generally a research strategy is understood as a combination of methodical solutions to carry out a research (Hirsjärvi et al. 2009, 132). The Case Study strategy aims to a detailed and intensive understanding of a single case, for example a person, a group, an organization, an association, a change process, an event or other case subject of that nature. A case study can be described as an in-depth inquiry focusing on a research phenomenon in its natural, real-life settings. A survey research in also carried out in real-life settings, but due to a limited number of variables it has more limitations when it comes to the ability to understanding the data collected. A case study, in turn, enables a more holistic and richer understanding about the research phenomenon. The case study strategy is applicable to both quantitative and qualitative research, as well as mixed research designs. (Saunders et al. 2016, 185)

Research methodology of this study

This study is carried out as a qualitative research because the objective is to create a holistic understanding about the research topic in its natural settings. It is also important to understand the perspectives of the participants as well as processes of the organization within the scope of the study. In this study there is only one case organization as a subject of research. That is one reason why a case study is used as a research strategy. A case study also makes it possible to create a better and richer understanding about the research topic. In addition, it is not judicious to carry out a multi-stage iterative, and resource-intensive action research within the timeframe and limits of this study. The research would require participants from the case organization. Thus, it can be very demanding in terms of intensity and resources that are needed to carry out the research.

In addition to aforementioned, other research strategies were also evaluated but they were considered inapplicable to this study. For example, the experiment strategy originates from

natural sciences and laboratory-based research. It is linked to a quantitative research design and it involves arrangements in which hypotheses are tested systematically to find out possible statistical differences. (Saunders et al. 2016, 178-192)

Data collection techniques of this study

In qualitative research common data collection techniques are for example interviews, surveys, observations, documents (Tuomi & Sarajärvi 2009, 71), field notes, conversations, recording and memos (Flick 2011, 3). In this study data is collected through semi-structured interviews because that technique allows some flexibility without a strict formalized set of questions. There is a framework of (thematic) questions, but the order and exact form of questions may change (Hirsjärvi et al. 2009, 208). Methodologically this type of interview emphasizes people's interpretation of things, the meanings of things and how these meanings are created during an interaction. It is not necessary strictly to follow the list nor order of questions, but rather to find meaningful answers to the research frame and research questions (Tuomi & Sarajärvi 2009, 75). The interviewees represent each business function within the limited group of internal stakeholders, and they are asked the same predetermined questions and possibly other thematic complementary questions. In addition, the case company's internal documents, data bases and process descriptions are utilized in the data collection.

4.3. Research structure

In this chapter the structure of this study is explained. The study is composed of six main phases illustrated in figure 10 below.

In the phase 1, the motivation for study was identified with the case organization. In addition, the scope and limitations of the study were determined and research questions were formulated.

The phase 2 is the theoretical part, in which a comprehensive literature review about essential disciplines was done. The objective was to create a theoretical understanding about the theories of SCM, KM and PM in connection with project stakeholder collaboration and interaction.

The phase 3 is the first part of the empirical part, in which the results of the pre-study were utilized as a groundwork. In fact, the pre-study was a prerequisite for the initiation of the empirical part, because the supply organization's functions and departments had to be identified in advance so that the actual study could be smoothly started. The data collection was carried out by semi-structured interviews.

The objective was to focus on the functions inside the supply organization, with the exception of one stakeholder from the outside. That is a representative from the case company's internal component factory. That exception was done, because that party (GOM) has a close technical and process managerial integration with the case organization's project management and supply operations. In practice, the persons that represent each function or department, were invited to interviews. Only one representative from each function or department was invited, unless different persons had considerably different tasks and presumably different perspectives about the interaction with the stakeholders. The interviewees were briefed on the study prior to interviews in a common kick off meeting.

Through the interviews it was possible to get an adequate understanding about the project knowledge, the collaboration and the interaction with the stakeholders of the supply organization, and the project phase when these activities took place. The official project management process defines the project phases that are being used in the case organization. These phases are not fully in chronological order, but they determine the project lifecycle in the case organization and therefore these phases were used to define the time span. The interviews were based on thematic questions focusing on clarifying stakeholders, project phases, contents and type of project knowledge, means and tools of communication, and whether the interaction was based on processes or informal communication. As defined in the limitations of the study, all kinds of stakeholder interaction that is not directly related to projects, for example to annual planning, general process development or a rollout of global corporate systems, was excluded from the scope of this study.

The phase 4 was the second part of the empirical part whereby an in-depth analysis was focused on the particular focus area. The data collection was carried out through semi-structured interviews. The preliminary plan was to concentrate on certain direct suppliers or subcontractors, but the scope of the focus area was decided prior to the focus are analysis.

In the phase 5, the objective was to analyse and find potential development areas within the focus area, identify weak points, and create suggestions to develop more systematic processes and practices related to supply organization's project stakeholder interaction and collaboration.

Finally, in the phase 6 the collected material was viewed through the theoretical framework of this study and the analysis, practical implications and conclusions were created as a result. The research questions were also answered in this phase. Additionally, this study report was completed.

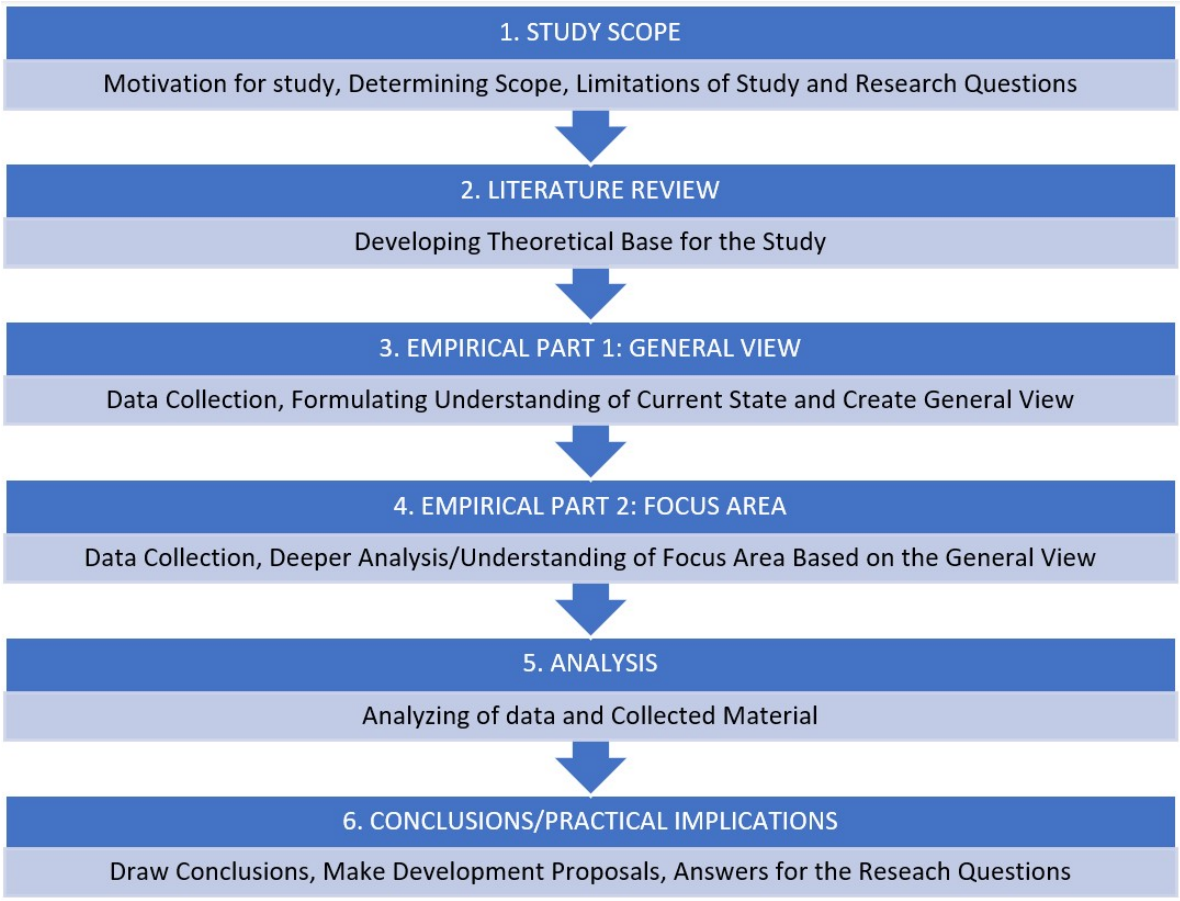

Figure 10: Overall structure of the study

4.4. The case company and organization

The case company in this study is Konecranes Finland Oy and its business unit Port Cranes. The BU Port cranes is a fully project-driven organization focusing on serving customers in ports, terminal and shipyards. The main products portfolio comprises manned and fully automated container and shipyard cranes. The actual case organization is the supply organization, which is responsible for sourcing, purchasing, logistics, (quality) and site operations. The main office is located in Hyvinkää, Finland but the BU has its own operations in China and Germany as well.

5. ANALYSIS OF THE FINDINGS

In this chapter the results of the study are discussed in their chronological order. First, the general view analysis concentrated on creating a general view about the current state of the supply organization's project knowledge management in connection with the stakeholder collaboration/interaction. The purpose was not to create a thorough analysis but instead, a simplified conceptual description of the current situation. The second phase concentrated on the focus area analysis and the direct components suppliers in particular.

5.1. The general view findings

The results indicate the supply organization's project stakeholders and their interaction during the project lifecycle. Therefore, it is worthwhile to notice that interaction or contents shared/exchanged between stakeholders are not identified, if the supply organization is not involved. Notwithstanding the fact that the same stakeholders may be interacting with the supply organization, or case company in general, in another occasions. For example, the interaction between project managers and suppliers is not taken into consideration, because the project management does not belong to the supply organization. In addition, apart from S&OP, the interaction or contents are not identified, if they are not considered direct project knowledge. The data collection took place between December 2020 and February 2021 and in total 11 interviews were conducted online through Microsoft Teams. The interviews were based on the thematic questions. The durations of the interviews varied between 45-60 min.

The material collected from the interviews was harmonized so that different notions and words with equal meaning could be defined with one unified term. The general view representation consists of six basic elements, as illustrated in table 3: stakeholder, factual content exchanged during the interaction, the direction of factual content exchanged during the interaction and the time span when the factual content was exchanged. The stakeholder defines the counterparty of the interaction. It can be a department, a business function or other party, but not an individual person. The content refers to the subject matter that is being exchanged during the interaction. The direction refers to the primary flow of the content (subject matter) that is being exchanged during the interaction. The direction is determined from the supply organization's point of view, and it can be either inbound, outbound or two-way. The two-way knowledge exchange involves discussions and a lot of content exchange in the both directions. The organization refers to the categorization of the stakeholders. Contrary to the pre-study, where the stakeholders were

identified in three levels, in the general view they are identified in four following categories: supply organization internal (Ports Supply PS), BU Port cranes internal (PC), Konecranes internal (KC) and Konecranes external project stakeholders (EX). The time refers to the project phase wherein the interaction takes place or when the transaction is submitted. There are eight phases in the project, but an additional phase named ”X” is included in the representation, because certain interactions do not actually belong to any of the particular project phases. The sixth element refers to the supply organization’s own function or department. The representation describes the regular and possible irregular stakeholders and interactions, which means that some of them are occasional. For example, a certain documents, such as a letter of credit requires arrangements with a bank or the corporate trade finance department, but that is not always needed.

Table 3: Main 6 elements of the general view

Element	**Description**
1. Stakeholder	Department, business function or other party (e.g. supplier)
2. Content	Factual content exchanged during interaction or system-based transaction
3. Direction	Primary direction of factual content exchanged during interaction (inbound/outbound/two-way from Supply’s perspective)
4. Organization	Organizational categorization in relation to supply organization
5. Time	Project phase wherein interaction takes place
6. Supply function	Supply organization's own function or department

The factual content was divided into two categories: transaction and interaction. The former was used in case an official system-based transaction, such as SAP PO, was identified, whereas the latter one was used when there is no system-based transaction exchanged during the interaction. These situation typically involve two-way written or verbal discussions. They need mutual active participation. The situations are conceptual so that one situation consists of all stakeholders in the same group in a given situation. Therefore the number of conceptual situations does not define the actual number of stakeholders (e.g. suppliers) in that situation.

The transactions are colour-coded so that they are more visible at a glance among the general view representation.

In order to make the representation more user-friendly, comprehensible yet informative, it was necessary to simplify certain the elements (contents of interaction) without diminishing the essential knowledge or the usability of the representation. For example, a request for quotation is represented as ”RFQ” but that term comprises both the submitting of an RFQ itself and the supplier’s response, that is to say submitting a quotation. In reality however, a project-specific RFQ process can take more than these two obvious steps, and a lot of two-way interaction before the quotation can be submitted. Another example of the simplification is the stakeholder ”supplier”. It comprises all direct material and component suppliers in a given situation, except those considered subcontractors. The definition for a subcontractor is based on the purchased product so that the products made according to the case company’s specifications, are subcontracted items and thus, the stakeholder is a subcontractor.

On the grounds of the general view the extent of the project specific interaction with the supply organization’s stakeholders became visible. There are many formal transactions but above all, there is a substantial amount of interaction which consists of (often iterative) two-way qualitative and quantitative knowledge exchange. The extent is presented by numbers in table 4 below.

Table 4: Overview of stakeholder interaction during project phases

Project phase	KC internal	KC external	All	Percentage	Cumulative
0 - Offering	23	8	31	17 %	17 %
1 - Project Planning	25	11	36	19 %	36 %
2 - Engineering	20	7	27	15 %	51 %
3 - Purchasing	17	5	22	12 %	63 %
4 - Component Shipping	7	10	17	9 %	72 %
5 - Steel Structure Manuf.	3	1	4	2 %	74 %
6 - Crane Transportation	4	1	5	3 %	77 %
7 - Site Works	17	4	21	11 %	88 %
8 - Warranty Period	6	7	13	7 %	95 %
X- other phase	6	3	9	5 %	100 %
Total	128	57	185		

In total there are 185 situations in which a stakeholder interaction takes place, on a regular basis or at least occasionally. These situations are additionally illustrated through following three indicators:

- Number of stakeholders by project phase
- Number of stakeholders by Supply function/department
- Number of interactions by organizational categorization

In this analysis, one project stakeholder interaction comprises all content related exchange, possible meetings and discussion in the given project phase, unless it is a system-based transaction. One stakeholder can be involved in many contents in the given phase.

Number of stakeholders by project phase

Based on the results, most of the stakeholder interaction takes place in the early stages of the project. In fact, the results suggest, that over 50 % of the collaboration is done during the first three phases (offering, project planning and engineering). Furthermore, the majority of all activity occurs within the internal stakeholders PS, PC and KC. For instance, in the offering phase there are 23 internal and 8 external stakeholders. The number of stakeholders by project phase is illustrated in figure 11 below.

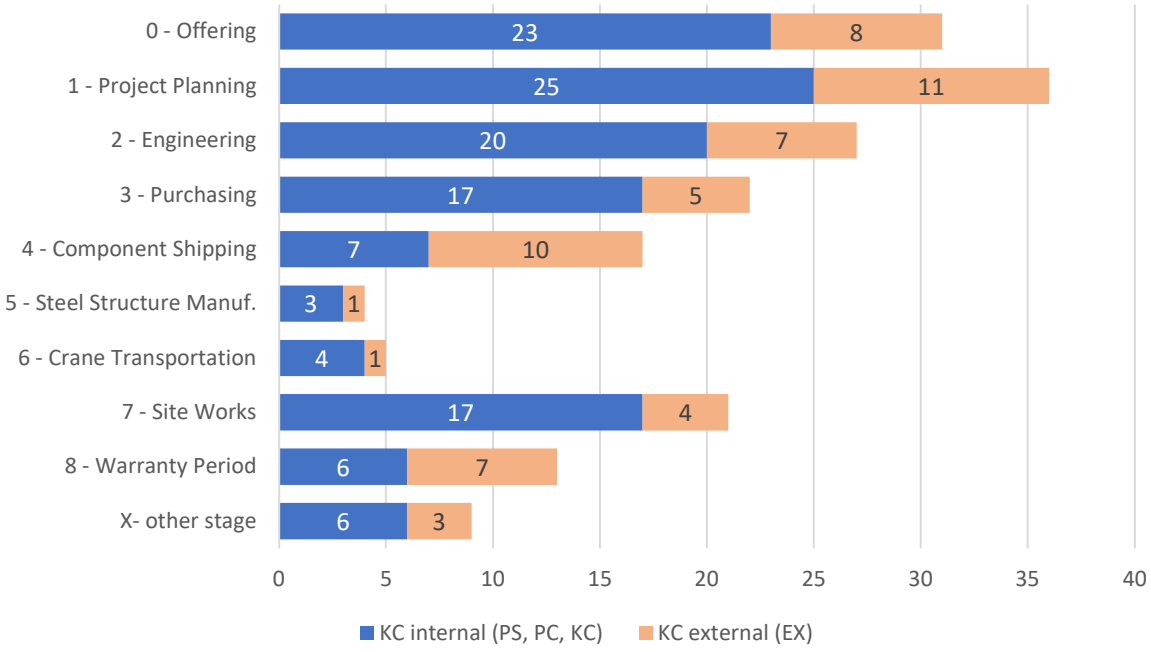

Figure 11: Number of stakeholders by project phase

Number of stakeholders by Supply function/department

The results also shed light on the stakeholder activity carried out by the supply organization's different functions and departments. This indicator is based on the number of stakeholders during the whole project lifecycle. The highest number of stakeholders is involved in the supply

logistics, consisting of 16 internal and 14 external stakeholders. The second highest number of stakeholders in involved in the supply purchasing, consisting of 12 internal and 11 external stakeholders. The number of stakeholders by Supply function/department is illustrated in figure 12 below:

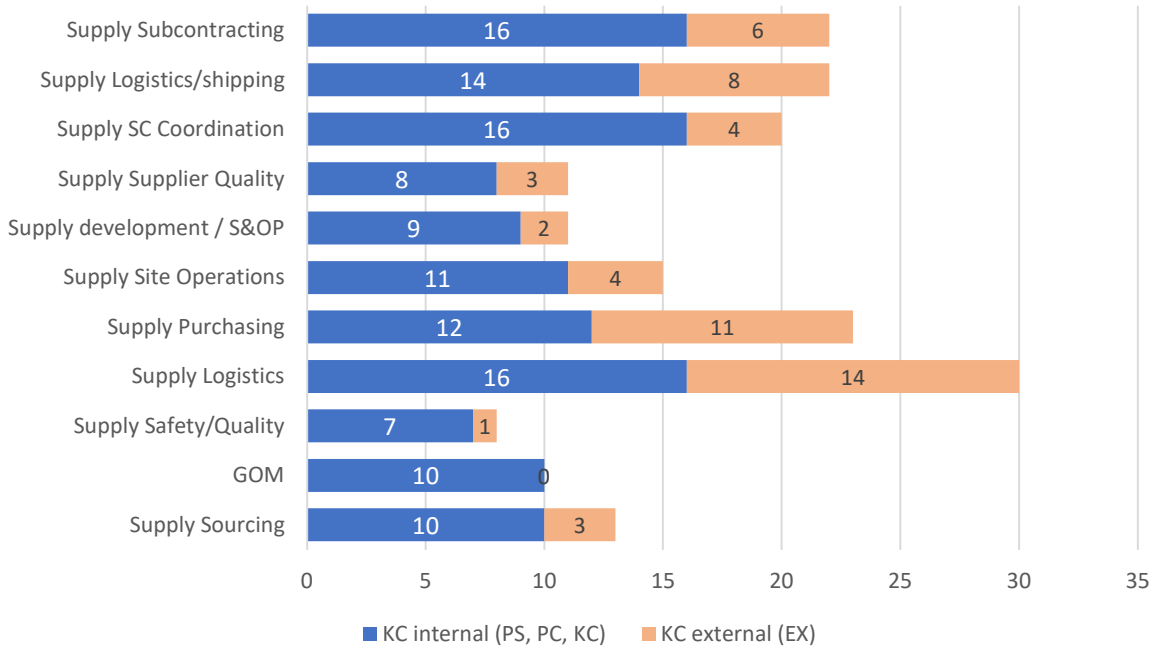

Figure 12: Number of stakeholders by Supply function/department

Number of interactions by organizational categorization

One of the essential indicators can help to understand whether the project stakeholders are internal or external in relation to the supply organization. In this indicator the organizational categorization (PS, PC, KC and EX) is used. That is hence more detailed than the two-level internal-external categorization. Three out of four categories belong to the case company and one of them is the case organization (PS = Ports Supply) itself. The percentage by organizational categorization is illustrated in figure 13 below. The most noticeable finding is, that the smallest amount of interaction (5 %) takes place with the corporate internal stakeholders (KC). Other three categories do not have major differences in that respect. Their percentages vary between 30-34 %.

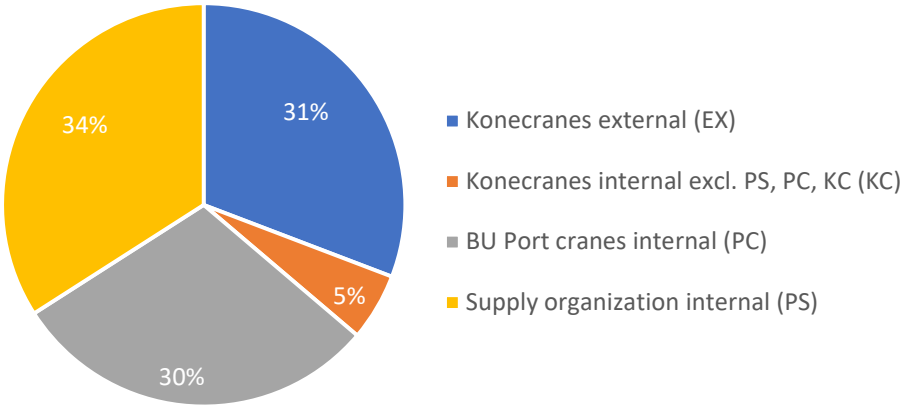

Figure 13: Percentage of interactions by organizational categorization

5.2. The focus area findings

The focus area analysis concentrated on the direct suppliers because there is a relatively broad range of different suppliers and products involved in this group. Some of the purchased product are standard components whereas majority of the most critical components are long lead-time project specific sub-assemblies or modules. In addition, there are different means of communicating the project specific specifications between the case company and its suppliers. The direct suppliers are located in many different countries which bring about the need to manage the multiple different distance attributes.

The more precise supplier selection was done according to the characteristics of the purchased product and the themes of the theoretical framework. For instance, the product is considered critical, if it has a long lead-time, the specification is project-specific, or a considerable amount of multiphase stakeholder interaction and project uncertainties are involved in the sourcing process. The selected products represent quite well the wide diversity of views, methods and procedures related to the sourcing and purchasing of these products. The findings of the focus area analysis are presented in table 5. In order to explain the phenomenon, the table also includes a brief descriptions of primary and secondary effects of each finding. In total, 15 findings are presented.

The data collection interviews were conducted online through Microsoft Teams in May 2021, and they were based on based on thematic questions. The durations of the 2 interviews varied between 45-60 minutes.

It was defined in the limitations of the study, that all kinds of stakeholder interaction that is not directly related to projects, for example to annual planning, general process development or a rollout of global corporate systems, was excluded from the scope of the study. However, certain interactions that do not precisely belong to any of the actual project phases were identified. These findings were taken into consideration, and they are briefly discussed in the paragraph 6.2.

Table 5: Findings of the focus area analysis

Finding		Primary effect	Secondary effect
1	Different purchase requisitions (PR) for the same item. Variation between projects and product lines	Different ways to exchange item-specific information (knowledge) and to define the scope of delivery between internal stakeholders (i.e. SC coordination and Purchasing)	Different ways to define the scope of delivery of purchase order (PO)
2	Different POs for the same item. Variation between projects and product lines	Different ways to define the scope of delivery of PO	Ambiguity in scope of delivery (e.g. definition of selected options and quantities), tracking of materials e.g. goods receiving (GR), especially partial deliveries and challenges in partial invoicing
3	Specifications for RFQ	Different ways to define specifications in RFQ. The same components/systems may have differences depending on product line (e.g. surface treatment spec)	Unclarities and inadequate specifications may result in confusion and unnecessary clarifications. Risk of wrong specifications
4	Technical deviations during RFQ - who will communicate with supplier, if more expertise is needed (Purchasing or Engineering)	No clear standard approach in place within all stakeholders	Overlapping work, lack of internal coordination, inefficient use of resources

5	Approval process of supplier's drawings and specifications (prior to PO and after PO when changes occur)	The approval process between Engineering and Sourcing/Purchasing is working, but there is no specific method in use for storing and exchanging documents and approval status other than email	Email is not the best method in case e.g. persons change or substitutes are needed during holidays. Email has disadvantages when specifications must be changed, revision management can be difficult
6	Missing order confirmation (OC) or missing records in the ERP	Not known or record missing in the ERP whether the supplier has received the PO	Risk of late deliveries and possible impact on project schedule, excessive costs due to e.g. extra admin work, more expensive transportation (even liquidated damages)
7	Possible discrepancies between OC and PO. Not always noticed or are not noticeable	Difficult to interpret what supplier has actually confirmed	Risk of incorrect deliveries and possible impact on project schedule, excessive costs due to e.g. extra admin work, more expensive transportation (even obligation to liquidated damages)
8	New supplier onboarding	Process requires a considerable amount of admin work (background check etc.)	No added value always obtainable by using new (potentially one-off) supplier but onboarding takes resources, the number of suppliers increases, potential compromises from cost and risk management point of view.
8	New supplier onboarding	Process requires a considerable amount of admin work (background check etc.)	Internal stakeholders may not be always aware of the process and the disadvantages, and thus may not strive for avoiding unnecessary (one-off) new suppliers

9	Shared project sourcing/purchasing responsibilities within the BUs of the BA	No clear standard procedure in place for coordination and follow-up. Different ERPs do not support system-based transactions nor management.	Internal coordination of sourcing/purchasing responsibilities has still development potential. Mutual data/Information storage and exchange processes are not clearly defined.
10	Availability of long lead-time components	Lack of up-to-date delivery times, or delivery times are no longer valid. Inability to react, make plans and place PO in time	Risk of late deliveries and possible impact on project schedule, excessive costs due to e.g. extra admin work, more expensive transportation (even liquidated damages)
11	Utilization of lessons learned (project post-mortem)	Knowledge of lessons is collected but its full potential may not be utilized	The same mistakes are repeated unless lessons and tacit knowledge are systematically utilized to steer the day-to-day operations in Purchasing/Sourcing.
12	Silo effect	Possible that project stakeholders do not understand the other project team members' profession, or do not know which knowledge the other project team members need, or which process should be followed	Lack of understanding may hinder other stakeholders to get needed knowledge/information and complete his/her task properly and timely
13	Definition of required quality documents and certificates for purchased items	PR does not always define all needed information, or there are differences. Purchasing does not have clear understanding about required documents and certificated, and thus they are not stated on PO	Required documents and certificated may be missing when the goods are delivered. Requesting afterwards may be challenging and takes excessive admin work

14	Communication of real-time estimations and S&OP information with critical/long lead-time suppliers	Real-time estimations, preliminary workload, S&OP information is regularly updated/maintained, but how to efficiently communicate that to named critical/long lead-time suppliers?	Regular monthly/quarterly meetings with suppliers are held by Sourcing or Purchasing but these departments do not always have the latest information
15	Purchasing/Sourcing is passed over when RFQ is sent to supplier	Purchasing/Sourcing is not involved in the RFQ process, and thus not able to affect commercial matters.	Commercial negotiations can be challenging if Purchasing/Sourcing is informed too late. Sometimes the time is running out.

5.3. The focus area development proposals

In this chapter the development proposals for all the 15 findings of the focus area are discussed together with the reasoning behind the proposals, their feasibilities and possible deficiencies. The objective is to present ideas how more systematic processes and practices related to the supply organization's project stakeholder interaction and collaboration can be developed. The development proposals were formulated as follows:

Finding 1 Different purchase requisitions (PR) for the same item

The proposal is to harmonize purchase requisitions so that the structure (principle) is always similar for items or modules that belong to certain category. Feasibility: PRs may be depending on the engineering structure (MBOM/EBOM) so that PRs cannot be harmonized without changes in the engineering phase in the product structure

Finding 2 Different POs for the same item. Variation between projects and product lines

The proposal is to harmonize purchase requisitions so that the structure of PO is always similar for items or modules that belong to certain category. Feasibility: PO lines are created according to PR lines, thus this proposal is interconnected with the finding 1. Deficiency: supplier's invoice lines may still be different from PO lines. It is not always possible to know in advance how many pallets are needed for shipping the goods of the PO, and therefore the PO lines cannot

always be created according to number of pallets, which would be preferred from material tracking and goods receiving point of view.

Finding 3 Specifications for RFQ

The proposal is to create a standard data sheet template for certain components/systems (e.g. cable reels, e-chains). Project-specific parameters would be determined on a case-by-case basis. There would be less details to be forgotten by human error. Implementation should be done in all the product lines. Feasibility: harmonization of processes and documents across all the product lines would improve the exchange of internal and external project knowledge, but that takes cross-functional effort and decisions-making. Management support is needed as well.

Finding 4 Technical deviations during RFQ - who will communicate with supplier, if more expertise is needed

The development proposal is to create and implement clear guidelines (practice) how to communicate technical deviations with the supplier in RFQ process, in case the need for changes occur. Feasibility: in normal situations the existing practice works mostly well, but certain situations require more technical expertise. Additionally, the approval of the changes in question would be more straightforward if the responsibilities were explicit.

Finding 5 Approval process of supplier's drawings and specifications

The development proposal is to evaluate possibilities to use other more efficient and less labour-intensive methods to exchange technical documents and their approval statuses. Feasibility: there are at least two perspectives. First, the RFQ process in which the specifications are needed, and second the management of project uncertainties. Projects typically involve certain degree of technical changes, and sometimes the specifications are completed after the PO. That must be managed somehow.

Finding 6 Missing order confirmation or missing records in the ERP

The development proposal is to promote more systematic utilization of the existing robotic process automation (RPA) in the purchasing department. Feasibility: there is an existing RPA procedure in place, but a more systematic use might help reacting to missing order confirmation before it is too late. It is a relatively easy and simple procedure and it mostly comes down to the organizational culture. On the other hand, Jaggaer (cloud-based sourcing application)

provides a systematic approach for monitoring POs but that is not yet used in the critical project-specific products.

Finding 7 Possible discrepancies between OC and PO. Not always noticed or are not noticeable

The development proposal is to make sure that there is enough time and resources to carefully review the order confirmations and clarify possible discrepancies with the supplier, if needed. Feasibility: the task requires thorough review of an order confirmation and it takes time and certain degree of technical expertise. However, less attention needs to be paid to this matter if GRs and POs are well prepared.

Finding 8 New supplier onboarding

This finding can be viewed from three perspectives. The development proposal consists of following measures: the number of new suppliers is monitored in order to see the extent of new supplier onboardings, and the true customer value is evaluated within the same timeframe (e.g. one year). A collective discussion with the internal stakeholders about the tacit perspectives and the actual necessity of new (one-off) suppliers. Furthermore, it is proposed to promote the awareness of the new supplier onboarding process itself, and the use of preferred suppliers for example with the product managers.

From the feasibility point of view, it can be said, that this topic has interconnections with the strategic perspectives. This initiative would strive for having less suppliers and putting more focus on the preferred suppliers. Presumably this proposal is more feasible with direct component suppliers than on-site service providers that are often located in customer's country.

Finding 9 Shared project sourcing/purchasing responsibilities within the BUs of the BA

The development proposal is to create a systematic procedure for internal coordination and follow-up meetings that would enhance the internal exchange of tacit and explicit project knowledge and efficiency of the process between stakeholders. Provided, that shared projects are delivered in future. Feasibility: the organization is still in the beginning of the learning curve, as only one large project has been started. In fact, it is still in the execution phase while this study is being carried out. As mentioned, this initiative may be less important and worthwhile if the BU's plan is not to deliver shared projects in the future.

Finding 10 Availability of long lead-time components

The development proposal is to create a simple table for "general delivery times" of long lead-time items that is regularly updated by responsible supplier manager (SM) or category manager (CM). Hence the information would be available prior to a project RFQ and supplier's budgetary or final quotations. Feasibility: PO-plan is updated by supply chain coordinator, but outdated information may result in delays if there is no up-to-date understanding about current delivery times. This proposal may help the project organization avoid project delays. The same information could be used in the Sales as well. However, it is possible that unforeseeable market disruption, such as a pandemic, can change the situation very quickly, so the information should be updated quite frequently.

Finding 11 Utilization of lessons learned (project post-mortem)

The development proposal is to create a procedure that would enable and maintain a more systematic organizational learning in the supply chain management, knowledge management and the stakeholder interaction. Feasibility: the post-mortem is in fact part of each project, but there might be potential for more systematic utilization of lessons learned and collected post-mortem material at organizations' disposal. Especially, when the popularity of remote work and online meetings is increasing, the tacit knowledge is not efficiently exchanged.

Finding 12 Silo effect

The development proposal is to communicate openly the needs of each stakeholder group and department, and promote collective understanding as well ”we’re in this together” attitude. Feasibility: generally speaking a "team spirit" strengthens mutual interest and respectively promotes achieving common project goals. That matter is not considered a major issue, and it has been improved, but according the interviews there is still some room for improvement. The organizational culture is of the essence in this respect.

Finding 13 Definition of required quality documents and certificates for purchased items

The development proposal is to fine-tune, if needed, and finalize the development of the existing procedure in collaboration with the purchasing, the Supply chain coordination and the Engineering. Feasibility: there is an existing procedure for exchanging the information on required documents and certificates, but there are still certain deficiencies, such as

underutilization. These should be clarified and implemented across the BU in all the product lines.

Finding 14 Communication of real-time estimations and S&OP information with critical/long lead-time suppliers

The development proposal is to evaluate if any added value (such as improved delivery times and mitigation of project uncertainties) could be obtained by improved communication in this matter. Evaluate if there are any feasible efficient procedures to communicate with certain critical/long lead-time suppliers. Feasibility: the S&OP process is an integral part of supply organization and the S&OP information is regularly updated, but it could be beneficial to share that knowledge more systematically with certain purposeful critical or long lead-time suppliers. Decide also which department will share that knowledge with the suppliers (e.g. Purchasing, SC coordination, S&OP team).

Finding 15 Purchasing/Sourcing is passed over when RFQ is sent to supplier

The development proposal is to create a common guideline for the RFQ process, including a definition that who can send an RFQ. At the minimum, it would be worthwhile to promote the general rule, that the purchasing/sourcing must always be kept informed in case other department (e.g. Engineering) sends an RFQ to supplier. Feasibility: in principle, RFQs are sent by the purchasing/sourcing, but in certain exceptions the Engineering may send an RFQ. In addition to the project in question, there is another wider interest if there are other negotiations ongoing with the same supplier. Furthermore, the Sourcing can also bundle multiple projects into one "package offer" in order to negotiate for more competitive prices and other commercial advantages.

6. CONCLUSIONS

In this chapter the conclusions of the study are discussed. First, the conclusions from the result and findings are drawn. The research questions are then answered, and finally the research process itself is evaluated through recapping the objectives and limitations of the study and discussing how they were achieved.

6.1. Conclusions from the findings and result

As external interaction is based on an efficient internal knowledge management, it can be said that attention must be paid both to internal and external knowledge exchange and stakeholder interaction. The early phases of the project are important, because more than 50 % of the interaction takes place prior to the purchasing phase. Delays in the early phases caused by poor knowledge management will most likely result in delays in the later project phases and it may be very challenging and costly to catch up with the project schedule. On the other hand, the high amount of stakeholder interactions can be seen as a difference between non-project-based businesses. According to the study, the project-based businesses have distinctive characteristics when it comes to stakeholder interaction and knowledge management. The best practices proven applicable to non-project-based business models may have less benefits in project-based businesses.

The existence of many interactions may pose questions about the social perspectives, as they have many positive effects, such as maintaining shared trust and confidence (Kawa & Maryniak 2019, 79-80) and enabling efficient teamwork, participation, cohesion and the sharing of tacit knowledge (Bryde et al. 2018, 551). Moreover, the lack of appropriate social interactions between the project stakeholders can be a bigger reason for project failures than ineffective project management practices (Missonier & Loufrani-Fedida 2014, 1108). How to make sure that the positive effects will not get lost while the physical proximity in the offices and face-to-face interactions are gradually replaced with remote work and virtual project teams? Either way, the essential questions are how the organizational culture is evolving, how the knowledge management practices and tools work, and how the tacit knowledge can be exchanged across the supply chain. Based on the interviews, the remote approach has worked quite well during the (COVID-19) pandemic, but the interviewees clearly pointed out, that they felt that they have been missing most of the tacit knowledge, both organizational and project-related.

Generally speaking, one of the observations from the literature is, that it may be a reasonable suggestion to develop entirely new procedures and novel tools for KM – whose sincere purpose is to enhance the knowledge management as a whole – but it should be done cautiously so that the development is not only superficial. Otherwise, there is the risk that it is an improvement on paper, but in reality the factual content will be reduced during the exchange process. That may happen if the knowledge codification is too structured, and the content with its distinctive properties may be diminished (Davenport & Prusak (1998, 68). The knowledge then turns into information or even data. In the end, the improvement proves to be failed.

The study findings also show that a noticeable majority of all stakeholder activity occurred between the internal stakeholders of the BU Port Cranes, whereas interaction with the corporate internal business functions only represent a fraction (5 %) of all activity, That may be considered an advantage from KM point of view, because this is how the project knowledge is mostly managed within the same line organization, involving internal stakeholders. However, the conceivable advantage may be questionable, if that misplaces the corporate's in-house expertise that could be utilized through well-coordinated collaboration. Perhaps, that is something that should be advanced, or at least studied. Anyway, it is depending on the organizational culture and the way it is evolved.

Based on the focus area analysis it can be said, that no fundamental issues requiring radical changes were found. However, a number of rather incremental changes can be done. By default they do not require a lot of radical change management, but all activities are influenced by the organizational culture, team spirit and commitment, so it is important to understand the importance of cohesion within the project organization. Therefore not all of the proposals are purely focused on developing more systematic methods and processes, but additionally the aspects related to trust, the organizational culture and organizational learning are taken into account as well. Managing these aforementioned areas would help the case organization better manage the project uncertainties and the prerequisites for the project knowledge management, and the stakeholder interaction and collaboration. In the end, they can help to reduce the supply chain costs, and in the long term, lower costs enable more competitive sales prices and hence the company can gain its competitive advantage on the market.

6.2. Answers to the research questions

Conclusions from the findings have been drawn so it is time to give answers to the research questions of the study:

1. What is the current status of the project knowledge management in the supply organization?
2. How can the supply chain management and the profitability of the business be improved by developing the project knowledge management and supplier and stakeholder collaboration?

RQ 1: What is the current status of the project knowledge management in the supply organization?

The supply organization's current state has following characteristics. There are 185 regular or irregular situations in which stakeholder interactions take place during a project, and about a quarter of these situation involve system-based transactions. More than 50 % of the stakeholder activity occurs during the first three project phases, prior to the purchasing phase. That can be considered an essential finding in understanding the dynamics of the project knowledge exchange. During these phases there is only a small number of system-based transactions. Instead, the stakeholders interact by different means of communication, including face-to face and online meetings, shared project folders, web-based collaborative platform (SharePoint). In addition, sometimes safety audits, supplier meetings or other project-specific arrangements require travelling prior to the purchasing phase.

The early project phases are important, because distractions and deficiencies can easily result in project delays in the later phases. It may be difficult to catch up with the schedule, and at least it takes extra effort form the project team. Often excessive costs occur as well. In the current situation all department of the supply organization have interaction with both internal and external project stakeholders. The logistics and the purchasing function have most of the activity. The process model defines the project phases, but in general it was identified that there is certain stakeholder activity that does not belong to any actual project phase in particular. For instance, regular S&OP meetings and clarification of invoices discrepancies are identified. The latter one especially is seldom seen as part of the purchasing department's duties, but according the interviewees, that takes time and resources. Additionally, it is related to the project margins, and even POC (Percentage Of Completion) if there are confusions with the goods receiving.

RQ 2: How can the supply chain management and profitability of the business be improved by developing the project knowledge management and supplier and stakeholder collaboration?

All the development proposals presented in this study aim at improving the prerequisites for the project knowledge management, and the project stakeholder interaction and collaboration in the case organization. Attention is paid both to the internal and external stakeholders so that the methods, processes as well aspects of trust, the organizational culture and organizational learning are taken into consideration. The exchange of tacit knowledge can be challenging but is also important. The implementation of certain proposals may require cross-functional evaluation and decision making, but if they are successfully implemented, they can help the case organization improve its supply chain management, reduce the supply chain costs and enhance its profitability. Eventually, that should to some extent have favourable influences on the competitive advantage of the company.

6.3. Conclusions from the research process

The study had two main goals. The first of which was to create a general view about current state of the supply organization's project knowledge management in connection with stakeholder collaboration. The second goal was to find development areas and suggest ideas to develop more systematic processes and practices related to the focus area suppliers. However, the target was not to initiate any development projects based on the development proposals, and regardless of possible overlaps with information technology (IT) and knowledge management (KM) tools, the study was not made from information technology (IT) viewpoint. The phases of the empirical part were determined by the goals of the study. First, the general view was created and then the focus area analysis carried out.

Prior to the general view a pre-study was carried out by the author of this study. That pre-study helped with valuable background information about the identified project stakeholders, and enabled the smooth start of the actual research work. As a result of the semi-structured interviews, the general view was created. It consists of the representation and the summary of findings including illustrative figures of three indicators in chapter 7.1. of this study. The general view helps the case organization understand which stakeholders are involved in the project deliveries, in which project phase the interactions take place and what is the extent of the stakeholder interaction. The stakeholders are divided in four organizational categories on

order to analyse whether the interaction is internal or external, and the primary direction of the factual content (subject matter) is indicated as well. Additionally, the analysis shed light on the volume of the system-based transactions and the effort needed in comparison to stakeholder interaction. The representation is based on Excel file. It was shared with the case organization. Based on that, it can be said that the first goal of the study was achieved.

The focus area analysis was carried out as a continuation of the general view. The research subject was the direct material and components suppliers, and more specifically the suppliers that deliver critical components. These components were considered critical based on their long lead-times, their project-specific specifications, or the considerable amount of multiphase stakeholder interaction and the project uncertainties involved in the sourcing process. As a result of the analysis 15 development areas were identified and development proposals for each of them were created. There are two proposals for the finding 8 so there are 16 proposals in total. The proposals aim at developing more systematic processes and practices related to the focus area suppliers. However, the proposals are not only directly related to the knowledge exchange and interaction with external stakeholders, as the study findings clearly indicated that attention must be paid to the development of internal interactions as well. They are is equally important. The proposals also take into consideration the operative and strategic perspectives as well as their possible effect on the profitability and connection to the competitive advantage of the case organization. From the feasibility point of view the proposals are concrete and incremental, and most of them are rather simple to put in practice. The scope and extent of the study was kept within the limitations of the study. Based on the aforementioned, it can be said that the second goal of the study was achieved.

7. SUMMARY

The case organization operates in a fully project-based industry, and its business during the last years has considerably grown through organic growth. Additionally, the company has merged several new business entities as part of acquisitions. As a result, the number of projects and number of cranes have increased quite significantly. At the same time, the need for different delivery and manufacturing concepts in different continents have increased. The case organization has many internal and external global suppliers and subcontractors, and effectively all end-customers are located in different countries The sourced materials and fully erected cranes must be shipped to their destinations overseas safely, timely and cost efficiently. Thus, the company has many great opportunities, but also challenges related to internal and external stakeholder collaboration. The case company seeks to improve competitive advantage and profitability through supply chain management. These circumstances have created the motivation for this study. The case company has initiated development programs in many areas, for example implementation of lean practices, and developed systems for information exchange with suppliers, but the project stakeholder collaboration and related knowledge management have not been previously studied insomuch that there would be a holistic and up-to-date understanding about them.

The goal of the study was to create a general view about current state of the supply organization's project knowledge management in connection with stakeholder collaboration. The second goal was to find development areas and suggest ideas to develop more systematic processes and practices related to the focus area suppliers. However, the objective was not to initiate any suggested development projects. The objective was to investigate "what the current status of project knowledge management in the supply organization is, and "how the supply chain management, and profitability of the business can be improved by developing the project knowledge management and supplier and stakeholder collaboration?".

The study was carried out as a qualitative case study and the data was collected through semi-structures interview. In addition the company's internal documents, data bases and process descriptions were utilized. Prior to the study a pre-study on the project stakeholders was carried out. The results of that study were utilized as a valuable source of background information. The empirical part was first concentrated on the general view, and after that on the focus area, in which the interaction and collaboration with the direct suppliers were examined. As a result, the general view provides a basic understanding of the characteristics and scale of the project

specific interaction with the supply organization's stakeholders. As a result of the focus area analysis, 16 concrete and feasible proposals for 15 development areas were formulated. They can help the case organization in improving the prerequisites for the project knowledge management, and the project stakeholder interaction and collaboration. Additionally, they can help to reduce the supply chain costs. In the long term, lower costs enable more competitive sales prices and hence the company can gain its competitive advantage on the market.

Conclusions from the study can be drawn as follows: the case organization has a lot of interaction with its project stakeholders, More than 50 % of that occurs prior to the purchasing phase. That can be seen as a difference between project-based and non-project-based businesses. That difference relates to one of the framework themes ”Project-based business has distinctive characteristics”. Another essential conclusion from the literature review is, that the PM theory has deficiencies in the context of stakeholder collaboration. One of the conclusions was that attention must be paid both internal and external knowledge management, which might be slightly contrary to the thoughts before the study, because at that time the anticipated focus fell upon the external rather than internal stakeholders. It was also observed that all departments of the case organization have both internal and external project stakeholders. The logistics and the purchasing have most interaction.

Most of the development proposals are deduced from the following framework themes: ”Methods, processes and standardization”, ”Organizational culture” and ”Managing project uncertainties”. Still, attention has been paid to all the framework themes: ”Trust”, ”Social interaction” and ”Organizational learning and lessons learned”.

As for restrictions, it can be said that the study does not take into account the true effort or amount of time that is needed to carry out the collaboration with the stakeholders, because only the number of categorical stakeholder groups is indicated. On the other hand, this restriction can be a potential subject for further study, if the case organization wants to get a more profound understanding on the actual effort and how much time it takes.

Based on the results and findings in both the general view and the focus area, it can be said that the goals of the study were achieved and its scope and extent were kept within the predetermined limitations of the study. The findings and conclusions could be used as a groundwork for further development projects in the case organization, and they may help other functions in the enterprise better understand the case organization's perspective and distinctive characteristics.

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APPENDIX 1: Pre-study - Project Stakeholder Identification