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Developing Procurement Processes with RPA in a Large International Procurement Organization:

Case study in an Energy Utility Company

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ABSTRACT

LUT University LUT School of Business and Management Master's Programme in Supply Management	ABSTRACT OF THE MASTER'S THESIS

Author: Jarno Vainio

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Purpose
The purpose of this master's thesis is to study how Robotic Process Automation (RPA) can be used to develop procurement processes in a large international procurement organization. The existing scientific literature and white papers on RPA is mainly focused on automated processes in international financial, telecom, and insurance companies. Thus, this thesis aims to broaden the scientific field for capability of RPA in procurement processes. However, the concentration is on the case company's procurement processes.

Methodology/approach
The research started with comprehensive review of current scientific publications on RPA and procurement theories, which were used to answer partly the research questions. Also, for the empirical part the data was gathered in semi-structured interviews both in workshops and individual interviews. Data was lastly analyzed by using qualitative research methods.

Findings
The research indicates that RPA can be utilized in certain case company's procurement sub-processes and RPA can be difficult to implement for complex end-to-end processes. Governance of RPA projects is crucial in order to successfully identify, develop and deploy RPA projects. Tasks should be divided between procurement professionals, IT personnel and third party service provider by using the provided RACI-matrix. RPA could be used to develop partly the processes of managing contract compliance, analyzing spend, qualifying suppliers and managing contract renewal and termination. RPA Centre of Excellence team should also be establish in the case company. KPIs for automated processes should be weighted case by case, depending on the desired outcome of the automated process.

Practical implications
The proposed governance model provides guidelines for implementing RPA projects successfully within corporate procurement at the case company. Benefits for utilizing RPA further at the case company allows personnel in corporate procurement to concentrate on more challenging tasks. Additional benefits of this thesis include the increased awareness of automation tools available.

Scientific value
Research provides guidelines to identify suitable procurement processes for RPA piloting and provides a governance model for the case company for the future automation projects.

Keywords: Robotic Process Automation (RPA), automation, procurement processes, process development

TIIVISTELMÄ

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Tarkoitus
Pro gradu tutkii miten hankinnan prosesseja suuressa kansainvälisessä hankintaorganisaatiossa tulisi kehittää ohjelmistorobotiikan (RPA) avulla. Saatavilla olevat tieteelliset artikkelit ja julkaisut käsittelevät ohjelmistorobotiikan hyötyjä finanssi, teleoperaattorien ja vakuutus yrityksien prosessien näkökulmasta. Tämän pro gradun tarkoitus on tutkia ohjelmistorobotiikan käyttöä hankinnan prosesseissa, keskittyen valittuun tapausyritykseen.

Menetelmät
Tutkimusprosessi aloitettiin laajalla kirjallisuuskatsauksella tämän hetkisestä RPA:n ja hankinnan prosesseista, tavoitteena tunnistaa tutkimusalueen pääteemat. Kirjallisuuskatsauksen tarkoituksena oli myös luoda teoreettinen pohja ratkaisuehdotukselle. Empiirinen osa suoritettiin tapaustutkimuksena, missä toimintamallia ehdotettiin yritykselle käytettäväksi automaatioprojekteissa.

Tulokset
Tulokset osoittaa, että RPA:ta pystytään hyödyntämään tapausyrityksen manuaalisissa hankintaprosesseissa. RPA on kuitenkin vaikea ottaa käyttöön pitkissä ja vaativissa manuaalisissa prosesseissa. Sen takia RPA:ta tulisi hyödyntää lyhyissä ja yksinkertaisissa prosesseissa. RPA:n hallintamalli on erittäin tärkeä projektin lopputuloksen kannalta. Tehtävät tulisi jakaa hankinnan, IT-osaston ja palveluntoimittajan kesken esitetyn RACI-mallin avulla. RPA:ta voisi tutkimuksen perusteella hyödyntää sopimuksien ylläpidossa, toimittajien hyväksynnässä ja sopimusehtojen varmistamisessa. Tutkimus ehdottaa myös että RPA Centre of Excellence työryhmä tulisi perustaa yrityksessä. RPA projektien hyötyjen mittaaminen tulisi olla tapauskohtausta ja mittarien pitäisi perustua RPA:n toivottuun lopputulokseen.

Käytännön arvo
Esitetty ratkaisu ehdottaa tapausyritykselle parannus ehdotuksia RPA:n avulla. Hallintamalli esittää suuntaviivat tapausyritykselle miten tehtävät tulisi jakaa ihmiset kesken. RPA:n hyödyt edesauttaa tapausyrityksen työntekijöitä keskittymään haastavimpiin ja mielekkäimpiin työtehtäviin. Käytännön arvoja tapausyritykselle tämän tutkimuksen myötä on laajempi ymmärrys automatiikan potentiaalista toimistotöissä.

Tieteellinen arvo
Tutkimus osoittaa että manuaalisia töitä pystytään automatisoimaan RPA:n avulla. Lisäksi tutkimus antaa pohjan tapausyritykselle miten manuaalisia prosesseja tunnistetaan ja kuinka projekteja tulisi valvoa ja hallinnoida.

Asiasanat: ohjelmistorobotiikka, hankinnanprosessit, automaatio, prosessien kehittäminen

ACKNOWLEDGEMENTS

My schooling started back in 1996 in Norssi's elementary school in Helsinki. Having spent majority of my life in school, at this stage I am glad to be done with my master's thesis, receive my diploma and be done with educating myself in the higher education institutions for the time being.

I would like to express my sincerest gratitude to my supervisor and the instructor of this thesis Elina Haaparanta and to the case company for providing me the opportunity to research this topic. Professor Jukka Hallikas also deserves a warm thank you for guiding me through this project and pointing me in the right direction when it was needed.

My peers and dear friends Tuomas and Ghofran also deserve my gratitude for working with me during my studies at Lappeenranta. Lastly, my wife to be Donya deserves the most credit for always pushing me to be better and to achieve the things I deserve in life.

I wish you a happy reading.
Thank you!

Jarno Vainio

In Helsinki, Finland 2.3.2019

Table of Contents

List of Figures

List of Tables

1 Introduction

Digitalization and automation has been identified as one of the major trends which will change the current society and ways of conducting business in the near and long-term future in ways of which many of us are not able to imagine. Even though the benefits and potential of automation is known widely, companies are still struggling to understand and see the long-term potential of automation (Parviainen et al., 2017). According to a study by Parviainen et al., (2017): 64-65, 76% of companies predict that automation solutions will disturb their industry greatly or moderately within few years. Therefore, the topic of this thesis is current and the potential of automation in procurement processes requires further study.

1.1 Background and Motivation

Organizations are constantly under pressure to perform leaner and efficiently in order to create higher value for stakeholders and shareholders. Thus, companies are constantly looking for ways to improve existing processes and ways of conducting business more efficient. Process management allows organization to transform their end-to-end and sub-processes to perform with lower costs, faster speed, greater accuracy, reduced assets, and enhanced flexibility (Brocke and Rosemann, 2015: 8). Currently, a relevant topic regarding process improvement and efficiency is Robotic Process Automation (RPA), which is an automation tool used to reduce manual labor by automating repetitive tasks done at the moment by humans. In fact, RPA is argued to compete with outsourcing (Slaby et al., 2012; Lacity & Willcocks, 2015; Lacity et al., 2016c). The concept of RPA will be introduced in more detail later in this thesis. However, at this point, it is crucial to understand that RPA is an automation tool which is designed to work together with humans in office environment to complete tasks, where robot handles a specific assigned task taught by a human, allowing humans to be more productive in tasks which require logicality or thinking (Lacity & Willcocks, 2012). The core value proposition of software robotics is similar to an industrial robot used in a manufacturing line. Which is to perform pre-programmed tasks continuously and accurately in a steady working environment (Heyer, 2010).

At the moment, the current scientific research coverage of the RPA usability in procurement processes is limited. Therefore, this master's thesis topic is current and research in this field is needed. At this point, it can be assumed that areas such as supplier data management, supplier relationship management, price comparison, supply and demand planning and procure-to-pay (P2P) RPA could be utilized. In these areas, it can be assumed that portion of the process could potentially be automated, and it requires further investigation how RPA can be utilized in these processes. The current studies regarding RPA and its usability and scalability in different business processes have been conducted by small group of researchers, among others: Mary C. Lacity, Leslie Willcocks, and Andrew Craig. The conducted researches highlight strongly the benefits and difficulties of robotic process automation. Their research papers and books cover mostly RPA use cases for large international financial, telecom, and insurance companies where RPA use cases are easily identified and deployed in large scale and processing significant number of transactions providing substantial benefits and return on investment.

Another motive for this research is the fact that the current scientific articles and journals are also lacking a scientific approach to RPAs capability in supplier data management and supplier relationship management. Therefore, there is need to research further how supplier data management can be improved with robotic process automation. In addition, the current literature is lacking a proper RPA governance model which companies could utilize when implementing robotics in their processes. Blueprism is a RPA platform provider has provided a generic governance model for companies to use, but is lacking a scientific framework. Furthermore, the current literature emphasizes that RPA is lightweight IT software and RPA governance should follow regular IT-governance structure (Lacity et al., 2015; Theyssens, 2017). However, RPA projects can be cross-functional, including personnel from various business units. Therefore, establishing a proper governance model for RPA with role description is needed to establish and maintain functional automated processes with RPA.

1.2 Research Questions

Saunders et al., (2009): 32, state that forming and defining research questions in a research project is the key criteria determining the success of the research. Defining the research questions supports considerably the process of drawing clear conclusions from collected data.

This master's thesis studies and discusses the existing literature regarding robotic process automation and procurement processes which are similar to the case company's processes. Procurement processes are described in detail, in order to clarify how supplier data management affects almost all areas of procurement. Therefore, RPA as technology is discussed and researched extensively, in order to answer the following research question:

- ***How can supplier data management and procurement processes be supported and developed through implementation of RPA?***

In order to understand and define how RPA can support supplier data management and procurement processes. It is crucial to examine how organizations can measure the benefits of automating a certain process. Therefore, key performance indicators (KPIs) should be established before starting the automation process. KPIs are widely used measurement tools used for measuring performance (Stricker at al., 2017: 5537). When determining KPIs for RPA, the scope of KPIs are essential, especially deciding on the specific meter for measuring the benefits and unit of measurement. In addition, it is highly important to agree on ways of collecting data and on how KPIs are reported (Laamanen, 2005: 353).

Additionally, as number of RPA projects are increasing, organizations are facing a question of how to govern RPA projects in a way which provides the most benefit. Hence, the following research questions tends to address this problem:

- ***How are the benefits of RPA assessed and RPA projects governed?***

As this research is conduced as a case study for a procurement organization, researching the project roles and factors relating to RPA projects is required. At the moment, the case company has piloted RPA in their procurement processes, however the roles of process owners, IT personnel, and service providers requires a proper framework. Hence, the following research question aims to address:

- ***How to organize RPA projects and roles within procurement organization?***

1.3 Research objective and limitations

Saunders et al., (2009): 34, state that research objective acts as an evidence of clear purpose and direction of the research. Hence, the objective of this study is to identify and understand how robotic process automation functions as a technology and how it can be utilized more effectively in the procurement processes. Furthermore, the objective is to identify the specific procurement processes and sub-processes, which contain manual and repetitive tasks which, could possibly be supported with automation.

Primary	Secondary	Tertiary
• Reports • Theses • Conference proceedings • Company reports • Unpublished manuscript sources	• Journals • Books • Newspapers • Unpublished manuscript sources	• Indexes • Abstracts • Catalogues • Encyclopedias • Dictionaries • Bibliographies • Citation indexes

Table 1. Three literature sources available (Adapted from Saunders et al., 2009).

Table 1 represents three sources of literature, which provides a foundation for the literature used in this research. Primary sources are published more frequently and requires less time to publish. The sources can include reports and white papers, which are not the most reliable sources for scientific research approach. Whereas, secondary and tertiary sources are more reliable sources in scientific research, however it requires more time to publish journals, books, indexes, and catalogues limiting the number of reliable secondary sources available. Importantly for research purposes, it is central to understand the most appropriate source for specific research and how information flows from primary to tertiary category, making the information more reliable (Saunders et al., 2009: 69).

Limitations for the research topic is the lack of the reliable scientific publications in secondary and tertiary categories. RPA as a technology is relatively fresh and growing rapidly (Lacity &

Willcocks, 2018). Most secondary source scientific articles are either published by a limited number of researches and their research papers are widely cited. Therefore, limitations of secondary and tertiary sources is a crucial limitation in this master's thesis.

1.4 Research Framework

Figure 1 represents the research framework for this thesis. Chapter 1 describes the background and motivation, research questions, and research objective and limitations in detail. Methodology is described in detail in Chapter 4.

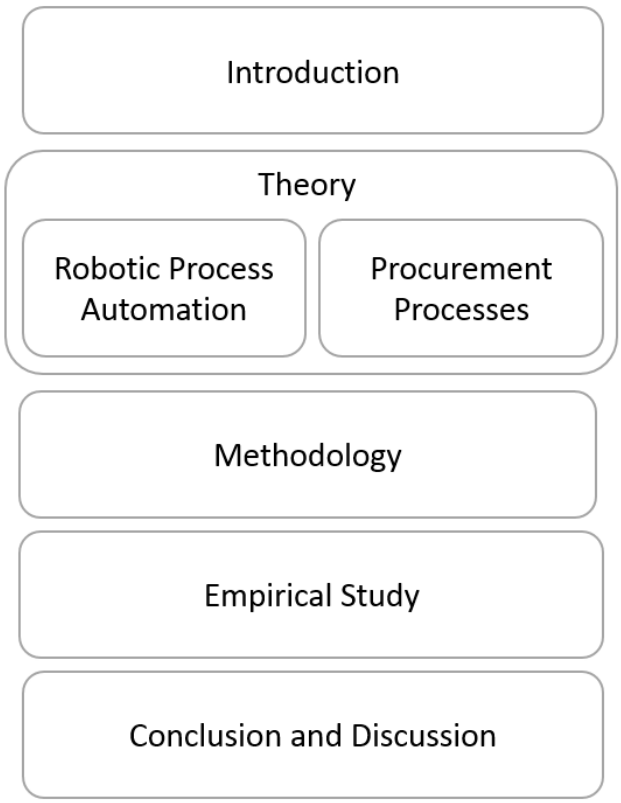

Figure 1. Research framework.

The theoretical background is covered in chapter 2, covering current literature review of robotic process automation and in chapter 3, procurement processes which specifically used in the case company are covered. Empirical findings are discussed in detail in chapter 5 and research questions are discussed in chapter 6.

2 Robotic Process Automation

This chapter discusses the current literature regarding Robotic Process Automation (RPA), covering the concept and technology behind RPA and what are the benefits of utilizing robotics in office tasks which are highly manual and rules based. In addition, the process of identifying potential use cases for RPA and how RPA is implemented is discussed in detail. Also, RPA governance structure and organizational structure is discussed in order to provide the reader a comprehensive understanding, how RPA projects should be governed within organizations.

Robotics is often tied to efficiency and cost cutting with back-office operations. Back-offices are constantly under pressure to perform more cost efficiently while concentrating on service excellence (Lacity et al., 2015: 3). According to fifteen yearlong study conducted by Lacity et al., (2015) companies have concentrated on five transformation levers to transform back-office into high-performing function which are: centralize physical facilities and budgets, standardize processes across all business units, optimize processes in order to minimize errors and waste, relocate to low cost area, and technology-enable. For the latest lever, Lacity et al., (2015) introduces automation which has been implemented in back offices during the last few years by many heavy automation adopters, being able to automate as much of 35% of basic repetitive transactions. Hence, cost savings in manual and repeatable back office tasks can be made in multiple different ways, automation could be the suitable option.

Companies are known to outsource their back-office operations overseas to low-cost English-speaking countries such as India. Which have resulted to increase the number of inexpensive FTEs (full-time equivalent) to perform repetitive back-office tasks. Shipping jobs overseas to low cost countries can damage the image of an organization or brand. Therefore, automating processes with RPA can be beneficial compered to offshore outsourcing since automation could avoid the backlash of sending jobs abroad (Asatiani & Penttinen, 2016: 68). Rutaganda et al., (2017): 105, argues that process optimization and reducing offshoring has resulted in innovation in the field of automation and these days companies considering RPA in-lieu of outsourcing. In fact, Wipro, a large scale outsourcing service firm in India, announced in 2015 that it will reduce workforce by 47 000 people in the coming years due to automation (Lacity et al., 2016c).

According to a study conducted by PwC, the estimation is that 45% of work activities is possible to automate potentially saving $2 trillion within the global workforce costs (Torlone et al,. 2016). McKinsey's research concluded in with the same numbers in their study, but added to PwC's study that the automation can and will affect beyond the low-skill and low-wage roles within organization. They discovered that automation can affect even the highest-paid occupation in the economy, including financial managers, senior executives and CEOs (Chui et al., 2015). However, according to a McKinsey study conducted in 2015, the number of activities to be fully automated in the near future resulting in a job loss is low, meaning that the general public has a wrong perception regarding automation. Notwithstanding, some tasks will be automated, but the automation requires a redesign of business processes, resulting jobs to be redefined within the organization (Chui et al., 2015).

Hence, Sutherland (2013) empathizes that RPA will not remove business process outsourcing (BPO) or would result in a job loss. Rather, RPA allows organizations to empower further their employees by removing routine tasks, allowing employees to spend their valued time on more strategic tasks which cannot be broken down to rules and which create more value to the company. Lowes et al., (2015): 13 underline that their studies on companies with automation is to increase the efficiency and effectiveness of their workforce, rather than eliminating it and as automation projects move further, the dependency on high skilled process owners grows.

2.1 The Concept of Robotic Process Automation

Robotic process automation (RPA) is a software license robot, characterized as a "virtualized FTE", which operates like a human on commands based rules, which have been mapped by a process expert. In order to accomplish tasks, the robot has its own user IDs which are used to log in and out of different applications (Alberth & Mattern, 2017: 55). Robotic process automation is a quite a fresh term in the scientific research. Whereas, as the technology behind RPA is relatively simple and not new since it can be argued that basic software automation has been around for a long time (David, 2015). In 2017, the worldwide RPA market was estimated to be worth under $1 billion but the estimated market revenue growth rate was estimated to be up to 100% annually (Lacity et al., 2018).

RPA is a software-based application which is taught to mimic the movements of humans, meaning that the software robot is configured to perform processes exactly like taught by the process owner (Willcocks et al., 2015; Aalst et al,. 2018). Theyssens (2017) describes RPA as a technology which follows specific pre-learned algorithms to mimic human interaction with the user interfaces. RPA is an extremely light and simple software which operates on a same level as human would, not triggering any significant IT changes when implementing (Alberth & Mattern, 2017).

Since RPA is argued to be relatively simple, it appears to be most suitable for processes which are highly rules driven. Compered to tools such as business process management (BPM) and service-oriented architecture (SOA). They are too heavy and costly to be implemented compared to RPA. BPM can be described to be more intensive and demanding way of improving processes and RPA can be even labeled to be one section of business process management (Slaby et al., 2012). Jeston & Nelis (2014) characterize BPM as a method, which is used to identify, analyze, measure, optimize, and automate processes on a large corporate level. The aim of BPM is to tailor processes on a large level to be more effective, whereas service-oriented architecture (SOA) aims to integrate all applications used on a corporate wide level and design processes to be as much flexible and self-sufficient as possible (Jeston & Nelis 2014; Erl, 2005).

The most important difference between RPA and BPM & SOA tools is that RPA does not require IT programming skills and can be argued to be much cheaper to implement. Hence, RPA is cost effective and can easily be used by business process experts, whereas BPM and SOA require business process experts to explain to IT professionals the process which needs to be automated (Willcocks et al., 2017). Simply put, RPA allows process owners to cut down the middle man when automating their own processes with RPA. Business owners can automate processes easily with graphical interface provided by RPA software providers with drag and drop flowchart tool and the code is generated automatically and therefore no coding skills is required but rather only specific knowledge of the process (Willcocks et al., 2015; Tornbohm & Dunie, 2017; Theyssens, 2017). At the moment RPA is seen as a strategic tool to achieve quick return on investment (Aalst et al., 2018).

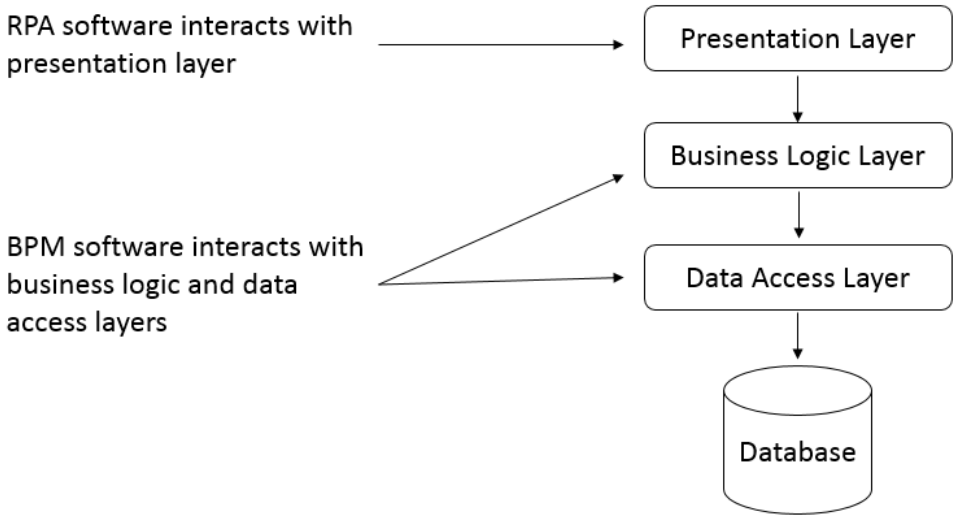

Figure 2. RPA presented as lightweight IT (Adopted from Willcocks et al., 2015).

Figure 2 explains the basic logic behind RPA. Willcocks et al., (2015) characterizes RPA as a lightweight software. According to Bygstad (2015) the current IT systems, software, applications and databases can be divided into heavy- and lightweight categories. Traditional sophisticated IT systems and databases which require expensive and advanced integration and implementation are categorized as heavyweight. Lightweight IT systems in the other hand are more flexible solutions ,such as mobile applications and software bots like RPA.

Bygstad (2015) also emphasizes that the main aspect of lightweight IT is more than low price and availability. It is the fact that it can be deployed by business users or vendors, bypassing the traditional IT department. However, Lacity & Willcocks (2016a): 23 state that their research indicates that RPA still requires traditional IT governance, security, architecture and infrastructure regulations and cannot be implemented completely without the IT department. Furthermore, Rutaganda et al., (2017): 109, highlights that RPA projects are required always to be business led than IT led. However, according to their studies, all successful RPA projects have IT as a strong partner and strong support during all phases of implementation.

RPA is a commercially available software, which is implemented on top of the existing systems at the organization, without the need of creating, replacing or developing further the current systems at place (Willcocks et al., 2015): 7.

Figure 2 presents how RPA only interacts with the presentation layer of a software, meaning that RPA software only follows same logic as a human would. Hence, it does not operate behind the software. Fundamentally, the robot repeats rule-based pre-learned steps reacting on a computer screen, instead of corresponding with system's application programming interface (API) (Asatiani et al., 2016). Willcocks (2015) explains the difference between BPM and RPA, that BPM solutions are best fitted for projects requiring high capacity of IT department like implementing a new ERP or Customer Relationship Management (CRM) systems. Whereas, Le Clair (2017) sees BPM having a reputation of challenging and complicated business implementations, RPA aims to be the opposite. Thus, RPA is relatively simple to implement and heavy presence of IT is not required, when technology has been adapted by personnel and process owners.

2.1.1 Benefits and Challenges of RPA

The benefits of implementing RPA can be measured both from financial and non-financial perspective. The current RPA literature focuses especially on cost reduction of FTEs and lowering the number of repetitive manual tasks (Fung, 2014; Asatiani & Penttinen, 2016; Willcocks & Lacity, 2016). In addition, the current literature emphasizes on RPAs ability to minimize human errors and the factor that employees can focus on more strategic and challenging tasks (Asatiani & Penttinen, 2016; Alberth & Mattern, 2017). Willcocks et al. (2017) highlight that the RPA licenses have relatively economical annual fees and can be expected to perform work of two or more people. Whereas, Alberth et al., (2017) argue that one RPA license is capable of performing up to five FTEs, but not replacing human fully. Willcocks et al., (2017) emphasize that IT programming skills are not required when implementing RPA, normal process owners can be taught and follow-up the RPA implementation. RPAs versatile and flexible appearance allows process owners to modify the robot relatively easily without engaging with IT (Asatiani & Penttinen, 2016). In addition, Asatiani & Penttinen (2016): 68 emphasize other significant benefits of RPA, among others, its ability to openness to third party software and the very short timeframe in which RPA can be implemented. Another well-known benefit from RPA is that almost everything regarding the automation is kept in-house and onshore. Furthermore, significant benefits from RPA is argued to come from; minimal upfront investment and return on investment (ROI) is easy to

calculate, processes and applications require no or minimal change, and continuous and transparent compliance is documented at all times in the history (Alberth et al., 2017: 56).

The current scientific literature highlights the success stories of RPA deployment especially in the finance, telecommunications, energy utility, and insurance sectors (Lacity and Willcocks, 2015; Lacity et al., 2016c; Rutaganda et al., 2017). In telecommunication industry, Telefonica O2 has implemented RPA successfully and the research published by Lacity et al., (2015a) is widely cited. According to the study, the company was able to automate 15 core processes, which account approximately 35% of their back-office operations, by deploying 150 software robots to process between 400 to 500 thousand transactions monthly, yielding a ROI of 650% to 800% (Lacity et al., 2015a).

As stated, RPA can yield high savings and true potential to transform job descriptions from operational to more strategic. RPA has the capability to offer lean and flexile developments to conduct back office operations and repetitive tasks. Yet, RPA does have its downfalls. Rutaganda et al., (2017) state that RPA projects tend to fail due to high hopes and lack of due diligence and RPA is seen as a key to answer problems relating costs reduction, efficiency, and customer data management. Furthermore, Rutaganda et al., (2017) explain that RPA projects can have major difficulties when automation use cases are too complex and business processes are broken to start with. Hence, Aalst et al., (2018): 271 state that the complexity of processes tend to be a problem for RPA at the moment. Therefore, artificial intelligence (AI) and machine learning (ML) techniques should allow RPA to be used in more complex processes. Meaning that at the moment without ML and AI, RPA is not able to adapt and handle non-standard cases, which is a major difficulty. However, AI development is in the horizon for RPA within few years and RPA solutions have been already introduced to ML (Alberth & Mattern, 2017: 55). Machine learning and cognitive automation will be discussed more in detail in chapter 2.3 and Figure 5.

Willcocks et al., (2015) states that RPA implementation and projects have different kinds of implications, for example, misleading RPA vocabulary, mutual understanding of benefits and gains within organization, role of IT within RPA projects and ownership, governance model and skill sets needed for automating a process. However, Willcocks et al., (2015) emphasize that all of these implications can be resolved with time.

Figure 3, displays the common features in failed RPA projects. Rutaganda et al., (2017): 109 underline that implications in RPA implementation are far beyond the adaptation of the technology.

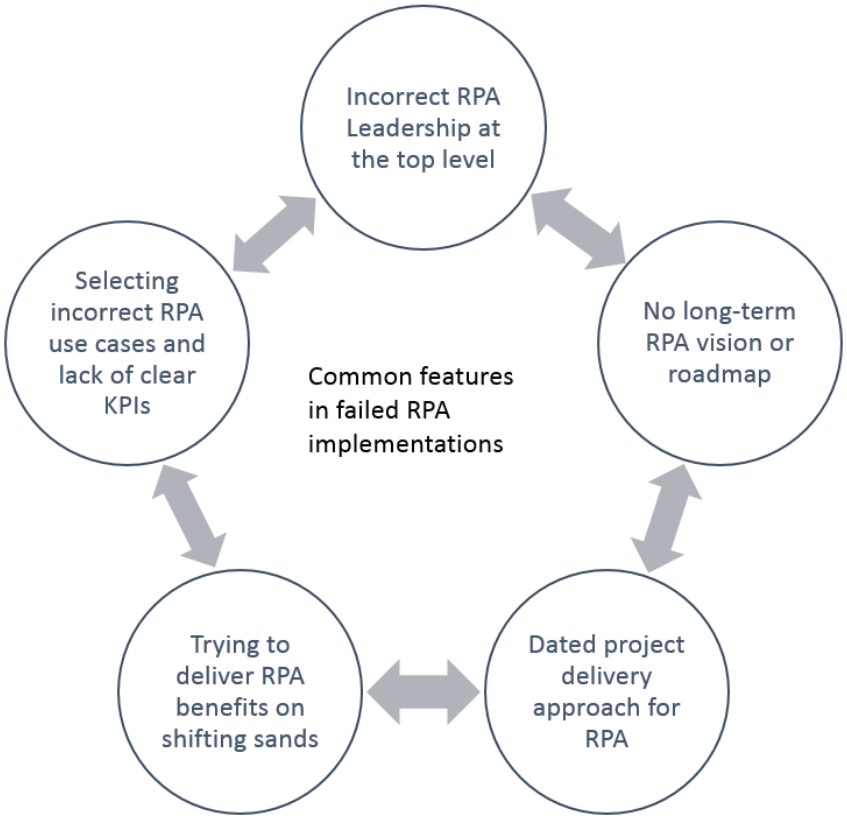

Figure 3. Common features of failed RPA implementations (Adapted from Rutaganda et al., 2017).

In order to overcome the five common failure features, Rutaganda et al., (2017) highlight that all successful RPA projects are business led with strong use case and firm IT support. In addition, RPA projects tend to fail due to lack of experience and vision, thus long-term direction is missing. Most importantly, RPA should not be implemented in processes which have a known history of transformation in business processes, tools used, technology and people structure. Therefore, RPA requires a stable process. In addition, there are hidden threats with RPA. As legal issues, Rutaganda et al., (2017) say that they could arise from misusage of robot user IDs and introduction of RPA could have an negative social impact on the workforce.

Willcocks et al., (2017): 19, state that one of the most significant disadvantages of software robots is that in reality the automated robot is unaware of its actions during a severe transaction-processing context. The lack of process state view and simply following a process the way of transcribed prevents RPA to be used in extensive and complicated transactions. Hence, RPA functions like an assistant which suits well for a simple sub process. Kääriäinen et al., (2018) mention that RPA is especially vulnerable for privacy and security related risks especially during implementation phase. As an example, denial of service and man-in-the-middle are ways of which RPA have been used to wound organizations. Denial of service can be described when, third party hamstrings an automatic process, whereas man-in-the-middle in IT term stands for a case where communication is blocked by a third party without others noticing it. These threats are severe, since robots are less likely to interpret such cases compared to humans.

2.2 Identifying Suitable Processes for RPA

The current case studies conclude that companies are being too ambitious in RPA project selection and companies tend to try to automate end-to-end processes which include various sub-processes (Lacity et al., 2015c; Sutherland, 2013). Therefore, Kääräinen et al., (2018): 37 state that in the early adaption stages of RPA, it is crucial to identify the pilot cases and continue with precaution, since in many cases the pilot use cases can fail.

According to a case study conducted by Lacity et al., (2015c): 15, in an energy utility company, RPA and process experts mapped the end-to-end and sub-processes before implementing RPA and concentrated on the sub-processes. Suitable sub-processes for RPA had the following attributes in common:

- unambiguous rules
- limited exception handling
- high predictable volumes
- stable working environment
- access to multiple systems
- known costs

Unambiguous rules for processes are essential since software robots are following exact rules and are limited to handle exceptions. High and predictable volumes together with a process which requires an access to multiple systems are also greatly beneficial to RPA, since software robots are capable of processing higher volumes of transactions than a normal FTE. However, RPA requires a stable working environment and the processes are likely to end up in an error state, if systems are updated or changed during operations, whereas a human would notice the changes instantly.

Lastly, Lacity et al., (2015c) emphasizes that understanding cost of conducting the process manually is crucial, since automation and manual costs should be compared with true cost of ownership (TCO) in mind. Slaby (2012), Fung (2014), and Asatiani et al., (2016), have also listed common criteria for RPA adding characteristics, which Lacity et al., (2015c) did not mention as a factoring criteria. Such as low cognitive requirements of the process and prone to human errors. Hence, humans are like to make errors in repetitive tasks, which do not occur in automated processes.

Sutherland (2013) has researched the potential value that RPA could provide for key functional processes within human resources, supply chain, legal services, and procurement (displayed in Table *2*). Sutherland's matrix follows the same logical path as Lacity et al., (2015c) where critical factors are assessed at early stage. Sutherland's model only differs from Lacity et al., (2015c) in sense that human intervention does no limit the attractiveness of RPA project, sub-processes can be automated and human intervention can be inputted when needed. Fersht and Slaby (2012) diversely argue that transaction volumes do not have to be high in a RPA process since, transactions can be processed 24/7/365 ensuring high customer satisfaction level and lowering human FTEs cost during holiday days and weekends. Dorr et al., (2018) underline that successful RPA deployment starts with a process screening which starts as simple checking if the process involves analog paper or voice at any stage.

Sutherland (2013) emphasizes that procurement processes have high potential for value creation by using RPA, and at the time of the article was published, highest potential was in spend data management and supplier management, more specifically in service level monitoring according to his criteria displayed in

Table *2*. In further detail regarding RPAs utilization in procurement in processes, Kääriäinen et al., (2018) concluded that only 7% of the RPA processes in their study were in procurement.

McKinsey (2018) concluded in a study that automation is preeminent and will have an impact in every industry, sector, and department, including procurement. The study concluded that approximate 40% of source-to-pay processes can be automated in the near future (Drentin et al., 2018).

Access Multiple Systems	Prone to Errors	Can Be Broken into Business Rules	Limited to Human Intervention	Limited Exception Handling	High Volumes and/or High Values
Yes	Yes	Yes	Sometimes	Yes	Yes

Table 2. Applicability of robotic automation to procurement business processes (Adapted from Sutherland, 2013).

RPA is a practical solution for automating processes which fall into the "swivel chair interfaces" category. These can be described as labor-intensive processes and the user is required to capture and re-enter data in multiple systems (Dorr et al., 2018; Lacity et al., 2015).

Figure 4 displays how highly cognitive and non-routine processes are not possible to be automated with RPA and how routine and manual tasks could be automated with RPA. Asatiani et al., (2016) state that a basic criterion for a suitable RPA process should be determined whether the whole potential automated process can be written down step by step as a process map, taking into account all possible outcomes and incidents which could occur in the process. In the figure, y-axis expresses the process from cognitive perspective to manual, where cognitive like processes require human thinking throughout the process. Highly cognitive processes can be easily labeled as processes which are not suitable for RPA piloting. Manual on the y-axis represents the manual nature of the process. The characteristics of manual process can be unambiguous rules and limited exception handling. Highly manual processes are

suitable for RPA piloting if the process places on the routine place on the x-axis. Even though, a process is highly manual, the nature of the process can still be a non-routine, which does not fully justify the need for automation. Therefore, processes which are highly routine and manual like, can be placed as a suitable processes for RPA piloting box in the figure. However, it is crucial to understand that the processes are not necessarily sensible to be automated fully with RPA technology, since end-to-end processes can be too complex to let RPA perform from start to end (Asatiani and Penttinen, 2016).

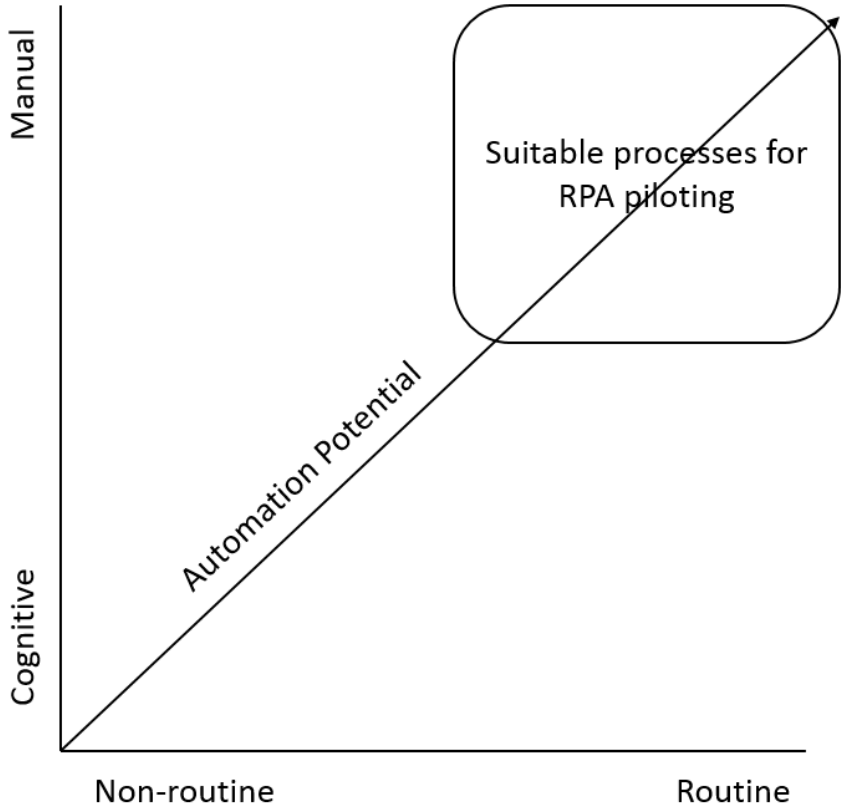

Figure 4. Identifying suitable processes (Adapted from Asatiani and Penttinen, 2016).

Kääräinen et al., (2018) conducted a survey on 12 companies in the public sector and 20 companies in private sector regarding adaptation of RPA in Finland during 2017 and 2018. The sample consists of 878 RPA processes in which 273 in the public and 605 in the private sector. The three most identified use cases of RPA, which covered 50% of use cases were in:

1) reporting,
2) updating information, and
3) reviewing information and data.

In the study 7% of the RPA uses cases where implemented in procurement departments and procurement processes. The most automated procurement processes both in public and private sector where in reporting, reviewing information, transferring information, and inputting information to systems. The least automated processes where preparation of information and data. Hence, preparation of data would fit into cognitive and non-routine tasks in Figure *4*, placing other above mentioned processes to suitable processes for RPA piloting box. According to Silvennoinen and Kärki (2018) over 76% of organizations in their study (n= 172 companies in Finland) have been able to optimize processes and minimizing routine tasks with RPA and one third of these companies are currently automating more processes with RPA.

AUTOMATED PROCESS CATEGORY	DESCRIPTION
REPORTING	Summarization of data and reports from multiple sources.
REVIEWING AND TESTING	Authentication of data and testing systems or applications.
PREPARATION OF DATA	Collecting, analyzing, and sorting data to be processed in other processes by humans.
UPDATING DATA	Maintaining quality of data. Overwriting old data and deleting old irrelevant information from systems.
MOVING DATA	Transferring or copying data from system to system, mass storing info, and archiving.
INPUTTING DATA TO A SYSTEM	Inputting new data to multiple systems, for instance creating suppliers, customers or employees.
MATCHING DATA	Compering and matching data from several sources.

SENDING A MESSAGE	Mass mailings, sending emails/reminders, and requesting information.

Table 3. Common RPA use cases (Adapted from. Kääriäinen et al., 2018).

Table 3 represent most common RPA use cases, which were identified in a study by Kääriäinen et al. (2018). As stated before, over 50% of use cases were identified either in reporting, updating information, and/or reviewing information and data related processes. In addition, Table 3 represent other relevant use case categories, which are suitable for RPA with descriptions, such as moving, inputting, and matching data which can be argued to be one of the strongest qualities of software robotics due to exceptionally low error rate, whereas humans would inevitable make errors when copying and matching data between several sources in the long run.

2.3 Compering RPA to Intelligent Data Capture and Cognitive Automation

As mentioned before, the technology behind RPA is relatively simple and the software robot just follows before taught logic and RPA itself does not include artificial intelligence related features. Therefore, RPA can easily be compared to an industrial robot, which follows exact logic and patterns, being unable to learn or replicate human reasoning (Theyssens, 2017). Asatiani et al., (2016) argues that when artificial intelligence is enabled with process automation, the general principles for criteria remains the same regarding process suitability for automation.

Figure 5 demonstrates how RPA differs from smart data capture and engagement technologies and cognitive technologies. RPA tasks can be labelled under transactional work, which is not categorized under knowledge work.

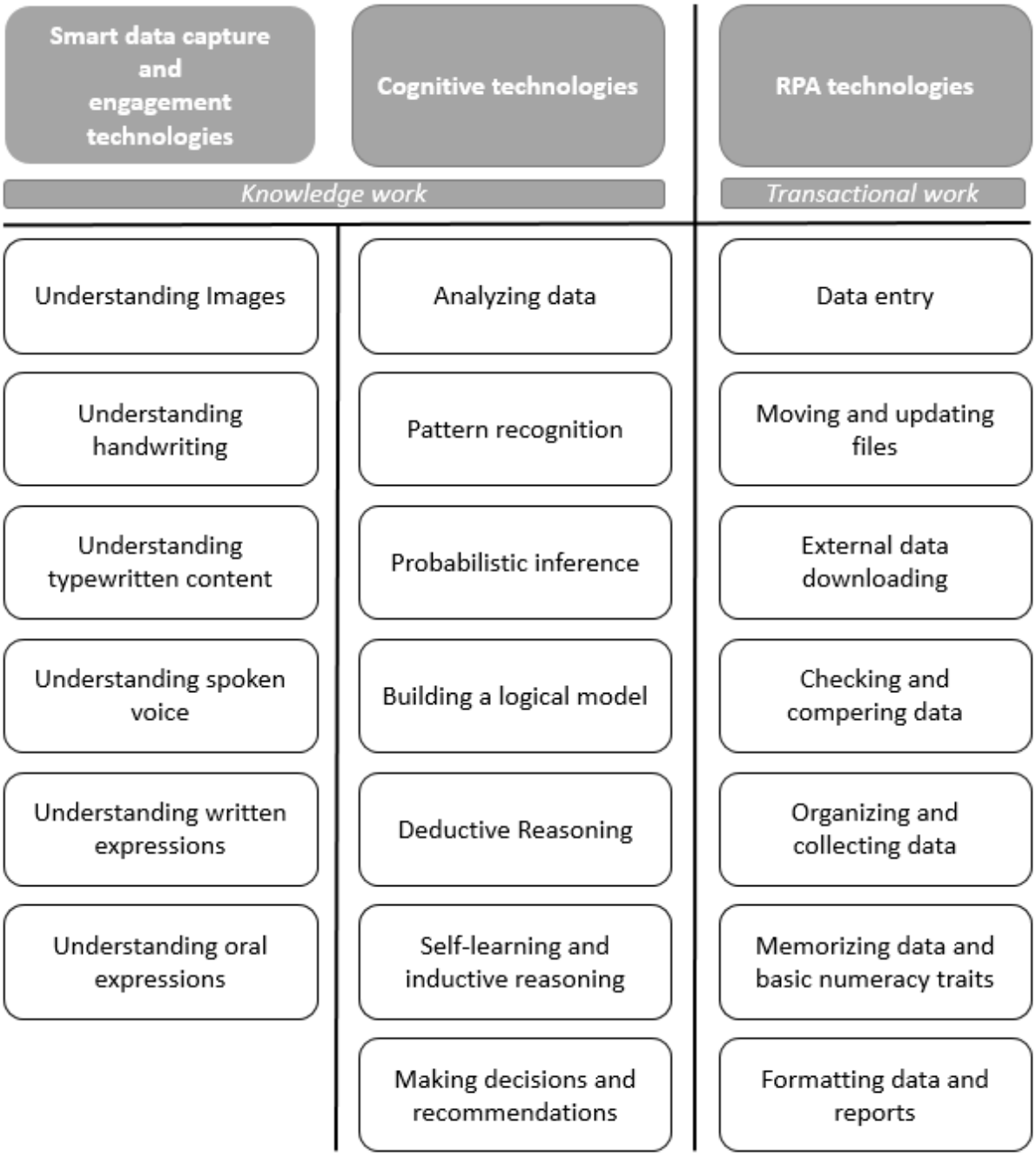

Figure 5. Three types of smart automation (Adapted from. Dorr et al., 2018).

Currently, RPA is only capable of conducting basic transactions, which are preliminary educated to the robot. However, the true potential lies in emerging the automation technologies represented in Figure 5. (Dorr et al., 2018). Additionally, Lacity and Willcocks (2018): 24, divides the automation classes in two segments; RPA and Cognitive Automation (CA) characterized in further in detail in

Figure *6*.

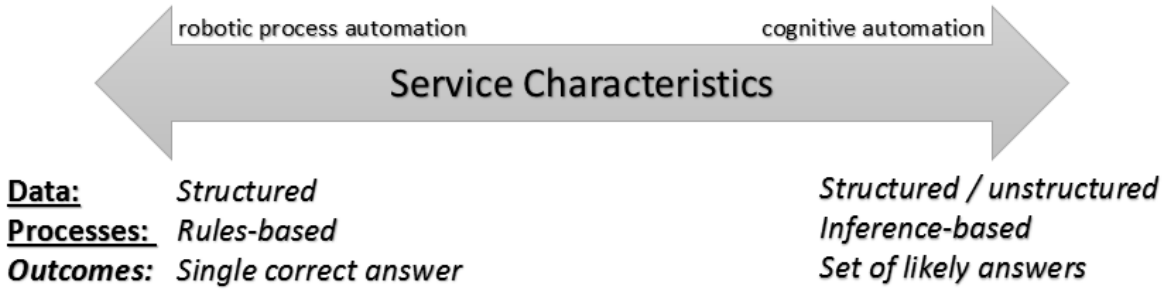

Figure 6. Service characteristics of RPA and CA (Adapted from Lacity and Willcocks, 2018).

Lacity and Willcocks (2018): 26, define cognitive automation as "*using software to automate or augment tasks that use inference-based algorithms to process unsecured and structured data to produce probabilistic outcomes."* Meaning that CA can be used for more unstructured inference-based tasks compered to RPA. Additionally, CA can be utilized in decision-making processes and has more capabilities in data analysis related tasks, whereas RPA is able to only follow specific pre-programmed steps which the robot follows (Lacity et al., 2018).

2.4 RPA Organization within Companies

As automation and number of RPA projects grow, the dependency and role of RPA within organizations increases. Hence, RPA should be established as a Centre of Excellence (CoE) within the organization having strong links to the IT department (Willcocks et al., 2015). The Centre of Excellence team should consist of professionals which is able to lead projects, support in any issue and provide training in the field (Hughes, 2012). Furthermore, Lacity et al., (2016) describe in their book how companies should establish a Centre of Excellence RPA team to fully specialize into to the potential capabilities of RPA which will guide each business unit in the future automation projects. CoE personnel can be in both IT or business units and process ownership would benefit from automation projects.

Willcocks et al., (2015) states that organizationally the location of RPA professionals within organization chart is not essential. However, essential factor is that RPA professionals are in

the business units or operations where processes are being automated. The role of RPA CoE increases significantly, if an organization decides to conduct automation projects without outsourced third party, which is often used. The risk of automating processes only with organization's own employees is higher due to lack of knowledge in the starting point. However, the payoff is significantly higher since everything which is learned from automation stays in-house and can be re-used later (Lacity et al., 2016).

Blue Prism, which is an early innovator of automation, RPA software platform provider and inventor of the term robotic process automation has provided an operating model to be used for RPA projects (Blue Prism, 2018). Due to the lack of existing robotic operating model, Blue Prism has provided three examples of an enterprise RPA operating models. The models described in detail below, are designed to provide maximum business benefits through scaled deployment of RPA through all business units (Blue Prism, 2018).

2.4.1 Divisional Structure

The divisional robotic organization model concentrates on specific business unit and functions, where RPA potential is seen the highest. Divisional structure is ideal, when establishing robotic automation to the organization and first use-cases are identified in a field of large future potential.

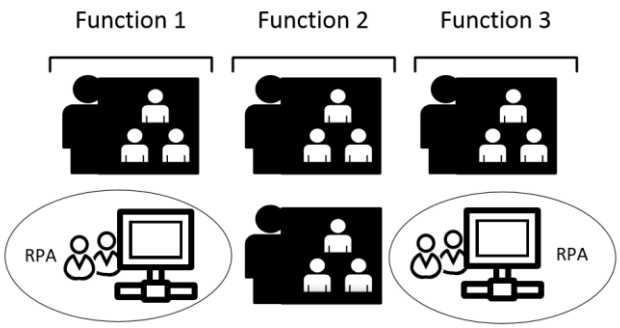

Figure 7. Divisional structure for RPA (Adapted from Blueprism, 2018).

The challenge with divisional structure is, that RPA is not scalable throughout the organization. The knowledge and use-how is not easily accessible in function 2 (Figure 7). Furthermore,

divisional structure is not sustainable option, if RPA capabilities are aimed to be utilized in each business unit within the organization (Blue Prism, 2018).

2.4.2 Federated Structure

In federated structure, the RPA capability is divided between a function and a centralized IT driven RPA capability function. In this structure, identifying and defining new robots should be conducted in the functions and IT driven RPA capability would support RPA development and maintenance process. The benefits of this model would be low economic impact of deploying the robots and being able to scale automations within all functions in the organization through strong RPA capability in IT department and RPA capability within functions (Blue Prism, 2018). This structure is particular appealing since process owners in functions are appoint of suitable processes for RPA, which cannot be appointed from IT department.

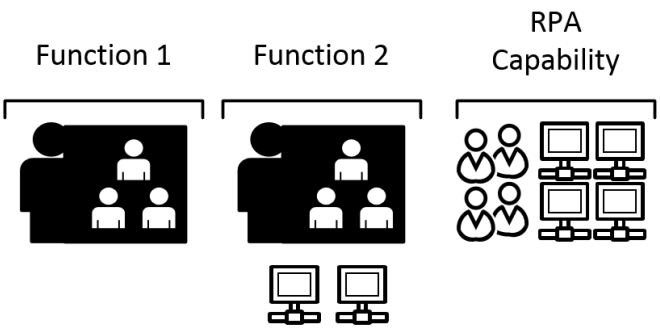

Figure 8. Federated structure for RPA (Adapted from Blue Prism, 2018).

2.4.3 Centralized Structure

In centralized structure, RPA capability is fully IT driven and RPA knowledge within functions is minimum. Benefits of this structure, besides low implementing costs, can be also the scalability through all functions since the RPA capability is centralized. However, Centre of Excellence is required to identify, develop and maintain the automated processes since use cases cannot be appointed from centralized IT driven RPA capability function (Blue Prism, 2018).

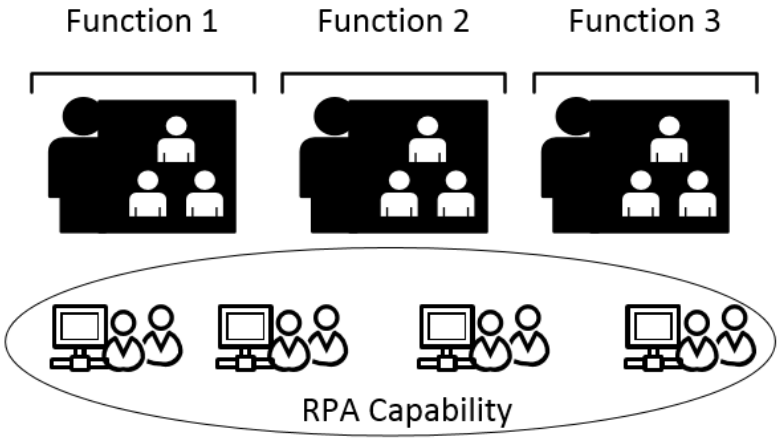

Figure 9. Centralized structure for RPA (Adapted from Blue Prism, 2018).

However, in centralized structure functions are not fully aware of RPAs capacity, therefore capability to identify and develop robots could be a bottleneck in the long run (Blue Prism, 2018).

2.5 Governance of RPA Projects

The current scientific research is lacking in the sense of providing a proper governance model for RPA projects. Since RPA is labeled as a lightweight IT, the governance model of heavyweight IT does not apply to projects such as RPA and a governance model for combined software is to be developed (Bygstad, 2015). Still, the current literature argues that RPA projects should adapt the known IT governance model even though RPA is labelled as a lightweight IT and it can be implemented without a heavy IT presence (Lacity et al., 2015b; Theyssens, 2017). IT governance, according to Weill (2004) is a key factor influencing the benefits from IT investments. Weill (2004) describes; *"IT governance as specifying the framework for decision rights and accountabilities to encourage desirable behavior in the use of IT." Weill (2004): 2-3.* In addition, Weill (2004) emphasizes that a well-functioning IT governance has a systematically determined chain of commands regarding each decision, decision right, and how people or groups are held responsible against their decisions. Weill (2004) also emphasizes that well-tailored IT governance model draws on corporate governance principles, supporting development and goal achievement. In addition, IT governance should

encourage all personnel within organization to fully utilize the use of IT, not limit the usage of on-premises software.

As mentioned before, Centre of Excellence is argued to be crucial part of RPA project governance. Lacity et al., (2015) argue RPA projects should be governed by a centralized team, with Centre of Excellence team guiding other business units with automation projects. Figure 10 below demonstrates the model proposed by Lacity et al.. (2015) where RPA Centre of Excellence is establish to consult all business units within organization on RPA piloting.

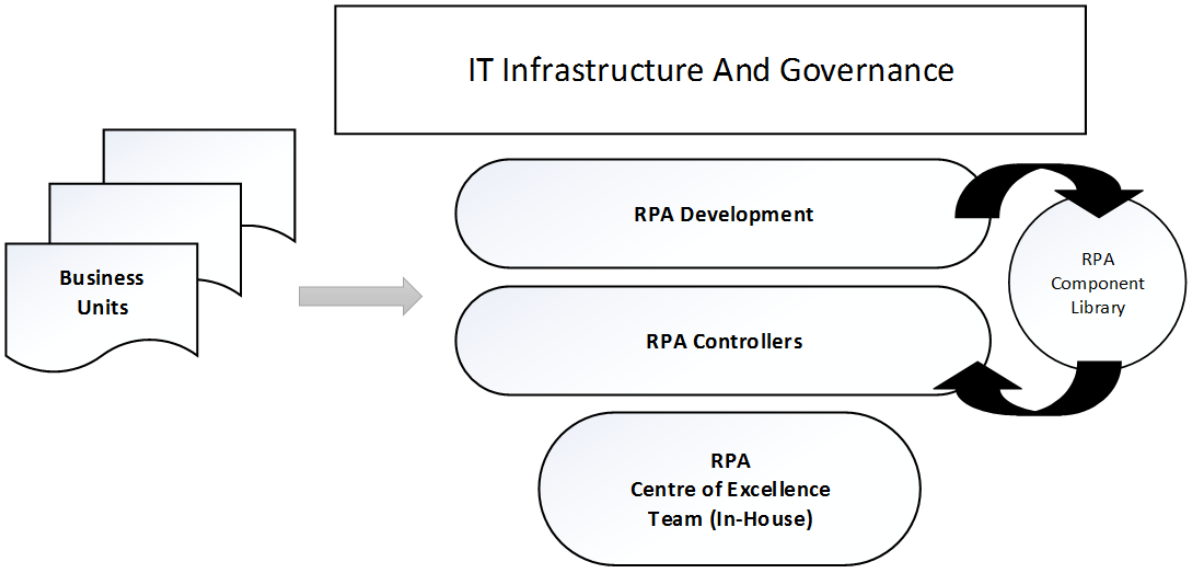

Figure 10. Centre of Excellence governance model for RPA projects (Adapted from Lacity et al., 2015b).

In the model, each business unit should have a basic knowledge of RPAs capabilities and each business units can identify suitable processes, which are reviewed by RPA Centre of Excellence team. RPA Centre of Excellence team should consist of RPA development and controllers. Developers and controllers can be partly outsourced but Centre of Excellence should consist of in-house employees. In this model, IT infrastructure and governance model is used and RPA team is centralized in the organization under IT. Business units request guidance regarding processes which could be automated and RPA development team assesses the potential for automation. Developers collaborate with controllers however, controllers

should hold the responsibility of keeping the automated process in production. Additionally, the RPA component library, which consist of previously automated processes, should be maintained by the RPA team. The economic costs of developing new RPA projects can be reduced significantly if automated processes are recorded in the RPA component library and re-used when needed (Lacity et al., 2015).

2.6 Implementation of RPA and Project Life Cycle

The reviewed case studies and current RPA literature conclude that companies are too ambitious in RPA projects and try to automate end-to-end processes that include various sub-processes (Lacity et al., 2015). Dorr et al., (2018) state that introducing RPA to the organization requires explicit plan and continuing focus on optimizing RPA processes throughout the RPA implementation. Meaning that a process cannot be simply automated and forgotten. Even after the implementation part, the robot is required to be maintained and improved throughout its lifecycle. Also, process owners should support RPA developers and Centre of Excellence team in a case of failure (Dorr et al., 2018; Lacity et al., 2015). Thus, the organization structure for RPA is crucial. Each business unit should have dedicated RPA specialist who are responsible for identifying use cases for RPA and supporting the development and maintenance of the robots (Asatiani et al., 2016).

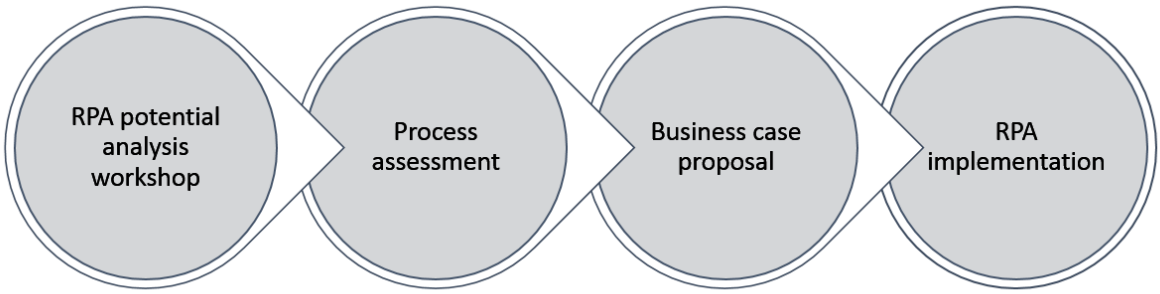

Figure 11. Four stages of RPA implementation (Adapted from. Asatiani and Penttinen, 2016).

Asatiani and Penttinen (2016): 69-70, propose a model, which breaks down RPA implementation into four stages, displayed in Figure 11. The model proposes that RPA project lifecycle should start with an analysis workshop with RPA consultants who review processes currently done in the organization and potentially identify areas in which RPA could be eligible. However, the suitability of process can be assessed by in-house RPA experts as well.

In the process assessment stage, the intention is to break down the identified process into rule-based steps in order to understand which steps of the process can be automated, if not all. Asatiani and Penttinen (2016) propose that RPA consultants should observe employees performing the identified manual tasks for approximately one day, in order to fully understand the potential. In the business case proposal stage, the benefits of RPA implementation is argued by presenting numerical figures on cost efficiency an d enhanced productivity. In the implementation stage, the software robot is configured to perform the process.

Dorr et al., (2018) emphasizes that before building the business case for RPA and sizing the opportunity, it is crucial to develop key assumptions and metrics to measure the performance. Therefore, key assumptions and metrics determine and guides the economic model of the robot. Consequently, total cost of ownership (TCO) has to be considered beyond the robot license. One-time costs can be process changes, organization changes, project costs, and IT costs. However, a successful RPA project allows onshore workers and high-cost resources to be used more efficiently.

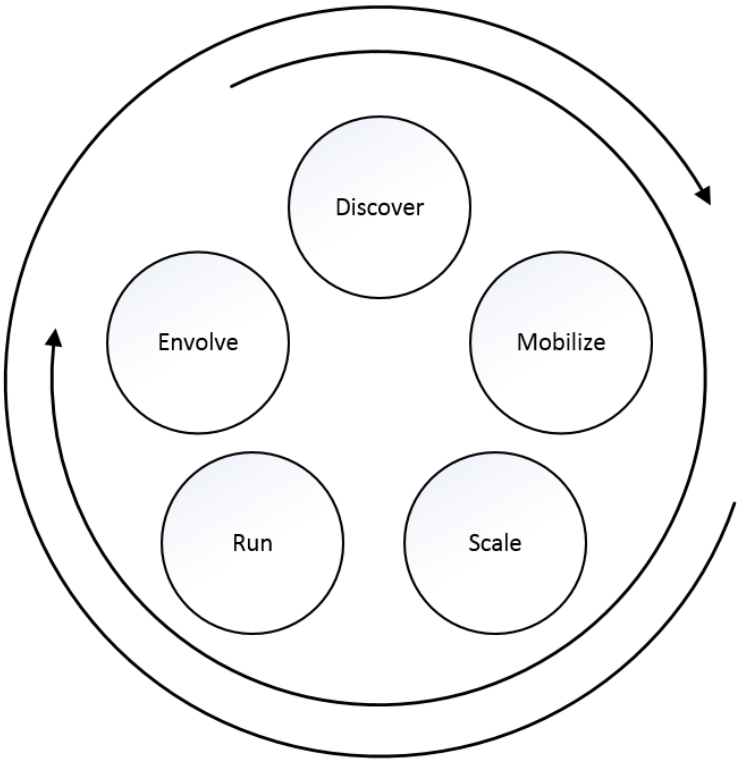

Figure 12. Managing RPA project lifecycle (Adapted from Dorr et al., 2018).

Dorr et al., (2018): 5 divide the RPA lifecycle in to five categories, emphasizing that the project lifecycle is required to be on-going, displayed in the Figure 12. In the discovery phase, the opportunities of RPA should be assessed through a pilot or proof of concept (POC). This phase should be repeated, when new potential RPA ideas are brought to light. During the mobilize phase, the RPA strategy, business case and operating model should be in the planning stage. In the scaling phase, the centre of excellence should be in place and in the early stages of RPA implementation slowly scaling the automation. Meaning that end-to-end processes are not tried to be fully automated at the start. In the running phase, the software automation should be optimized accordingly in order to create capabilities for hosting, running and supporting the automation process. Implying that RPA processes require support and monitoring by process owners to ensure consistency. In the evolve stage, the successful RPA strategy should be spread within the organization. The RPA lifecycle presented by Dorr et al., (2018) proposes a model where implementation of software automation is an everlasting process where new processes are assessed, piloted, and automated as well as supported by COE, and support is being provided within all business units through experience and knowledge from previous projects.

2.7 Summary of the RPA Theoretical part

The introduction of robotic process automation has enabled organizations to automate processes and tasks with relatively low economic impact compared to traditional business process improvement processes and tools such as business process management (BPM) and service-oriented architecture (SOA). RPA software only follows same logic as a human would. Meaning that it does not operate behind the software as traditional automating software would. Fundamentally, the robot repeats rule-based pre-learned steps reacting on a computer screen, instead of corresponding with system's application programming interface (API) (Asatiani et al., 2016). RPA is a simple software, which follows only pre-programmed steps. RPA is not capable handling processes which require humanlike decision-making and the environment where the robot is operation cannot be unstructured (Lacity et al., 2018).

Most suitable processes for RPA are processes which have attributes such as unambiguous rules, limited exception handling, high predictable volumes, stable working environment, access to multiple systems, and known costs (Lacity et al., 2015c; Kääriäinen et al., 2018). Most often, RPA is used for processes which require; reporting, updating information from a source to another and reviewing information. Furthermore, RPA projects are likely to succeed when processes have a known history of no major transformations in the processes, tools used, technology, and people structure. In addition, successful RPA projects are often business led instead of IT lead (Rutaganda et al., 2017).

RPA can provide substantial benefits when implemented correctly and the process is selected precisely. Even with all the benefits in mind, organizations need to comprehend that RPA does not solve the everlasting automation question or replace existing applications in the company (Rutaganda et al., 2017: 107).

3 Procurement Processes

In this chapter, the most common procurement processes are defined in detail, which broadens the readers' horizon in order to understand how organizations are handling their procurement related needs. In the current literature, terms such as sourcing, supply management, external resource management, purchasing, and procurement are used interchangeably (Weele, 2014). However, all of these terms and specific processes can be broken down, which makes for instance external resource management different from sourcing or purchasing.

According Porter's (1985) business strategy concept of value chain management, procurement processes are placed into to the support activities of an organization. Weele (2010): 6 describes procurement as a set of activities required to acquire and receive goods or services from supplier to final destination, including processes such as purchasing, quality control and service level monitoring which allows buying organizations to assess supplier performance and conduct supplier selection based on total cost of ownership (TCO) rather than choosing lowest price available on the market. TCO relates to all costs which are not included in the purchasing price and will incur during the life-cycle of the product or service being purchased. According to Ellram (1995): 4 TCO is a complex approach which requires buying organizations to assess the cost which they consider most impactful and significant in the purchase. Additionally, TCO may include activities which will most likely be a cost in the long-run such as order placement, receiving, inspection, replacement, unexpected maintenance, and revenue lost due to failure.

Purchasing means the management of external resources in a way which keeps company's primary and support activities in operation. Resources acquired outside of the organization including services, materials, and raw materials, depending on the industry and operating model, account on average from 50% to 80% of total expenses of companies (Weele, 2010; Iloranta et al., 2015). Thus, total cost of purchases dominates profit and loss statements of organizations (Iloranta et al., 2015: 21-22). Therefore, acquiring required resources as efficiently and cost effectively can really make a significant impact on the profit and loss statement. Figure 13 demonstrates how strategic approach to purchasing can affect positively on profitability of a company and reputation, company image, agility, and strategic positioning.

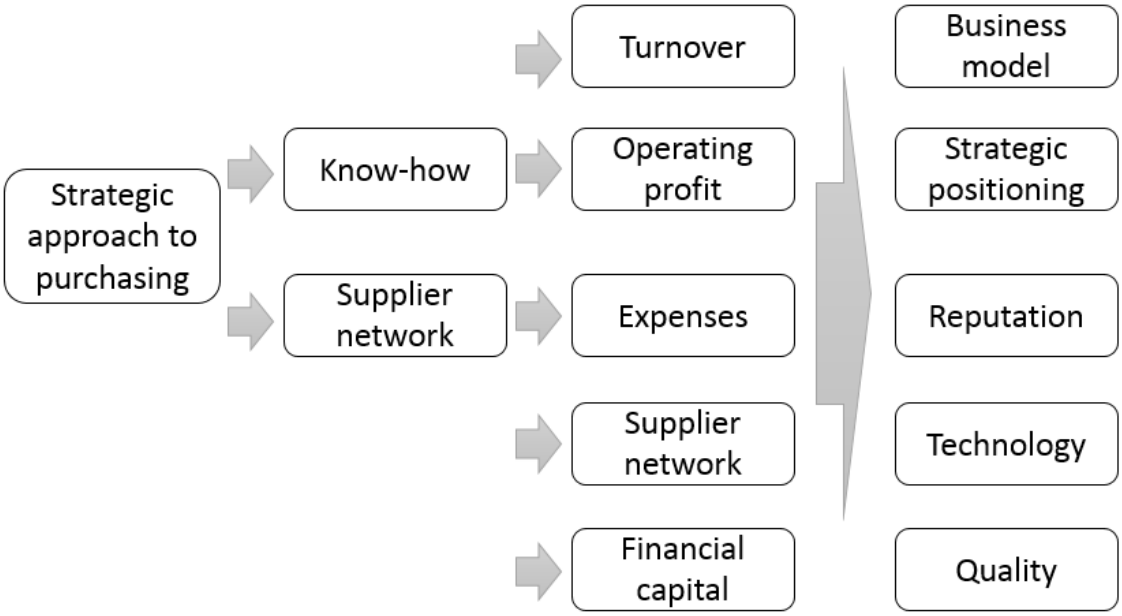

Figure 13. Effect of strategic purchasing to competitiveness of an organization (Adapted from Iloranta and Pajunen-Muhonen, 2015).

According to Manojlv and Nagy (2014): 926, the procurement processes have an significant effect on the end product of the company depending on the industry the company operates in. In manufacturing industries with finished end product including several raw materials and external services, the impact of procurement processes is the highest, and in the service industry procurement organization and processes have a smaller influence on the end product. Therefore, it can be argued that procurement department and the role of supply management is an essential key in achieving a competitive advantage. Hence, resource dependency perspective (RDP) indicates that organizations are relying partially on external resources which are acquired, and the continuity and future is dependent on the ability to acquire needed resources and to avoid dependencies and external control (Preffer and Salancik , 1978). Therefore, development of procurement processes and supplier relationship can be argued to have an significant effect on the performance of organizations. According to Lehtonen (2008) one of the most important strategic matters of organizations is the make-or-buy decision, which allows organizations to concentrate in their core competence areas. The strategic value of core purchasing processes

increases, since the requirements for functioning procurement processes are fueled by: quality, flexibility, lead times, low tide capital, and total costs of purchases.

3.1 Procurement Function and Processes

The procurement function contains traditionally the process of acquiring materials and services. Purchasing and procurement processes involve other crucial processes as well, which can determine the profitability and competitive advantage of a company. Such as negotiation purchasing price, specifying terms and conditions, handling the contracting, and following up on purchases to ensure proper delivery and quality according to the service level agreement (Weele, 2014). Figure 14 represent a typical purchasing process in which procurement function is divided into strategical and operational purchasing and the purchasing operations have been divided into two sectors; sourcing and supply. Strategic purchasing can be defined as a way of strategically guiding organizations, such as selecting suppliers and contracting. It does not include day-to-day activities such as routine buying activities, logistics, and payment (Sollish, 2011: 2).

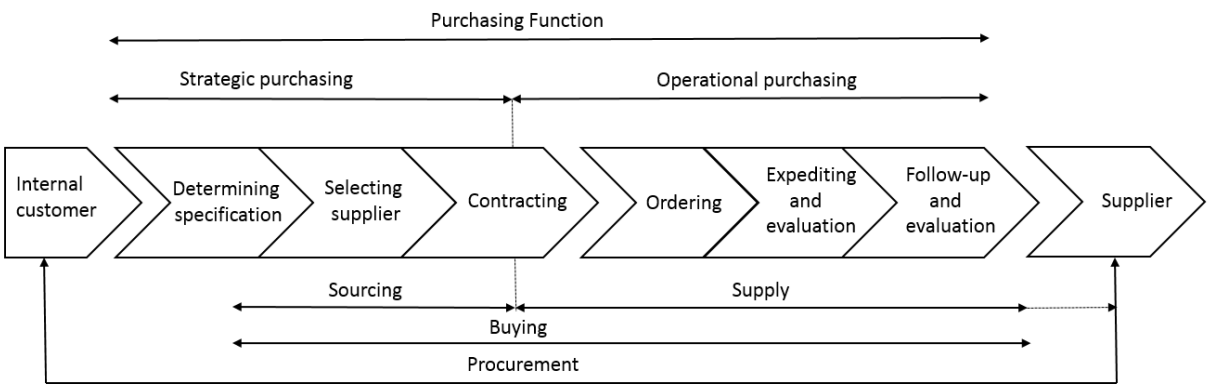

Figure 14. Purchasing process model (Adapted from Weele, 2014)

The Purchasing process model (Adapted from Weele, 2014), represents all main functions of the procurement function and how each process are interconnected to each other. Weele (2014): 9-10, mentions, that buying process in Figure 14 does not include inventory related processes such as; planning, scheduling, and stock keeping. All of the before above material related decisions and actions should be done based upon total cost of ownership. Ritvanen et al., (2011):

31-32, divide procurement processes and tasks involved into three categories strategic, tactical, and operational. Strategical tasks include supplier relationship management, demand planning and development, supplier selection, analyzing supplier performance and segmenting suppliers. Tactical processes are budgeting and contracting, which are placed in Weele's model between strategic and operational purchasing. Operational purchasing includes similar tasks as displayed in Figure 14, including day-to-day operations such as ordering, invoice reviewing, and shipment monitoring. Importantly, Ritvanen et al., (2011) emphasize that operational procurement function should be reactive, highlighting purchasing costs, transportation cost, service level and delivery times and strategical purchasing should be proactive and forecast changes in the market.

3.1.1 Sourcing

The sourcing process displayed in Figure 15 represent a basic sourcing process. Weele (2014): 10 describes sourcing as a process of finding, selecting and managing the leading and most suited sources of supply globally. Sourcing start from assessing the requirements of the purchase and prequalification of potential suppliers.

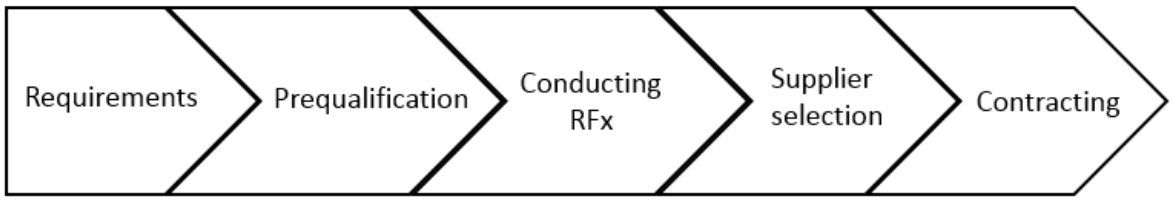

Figure 15. The sourcing process (Adapted from Sollish, 2011).

RFx is a term used for combining several sourcing steps, which are request for information (RFI), request for proposal (RFP), and request for quotation (RFQ) (Weele, 2014; Sollish, 2011). Request for information (RFI) is a an early process step in sourcing in which suppliers are invited to submit specific acknowledge of their attributes and general information that could possible support the suppliers possibility to be qualified for a potential tender. In a typical RFI process, a group of suppliers are invited to an event where the procuring organization collects general data about each company and their products and services (Weele, 2014).

Request for proposal (RFP) is a process which often follows after RFI. The goal of request for proposal is to get suppliers to contribute and propose solutions for the procuring organizations. In addition, the aim of RFP is to detail more specifically the needs of the procuring organization, documenting the specifications in more detail compered to RFI (Weele, 2014; Monczka et al., 2005). However, RFP is not a compulsory procurement process and the sourcing process can be moved from RFI directly to RFQ (Weele, 2005). Request for quotation (RFQ) is more detailed compared to RFP, and it is a document sent to selected suppliers identified in step RFI and RFP. Suppliers selected for RFQ submit a bid, which meets the requirements listed in the RFQ against the possible cost. This process step can be also called request for tender (Weele, 2005). When these pre-steps are conducted the information regarding supplier responses are consolidated into a RFx (Sollish, 2011: 17). After assessing the RFx through total cost of ownership and supplier is selected, contract is required to be signed with the supplier, including requirements and service level agreement (SLA).

3.1.2 Segmenting and Selecting Suppliers

Segmenting suppliers provides organizations an opportunity to divide suppliers into different group based on the values, which suppliers are able to provide for the buying organization. Additionally, segmenting suppliers eases buying organizations to identify the possible opportunities brought by co-operating with suppliers (Enz et al. 2012). Therefore, segmenting suppliers is a critical step in supplier relationship management for mapping out the strategically important suppliers and additionally, companies have been able to reduce their supply base by segmenting their whole supplier base and co-operating with strategically important suppliers (Moeller et al. 2006). Park et al., (2009): 504, state that to achieve most of SRM process, it is critical to understand the supply relationship with different suppliers and segment the suppliers accordingly. The supply relationships can be distinguished into strategic relationship, collaborative relationship, and transactional relationship. Strategic relationship would be formed only with small quantity and carefully selected suppliers, which requires transparency and long-term commitment from both parties. Collaborative relationship is a similar relationship as strategic, but it can be formed with larger group of suppliers without such a specific scope of supplier involvement and development. Whereas, transactional relationship would be ideal relationship for suppliers which would be categorized as non-critical suppliers in Figure 17.

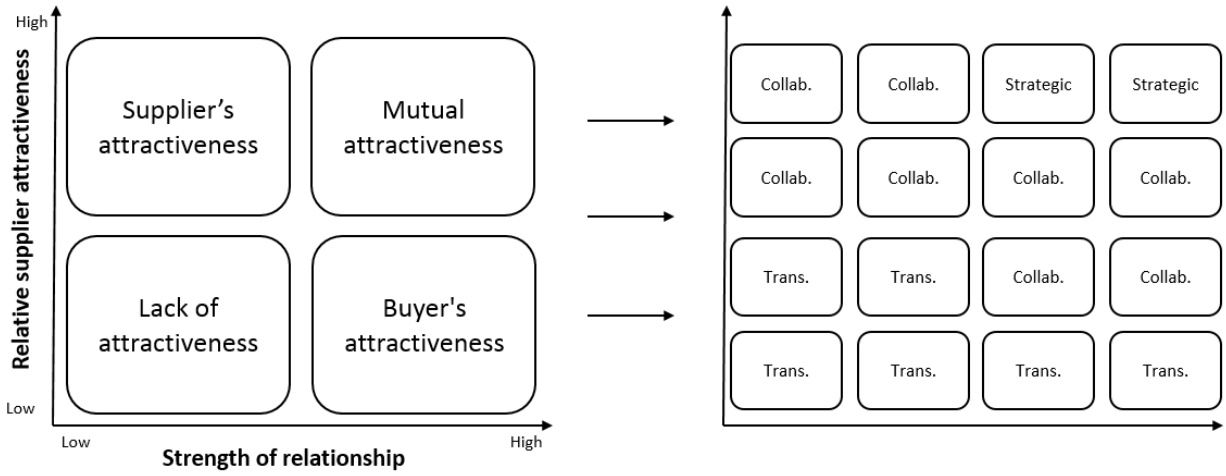

Figure 16. Attractiveness of supplier relationship. (Adapted from. Olsen and Ellram, 1997; Park et al., 2009).

Figure 16 represent a model by Olsen and Ellram (1997): 106, which categorizes suppliers by strength of relationship and relative supplier attractiveness. The factor groups affecting supplier attractiveness can be divided into four main categories which are displayed and explained in Table 4.

FACTOR	DESCRIPTION OF PONTENTIAL FACTORS
FINANCIAL AND ECONOMICAL	Margins, financial stability, scale and experience, and supplier's barriers to entry and exit
PERFORMANCE	Delivery, quality, and price
TECHNOLOGICAL	Patent protection, design ability and speed to develop against needs, current and future capacity utilization, and ability to cope with changes in technology
ORGANIZATIONAL, CULTURAL, AND STRATEGIC	Top management capability and attitude, fit between organizations, trust, risk and uncertainty of dealing with selected supplier, influence on buying company's position in network, and internal and external integration of supplier.

Table 4. Factors influencing the relative supplier attractiveness (Adapted from Olson & Ellram, 1997: 106).

Other factors, which are not listed in Table 4, according to Olson et al., are supplier's ability to cope with ever-changing environment and safety record. By assessing each supplier individually by factors displayed in Table 4, the overall description of supplier attractiveness can be segmented by using Figure 16 into either strategic, collaborative or transactional segment. According to Olsen et al., (1997) companies should try to limit strategic suppliers and select them carefully. The nature of collaborative suppliers should be similar to strategic but with easier exit plan if required. Transactional suppliers should be used for non-strategic purchases in which the resources or services can be purchased from any supplier for a specific price.

Kraljic's matrix or portfolio model is a widely used tool for segmenting suppliers (Jensen, 2017; Olsen et al., 1997) which is displayed in Figure 17. The matrix is a portfolio model, which can be used to categorize either suppliers, goods or services that are being purchased, by importance of purchasing and complexity of supply market. As importance of purchasing Kraljic (1983) states as criteria such as; cost of materials or total costs, value-added profile and profitability profile. As a complexity of market Kraljic states criteria as supply, monopoly or oligopoly conditions, pace of technology advance, entry barriers, and logistics costs and complexity. In addition, Kraljic (1983): 112 argues that the four stage approach can be used to forecast future supply scenarios and identify and minimize the supply vulnerability.

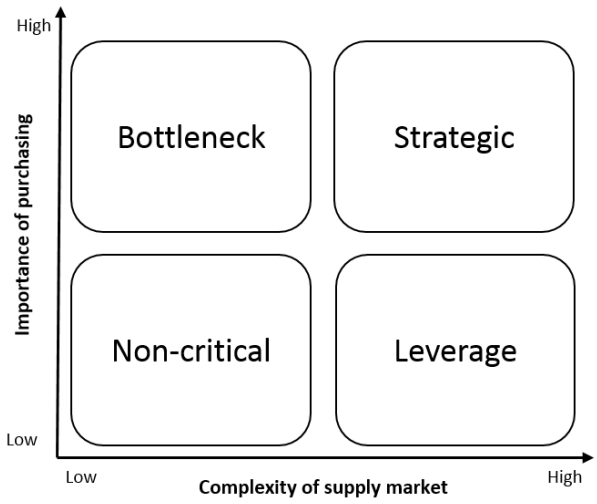

Figure 17. Kraljic's matrix (Adopted from Kraljic, 1983).

The above mentioned criteria can be applied to either supplier or goods level. The two by two matrix categories supplier or goods in the matrix based on their attributes in four categories which are bottleneck, strategic, non-critical, and leverage (Jensen, 2017; Kraljic, 1983). The Non-critical segment can be seen as a category in which spend can be relatively low and there are plenty of suppliers available to choose from. In addition, the in non-critical purchase segment, the main goal is to minimize the spend. When purchasing leverage items or services, the main goal is to ensure supply and there are limited number of suppliers available in the market. The strategic segment is the most important for the buying organization. The goal is to establish a strategic partnership with selected suppliers since the purchases impact directly the company. In the bottleneck segment, the buying organization and purchasers have a significant leverage in the market and the goal is to optimize the purchases in order to lower overall costs (Ritvanen et al., 2011): 37.

3.1.3 Category Management

Kraljic (1983): 109, embarked the wave of forming supply strategies, segmenting suppliers, classifying spend and establishing strategic partnerships with key suppliers. Furthermore, highlighting that procurement organization and processes cannot lag behind other departments and processes in acknowledging and adjusting to ever-changing business and supply environment. Hence, category management has been shaped from Kraljic's view of future

purchasing in the 1980s. Category management tools and theories border lines supplier relationship management (SRM) theories slightly, however the main objective is to gain as much benefits from supply base as possible (O'brien, 2015).

According to O'brien (2015: 5-6) category management is a strategic and process-based approach, which categorizes vast majority of organizations spend with strategically important suppliers. Segmenting main areas of spend into various groups of products or services, organizations are able to work cross-functionally on individual categories by analyzing the category specific spend and how the organization utilizes the products or services of the category, supply base and analysis on specific supplier level. In order to have successful category management, it requires active participation and engagement of stakeholders, business functions and individuals within organization to engage to the process. However, O'brien argues that category management can deliver potentially large economic benefits both for supplier and procurement organizations, if all stakeholders are fully committed (O'brien, 2015). Iloranta et al. (2015: 323-324) state that the category management model is a widely used concept, in which consist of multiple dedicated category specialists who are responsible for handling the purchasing strategy, supplier selection and segmentation, and all decision making regarding purchasing within their categories, led by a category manager. In addition, one of the main functions of category team is to follow supplier performance and develop their performance through supplier relationship management.

Category management is used to ensure that relationships with key suppliers are on a sustainable level, which can protect organizations against volatility in the market. In addition, category management has also been proved to enable new businesses and ventures to grow through utilizing the value in supply base (O'brien, 2015: 17-18). Category management is capable of delivering significant benefits to organizations through optimizing the value achieved from value chains and networks, if deployed effectively. In addition, category management is capable of providing an approach to procurement organization, which allows examination of organization-wide spend and allows cross-functional way of working, including key stakeholders to the sourcing strategy. Cross functional integration ensures that strategy is implemented properly and all benefits are delivered within the organization (O'brien, 2015: 3).

3.1.4 Spend Analysis

Pandit & Marmanis, (2008): 5, describe spend analysis as the first step of strategic procurement, which provides the foundation for compliance, control, and spend visibility. Additionally, by analyzing accurately the total spend of the organization, procurement professionals are able to:

- determine exact category spend,
- identify strategic sourcing opportunities within supplier base,
- identify and develop supplier rationalization,
- engage specific expense reduction through increased compliance, and
- track maverick spend, contract compliance, and purchasing budgets.

Spend analysis is used to increase transparency within organizations and identify opportunities for cost cutting within all business functions (Pandit et al. 2008). As a basic function, spend analysis should provide answers to regarding the total volume of spend, number and name of suppliers, and whether the value provided by suppliers meets expectations (Partida, 2012: 56). As main functions spend analysis solutions tools should be able to provide predefined reports, create ad hoc analysis through dimensional filtering, pivot tables, and charts along various dimensions, for instance; country, time, division, and category (Pandit et al. 2008: 28).

3.2 Supplier Relationship Management (SRM)

Park et al., (2009): 496 describes SRM as strategically aiming to collaborate between buying organization and selling organization in order to produce goods or services more efficiently and faster to market. Krause and Ellram (1997): 21 defines supplier development as "*any effort of a buying firm with its supplier to increase the performance and/or capabilities of the supplier and meet the buying firm's supply needs"*. Watts and Hanh (1993): 12 describe supplier development as an beneficial relationship and the desired outcome is to have supplier and buying organization to operate more efficiently and create more value from collaboration. Additionally, supplier development requires long-term dedication from both ways and the process can be take a long time (Olsen and Ellram, 1997). Whereas, Lambert and Schwieterman

(2012) describe supplier relationship management (SRM) as a process which provides the structure and guidelines for maintaining and developing relationships between buying organizations and suppliers, aiming for win-win situation for both parties in the long-term.

Adapting the mentality of supplier development and SRM, companies have moved from passive purchasing perspective, where purchasing was considered as a black box in which the buying institute has no power or willing over. Buying organizations have realized that value can be created through co-operation with suppliers and developing suppliers' capabilities and performance (Iloranta et al., 2015). Krause, Scannell and Calantone (2000): 33, mention that buying organizations are using diverse supplier development strategies in order to develop their supplier performance, which can include; providing incentives for high performance and service levels, training supplier's personnel together with buying organization's personnel. In addition, supplier development can be even provoking competition within supplier base in order to achieve more capabilities in the existing supplier base.

3.2.1 SRM Process and Framework

According to Lambert and Schwieterman (2012): 340 the SRM process should be divided into two segments: firstly in strategic process, in which management consisting of senior executives and managers, manages strategically the process and secondly the operational process, which includes implementation of SRM to the procurement processes. The strategic team is responsible for identifying the key suppliers selected for SRM and determining the ways how relationships with key suppliers are developed and maintained. A widely use tool for segmenting suppliers is Kraljic's matrix, which is displayed in detail in chapter 3.1.2 (Olsen et al., 1997; Lambert et al., 2012). Second segment of SRM process is on an operational level, where operational purchase personnel or team is responsible for each identified key supplier for daily operations and development (Lambert et al., 2012).

Lambert et al., (2012): 348 propose supplier relationship management process to be divided into seven sub-processes which are listed below. The SRM process requires top executive support and each step requires either actions by strategic or operational SRM teams. In addition, some steps require co-operation between strategic and operational segments are required.

1. differentiate suppliers;
2. prepare the supplier/segment management team;
3. internally review the supplier/segment;
4. identify opportunities with the suppliers/suppliers segment;
5. develop the product/service agreement and communicate plan;
6. implement the product/service agreement; and
7. measure performance and generate supplier cost/profitability reports

First, the suppliers should be segmented and differentiated according to needs of the company by using for instance Kraljic's matrix. In the second step, the procurement organization should internally form cross-functional teams for each segmented supplier in order to negotiate product and service agreement (PSA), which detail specific organizational needs from each segmented supplier. Third and fourth steps include actions to be taken internally by reviewing each supplier or supplier segment together with PSA, which in the fifth step assists both strategic and operational segments together to form and develop feasible service agreement and communication plan with suppliers. Lastly, the product or service is implemented in the organization and monitored. Measuring performance of SRM is a crucial sub-process, since it justifies the importance of SRM to the top management (Lambert et al., 2012): 347-349. However, measuring the impact of SRM can be difficult, since suppliers can provide value which cannot be measured necessarily in economic factors (Olsen et al., 1997).

The SRM framework displayed in Figure 18, by Park et al., (2009): 499 proposes a framework which integrates different functions of SRM and concentrates on continuous improvement. The framework proposes that SRM process should start from shaping the proper purchasing strategy, after which suppliers are segmented and selected for supplier involvement and collaboration. Supplier selection is performed based on evaluation of suppliers financial status and technological capability. In addition, in supplier selection phase, it is crucial to evaluate suppliers based nature of goods or services being purchased. Goods and services sourced for indirect and direct purposes should be evaluated on different parameters. However, cost, delivery and quality should always be considered as high criteria when selecting a supplier for SRM process. Supplier assessment and development phase includes steps of segmenting the suppliers the selected SRM suppliers and develop them differentially based on the relationship between the buying organization and supplier. In addition, suppliers are evaluated based on

their capability, performance and collaboration relationships and given a rating from bad to excellent (Part et al., 2009: 504-507). Accessing information on suppliers performance can be a difficult tasks, since it can be located in several applications, spreadsheets, email conversations, and other relevant locations. Therefore, assessing wide range of suppliers can be a difficult tasks without a well-functioning SRM applications or robotics, which can fetch information from several locations and consolidating the information for humans to process.

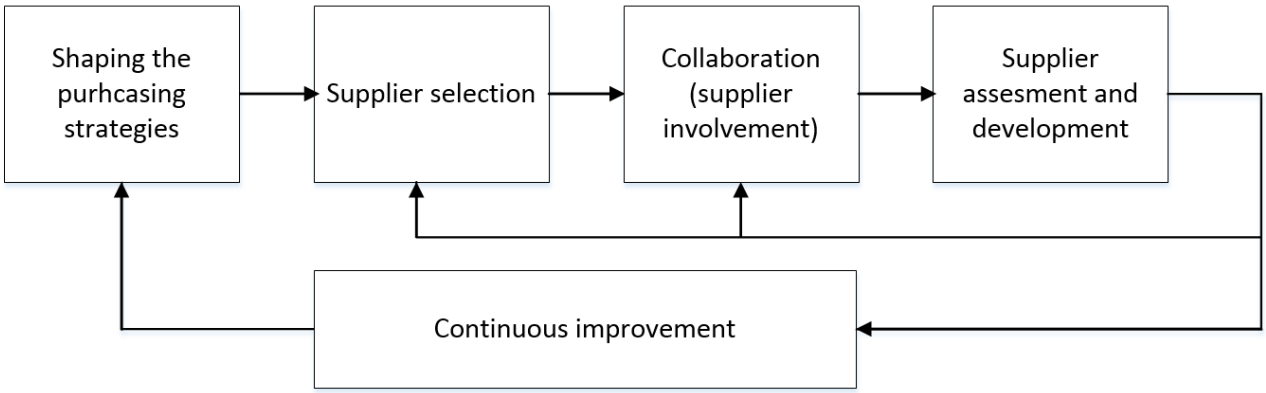

Figure 18. Integrative SRM framework (Adapted from. Park et al., 2009).

Park et al., (2009): 508, emphasize that continuous improvement step in the framework should include processes such as integrating suppliers ERP systems and buying functions SRM systems and improving systems to function better with suppliers.

3.2.2 Benefits of SRM

As benefits Dalvi et al., (2015): 666 state that supplier relationship management and supplier development have been proven to benefit both buying and selling organizations. Additionally, successful SRM and especially supplier development has multiple benefits such as achieving competitive advantage, improving supplier performance, receiving long-term strategic benefits, improving end-product quality, and economical benefits. Park et al., (2009): 496 argue that SRM allows companies to leverage their supply base by diminishing supply risk and uncertainty, and also optimize the inventory levels and service levels. In addition, Park et al.,

state that well-tailored SRM systems are able provide value for the whole organization, not only to the procurement organization by cross functional information sharing regarding supplier performance, which can be used for supplier development through data driven decisions.

Lambert et al., (2012): 337 state that the role of SRM has increased over the years, which allows companies to innovate and deliver products to customers more effectively and successfully through managing the relationships correctly with carefully selected suppliers. Overall, Lambert et al., (2012) summarize SRM as a tool and guideline, that guide the procurement organization to better manage the relationship between supplier, which increases performance for both firms. Generating a win-win situation from collaboration point of view.

4 Methodology

In this chapter, research methods which are used for empirical part of this thesis are discussed in more detail. Furthermore, the use of research methods are justified in this chapter. Such as; why case study approach was chosen and why qualitative research approach was chosen for this master's thesis.

A case study method was chosen for this research, because the research topic and questions fit perfectly in to the description of a single event case study. For instance, the research topic focuses on contemporary event of RPA and requires no control over behavior events. In addition, the research questions are formed in a 'how' form (Yin, 1994: 6) which justifies the use of case study method. A case study method was also a legitimate reason for the research strategy, since the research sample was chosen from known contacts within the case company. Also, in depth analyzing and studying of answers and results from a small purposively selected sample is a known approach to a case study (Saunders et al., 2009: 176). These arguments support fully the reasoning behind choosing the case study approach for this thesis and additionally previous studies have been conducted using similar research methods, which indicates that tools and methods should be aligned.

Saunders et al., (2009) state that qualitative research method can be seen as umbrella for different research methods or approaches, such as case studies, business history research, and grounded research. Therefore, qualitative research was chosen as the method for this study. In addition, answering the research questions could not be possible by using quantitative research methods, due to the nature of data and availability of numeric data concerning the topic. In this research, qualitative data refers to all non-numeric data which can range from answers to open-ended questions and in-depth interview transcripts or significant number of documents. In order to be effective with analysis, the meaning behind qualitative data has to be fully understood, hence qualitative data analysis procedures are practical and effectual (Saunders et al., 2009: 480).

4.1 Research Design and Methods

Research design can be explained as the general plan, which covers the way of researcher answers the research questions. Additionally, research design should mirror the reasoning, why a certain research design has been chosen for a particular study (Saunders et al., 2009: 136-137). Yin (1994): 19 describes research design as an action plan or a road map from "A" to "Z", "A" symbolizing the research questions and hypothesis and "Z" conclusions and ways of answering the research question. In addition, between "A" to "Z" there are several steps, such as data collection and analysis of collected data. Jalil (2013): 6 states that research design should aim to express and justify to the researcher on what data is required from which sources for the study and how the data will assist the researcher to answer the research questions. In this case study conducted in a Finnish energy utility company, the research design should justify and legitimate the reason what was the eventual need for researching the capabilities of robotic process automation in procurement. As a sources of resource data, literature of RPA was studied, in order to gain a broad understanding of its capabilities. Additionally, procurement and sourcing theories were researched for this study. For the purpose of discussing how RPAs capabilities can be utilized in procurement processes, which are in use at the case company.

Jalil (2013) emphasizes that research design and methods are often used interchangeably, however the two concepts differ from each other. Research methods justify the mode of data collection from quantitative to qualitative or mix of both. As stated before, this case study uses qualitative research methods by analyzing data gathered from semi-structured interviews and scientific publications which discuss robotic process automation.

4.2 Research and Data Collection Process

The research process for this master's thesis is presented in Figure 19 below. The research process started with a comprehensive review of robotic process automation related articles and publications available in the university data bases, google scholar, university library, and publications available at the case company. The aim of the literature review was to gain a broad

understanding and a deeper knowledge of the technology behind RPA and its capabilities together with benefits and difficulties of using RPA in different processes. In addition, a comprehensive literature review of RPA was required in order to answer two of the research questions. Which were assessing benefits of RPA, project governance, and RPA roles within procurement department can be mainly answered based on the conducted literature review.

Figure 19. Research process for the thesis.

Data for the empirical was collected in workshops and individual interviews in case company during October, November and December of 2018. The workshops which were organized for different purchasing teams within the corporate purchasing department and purchasers who are located at different power plants. The workshops followed a similar structure, where RPA was introduced as a technology followed by listing benefits and difficulties of RPA. In addition, processes which RPA is most suited for were discussed in detail with examples from the case company. Example video of RPA process from case company's finance department was also displayed in the workshop and interview sessions. The video displayed a process where a report was created through accessing multiple internal applications with zero error rate in data quality. The video displayed a flowchart of the process which the robot followed. Displaying the video provided the interviewees a comprehensive understanding of RPAs capability. After introducing the technology and capability of RPA, interviewees were asked questions regarding case company's procurement processes and whether they see a need for developing RPA and automation in order to develop supplier data management. The interviews followed a designed semi-structured interview structure (research questions available in Appendix 3). The benefit of semi-structured interview is the ability is the ability to explain and clarify the questions in more detail, if the interviewee does not fully understand the scope or reasoning behind a certain question (Saunders et al., 2009: 158).

4.3 Data Analysis Methods

Data analysis for the case study started by analysis and reviewing the interview records both from workshops held for procurement professionals and individual interviews. Based on the review of transcripts, the identified processes which require further development possible with RPA were mapped into six process categories in the case company which are category management, contracting, supplier relationship management, sourcing, and contracting. Under these case company procurement processes, in total 13 sub-processes were identified based on examining the existing processes and weighting the capabilities of RPA against complexity of the processes, unambiguous rules, need of accessing multiple systems, limited exception handling, and having a stable working environment within the systems needed in the processes. Based on these attributes, the processes were analyzed and placed on a chart demonstrating the suitability for RPA piloting.

The data for answering research questions regarding RPA benefits, RPA governance model, and organizing roles for RPA projects within procurement organization was mainly gathered from current scientific publications. The empirical findings were drawn from interviewing RPA professional in the case company, mirroring RPA theory and analyzing case company's internal RPA data.

4.4 Validity and Reliability

Yin (1994): 2 states that case study research should always try to maximize four aspects of quality, which are construct validity, internal validity, external validity, and reliability. These aspects of quality can always be used for testing the validity and reliability of a research. Construct validity aspect in research can be achieved by using multiple sources of evidence, establishing chain of evidence and by ensuring that findings are tested with key informants. Internal validity refers to a aspect of study where conclusions are drawn based on example two factors and in reality the third factor has impacted the findings with researcher neglecting, therefore patterns should be matched. Thirdly, external validity refers to an aspect in which the results could be tested by using replication and linking results out of scope and examine if the

used logic is repeating in other studies. Lastly, the reliability in a research can be tested by ensuring that if one would follow exactly the same procedures as the researcher has described, they would arrive to same findings and conclusions (Yin, 1994): 34-39. Whereas, Saunders et al., (2009): 156 state that reliability of findings can also be tested through transparency of data, if researcher can provide gathered data and others researchers can arrive to similar observations and conclusions from the provided data.

5 Empirical Findings

This chapter discusses the empirical findings of the case study regarding robotic process automations utilization in procurement. In addition, the case company is introduced together with procurement processes, which are displayed in a high level to provider the reader a basic understanding of general procurement processes. In addition, RPAs capability to be utilized in the case company's procurement processes is discussed in this chapter.

Data was gathered in semi-structured RPA workshops and individual interviews with 24 different procurement professionals and one in-house RPA development manager, who has an impressive knowledge and know-how regarding RPA processes. In the procurement RPA workshops in total 49 use cases were identified as potential use cases for RPA piloting or requiring further development in some other way. Processes identified were analyzed based on the characteristics of the process and weighed against characteristics identified in the literature review of RPA. In addition, the suggested governance model displayed in this chapter was drawn based on interviews and case company internal material on IT governance.

5.1 Introduction to the case company

The case company used in this master's thesis is a Finnish utility company offering electricity, heating and cooling, and waste management solutions to cities and municipalities. The company operates in the Nordics, Baltic countries, Russia, India, Poland and through recent acquisitions the geographical presence has increased in the continental Europe. The case company has stated in its mission that, mitigation of climate change and moving towards a low-mission energy system and optimal energy and resource efficiency is significant part of their vision and mission in long-run (Case company website, 2018). In 2017 the case company generated sales of €4.5 billion and the comparable operating profit accounted €0.8 billion, employing approximately 8800 employees (Investor / Analyst material, 2018).

The purchasing volume of the case company is approximately 2,5 billion euros annually depending on investment volume. The size of investments of purchasing volume vary annually. The case company has over 15 000 suppliers.

5.2 Case company's procurement processes

Figure 20 represent the procurement processes of the case company on a high level. Strategic planning is divided into category management and forming of sourcing strategy. Source-to-contract includes sourcing and contracting related processes. Purchase-to-pay in the other hand includes all processes in purchasing and invoice handling and payment. Supplier relationship management is expressed as a process or tool which should be used in all areas in procurement.

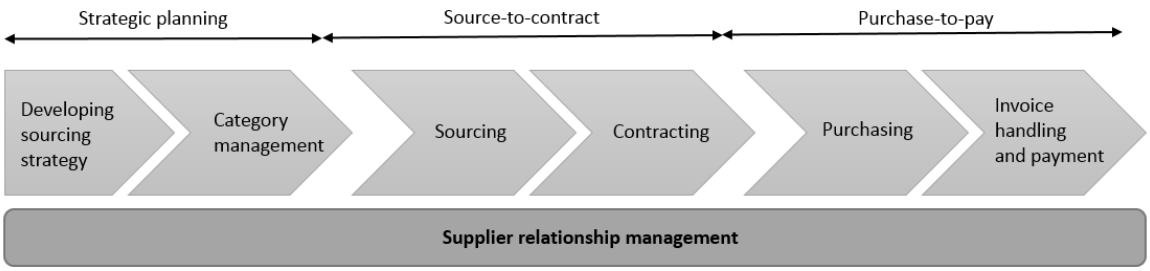

Figure 20. High level description of procurement processes.

Figure 21 demonstrates the logic, how procurement processes have been divided into four categories at the case company. The category management enables categorization of suppliers and purchases into specific categories through cross-functional process, involving professionals from necessary functions. Category management team is responsible for leading, coordinating and developing sourcing strategies in a way which controls a large scale of purchase spend, including capital expenditure (CAPEX) and operating expense (OPEX). Weele (2014) explains CAPEX as expenses that can be divided for several fiscal periods, whereas OPEX is reported in a specific fiscal period. Each category manager is responsible for creating and implementing category specific strategy and manage SRM process with selected suppliers and keep track on the performance of suppliers and category.

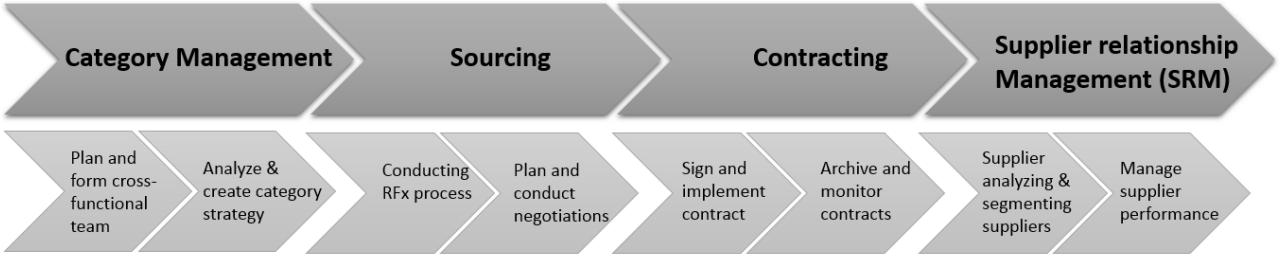

Figure 21. Detailed description of procurement process of the case company.

The sourcing process follows a similar structure as demonstrated Figure 15. RFx process also follows similar steps, which is explained in more detail in chapter 3.1.1, depending on the product or service being procured. Additionally, this step of the process includes traditional supplier qualification, which ensures that suppliers used by the case company conducts their business ethically, environmentally responsible way, and apply same standards as the case company does. Qualification of supplier is a critical step in sourcing, since it can be argued to play a significant role in the supplier selection process.

5.3 Current procurement RPA processes

Currently the case company has utilized two robots in their procurement processes. First robot which was implemented in the sourcing process, conducting the manual labor of qualifying suppliers using a web-browser based e-sourcing tool, MS Excel and internal supplier data management tool. The qualification robot project was started in the end of 2017 and during that time, the case company's framework for implementing a RPA was difficult to interpret from procurement's point of view. Due to the highly manual process of conducting supplier qualifications, it was first calculated that RPA qualification robot would save approximately 0.5 full-time equivalent (FTE) of manual labor in the overall the process. Since, the qualification robot was a pilot case and there were no ready KPIs or frameworks to follow, the project provided great learning curve for procurement personnel on how a process should be automated in the future and what are the capabilities of RPA. Importantly, the pilot case have also taught RPA projects require strict governance model, which was unclear when the qualification robot was in development and early production.

According to the interviews, the process was ideal for RPA, which uses two internal applications and MS Excel, in order to conduct the qualification process. However, as the process was automated, it turned out to be too complex and unstable for RPA. With current experience, the person responsible for the automation of the process said, it would have been wiser to automate smaller portions of the process one by one and create several different robots conducing small portions of the process. Because of the complexity of the process and unforeseeable changes within the external applications, there has been several business errors which have caused the robot to crash, forcing the process to be conducted manually by humans. Overall, the learnings from automating the qualification process was that the person developing the process should fully understand the business logic of the process and exceptions in the process should be tested before putting the robot in production. In addition, the processes should not be too complex and long. Processes should be automated in small portions and later linked together if possible.

The second RPA process which was automated in the case company's procurement department was Intrastat reporting process. Intrastat is the system used for reporting statistics of traded goods between European Union countries (Logistiikan Maailma, 2019). Case company's process for reporting the Intrastat statistics is highly manual and repetitive process, therefore highly suitable for RPA. The Intrastat RPA uses browser based invoice viewer to scan import invoices requiring Intrastat reporting. After reviewing the invoices, the robot has been taught to generate an excel sheet, with required information needed for the reporting. The missing information for the reporting is gathered by enquiring pre-identified persons to fill in the details in the excel. According to the interview, the missing info, which cannot be read from the invoices is usually the net weight and item specific customs code. When all missing information is gathered, the robot creates the Intrastat report, which is submitted after particular tax period.

According the interview, the Intrastat RPA functions fairly well. The process only utilizes one internal application, MS Excel, and e-mail. The weakest link in the process, is humans who do not answer the robots email enquiries to fill in the missing information to a excel sheet. Currently, the number of case company's import invoices are relatively low and the process can

be easily done manually if required. However, RPA's ability to scale for large number of transactions is ideal for Intrastat RPA. If invoice reviewers are advised regarding Intrastat reporting, it is possible that the robot can perform the whole process, leaving the submitting and reviewing of the report to humans.

5.4 Current process of identifying and deploying RPA processes

Figure 22 represent the current process of identifying and deploying a RPA process. The process starts by mapping out potential processes, which meet the RPA criteria such as; stable working environment, limited exception handling, and unambiguous rules (Lacity et al., 2015c). In this step, the goal is to define a list of processes prioritized with business cases together with business process owners and business unit specific RPA main users within the specific business unit. Development time, resourcing and cost are defined in the first step, which are approved by business owner within the business unit. Currently, the case company has no structured framework for identifying procurement processes or tasks for RPA development. Hence, this thesis aims to provide a channel for procurement personnel at the case company to propose potential manual tasks to be automated.

Figure 22. Current process of identifying and deploying RPA process.

In the second step, the process is defined precisely as a step-by-step business workflow which is documented in process definition document (PDD). PDD is a document which details the flow of the business process which is automated and changes to the process should always be marked in this document. In addition, PDD is a crucial document throughout the robot process lifecycle, since it contains a specific flowchart with captured screenshots of the process, listing of the systems which are used in the process, and all other relevant information regarding the process. PDD should be drafted in a manner, in which personnel

who are not familiar with the process are able to understand how the robot functions. In this phase, resources and access rights for RPA robot and RPA developer are agreed.

In developing phase, the process is developed by a third party service provider based on the step-by-step description in the PDD. Robot developer defines the robot structure and openly communicates about issues in the process, if the robot is not functioning as planned. In the testing phase, the robotic process is tested throughout and all possible outcomes are tested which could occur and break the process when in-production. Third party service provider who monitors 24/7 the processes, are in crucial part in this step, since they are responsible for day-to-day operations. Also, in the testing phase user acceptance test is conducted in which user rights are tested in the test environment. In the deploying phase, the robot is transferred to production environment with intensive follow-up period regarding potential issues followed up by the process developer and 24/7 maintenance team.

5.5 Current governance model for RPA

Currently the case company's RPA governance model is comparable to the federated governance model, which is displayed in Figure 8. Each business unit, which utilizes RPA in their processes, have main users who can be considered as the business process owners, they are capable of assisting, if the robots require maintenance. In addition, there can be users within the business unit, who receive execution alerts, which are basic notifications indicating that the robot has executed the process. In addition, the notifications can inform a user if actions are required.

The basic roles of RPA project governance is displayed in Figure 23. The user role can be anyone in procurement department whose own tasks are reliant on the performance of the automated process. They are not responsible for maintaining the robotic process. Figure 23 also represents that main user's role is critical part of governing the robotic process.

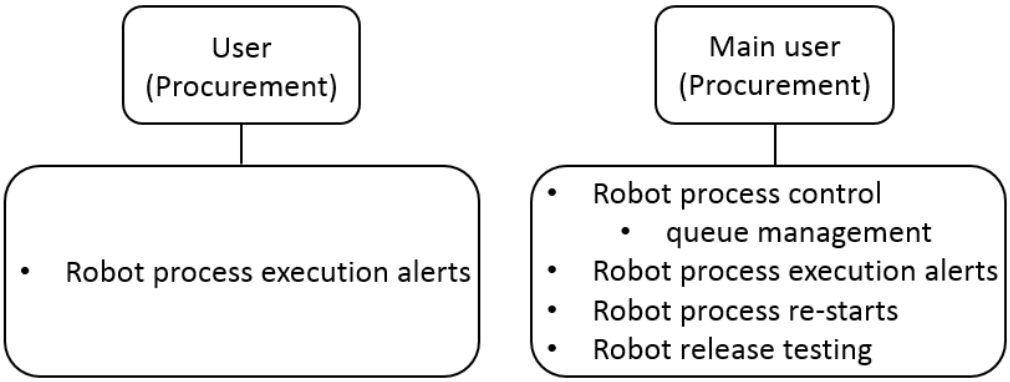

Figure 23. Current RPA roles in procurement.

RPA IT capability is divided to internal IT personnel and third party service providers, meaning that 24/7 monitoring of RPA processes, applications, and infra is outsourced to a specific service provider. RPA process maintenance is currently provided by third party provider and in-house IT. RPA process maintenance is a crucial role in the automation projects, since it is known that RPA processes experience issues after implementation and processes are often changed after roll-out to be more efficient and effective. Applications which are utilized in the RPA process can be also updated or have changes in the interface. If changes occur in the applications or processes, all the process steps of the robot can be recoded in video format or displayed in a process description document (PDD). Documenting carefully the process minimizes the needed resources for recoding the robot, if changes occur. According to the interviews some RPA processes, small modifications are handled by the third party service provider. However, if the change includes a modification which requires process knowledge, a viewpoint is needed from the process owner.

5.6 Suggested governance model for RPA in procurement

Lacity et al., (2015) state that RPA governance model should be similar to the IT governance model, since RPA can be labelled as a lightweight IT application. However, as interviewees and current literature have stated, an automated process requires constant surveillance and maintenance. Hence, the process owner of the automated process should possess a basic knowledge of RPAs capability, in case of a business exceptions occur. Business exception in

RPA processes stand for an error occurred in the process or a case in which the robot is not capable of handling the task. Therefore, personnel responsible for specific RPA process within procurement function should be able to consult and guide third party service provider, if RPA process requires maintenance. The third party providing 24/7 support and maintenance for RPA processes, is responsible for ensuring that the RPA process is functioning as agreed, however the service provider is often lacking the broad view of the whole process. Therefore, process owner should be able to assist and guide the service provider, if RPA processes require changes or maintenance. In addition, the process owner should be able to operate the process manually, if RPA is not functioning as designed.

Figure 24 suggest a model where RPA capability would be still located centrally within IT. It would provide support and consult the business units, where processes are automated with RPA.

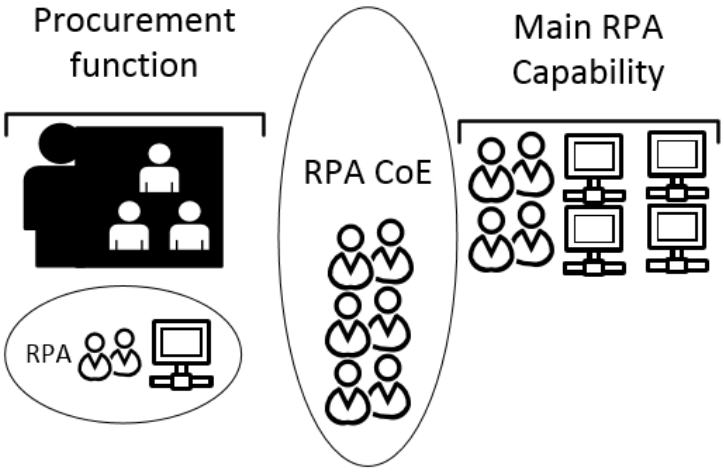

Figure 24. Suggested roles for RPA in case company.

Additionally, Figure 24 suggests how roles within IT department (Main RPA Capability), Centre of Excellence team (RPA CoE), and procurement function should be divided within the case company. Currently the case company does not have a Centre of Excellence RPA team which would share ideas, components and discuss if an identified process for automation is suitable for RPA or not. RPA CoE team should consist of RPA professionals from all business units within the case company. Suggestion is to have the main RPA capability within the in-house IT department and to have one or two persons within corporate procurement.

Procurement specific RPA persons should be capable of handling RPA related matters regarding development of new robots and maintaining the robots in production.

5.7 Framework for utilizing RPA in procurement processes

Figure 25 below proposes a framework for identifying procurement related processes which can be automated with RPA.

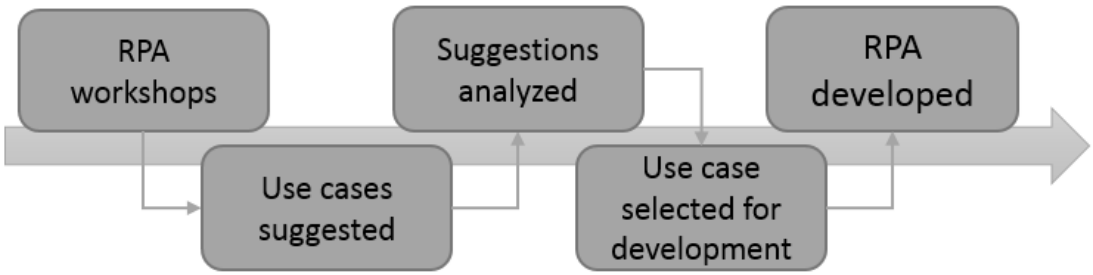

Figure 25. Framework for identifying processes for automation.

RPA workshops, meetings, and individual meetings with procurement personnel should be held continuously, in order to increase the knowledge of RPA capability to the case company's procurement personnel. RPA workshops have been held during data gathering phase for this thesis and the suggestion is to continue RPA related workshops with even larger audience. In the workshops the nature of the transactional processes suitable for RPA should be empathized, because during the data gathering phase, interviewees suggested processes to be automated, which is not possible with current RPA technology.

As a part of this thesis, a SharePoint site for suggestions was created for personnel to insert potential use cases for RPA development. In the workshops and meetings, where RPA is advertised, the channel for suggestions is introduced. Personnel from case company's procurement department are encouraged to reflect RPAs capabilities to their daily work and suggest potential use cases and processes, which could be automated with RPA.

The following information regarding the potential automated process is asked, when a process or tasks is suggested in the SharePoint form:

- Name of the process / idea
- Process related questions:
    - Short description of the task/process
    - Is the process rule based? (Yes/No)
    - Can anyone with no previous experience perform the task based on instructions?
    - Is all information in the process in digital and structured from (Yes/No)
    - Decisions in the process are based on unambiguous rules (Yes/No)
- List of applications used in the process.
- Contact person

As a third step, proposed ideas are processed by a procurement RPA main user, assisted by RPA Centre of Excellence (CoE) team would be able to assist the main user, if applications in the automated processes have been previously used in similar processes within other business units. In addition, CoE should inform if, there are already developed components in the library, which could be utilized during the RPA development phase. Figure 10 represent a model, where components are re-used in the Centre of Excellence governance model. Furthermore, Lacity et al., (2015) state, re-using developed components can reduce development cost of robots significantly.

After investigating the possibility for automation, RPA main user will introduce the suggested process to a procurement management. The procurement management decide whether the process should be automated or not, based on the benefits calculated and weighed before. As stated in the literature review and in the interviews by RPA professional, each RPA project and process differ from each other. Therefore, KPIs and benefits of automating a certain process or task should weighed and agreed upon separately each time.

KPIs depending on the process which is automated can be any of the following; cost reduction, quality control or scalability. Calculating cost reduction for KPI purposes according to the interviews is not easy, because FTE reduction in short term with RPA is not often possible. However, if RPA is scaled widely and there are multiple processes automated, it can prevent an organization from hiring more FTEs in the long-run. Although, RPA processes require

process owners and personnel who are capable of maintaining the robots. Quality control can be selected for a process or task as a KPI, which tend have high tendency percentage of human error, even though the transactional numbers for the robot would be low. Quality control is especially suitable justification for automation, if there is a chance for human to make minor mistakes, which are difficult and difficult to spot later in the process. Scalability can be chosen as a KPI, if the process or task is seen at first quite small, but there is potential to scale it much larger in the future, justifying cost control and quality over time. The Centre of Excellence team could potentially assist KPI defining process.

Even though a certain process or task, which has been suggested by a procurement professional is not chosen for RPA development, personnel should still be encouraged to suggest processes or individual tasks, which require further development. The list of processes in the SharePoint, can be used to sort larger areas of processes which could be looked as a whole and investigate what other options or tools are available for minimizing and simplifying work from repetitive nature of tasks.

5.7.1 RACI-matrix for RPA-projects

RACI-matrix is a widely used matrix in project management, which describes and states the roles and responsible persons cross functionally. RACI is an abbreviation of Responsible, Accountable, Consulted, and Informed (Lehtimäki, 2006).

- *R (Responsible)* - Responsible person selected for performing the tasks or assist others to perform the tasks, if needed. In smaller projects responsible person can be also accountable for the completion.
- *A (Accountable)* - Only one person to be given responsibility for answering for the completion of selected tasks.
- *C (Consulted)* - Persons who act as experts, providing knowledge for subject matter. This role can have multiple personnel acting as a consultant if required.
- *I (Informed)* - Persons who are kept updated on status and completion of different statuses. Informed personnel are not responsible for completion of tasks.

(Lehtimäki, 2006; Costello, 2012).

	Procurement main user	Procurement user	Process owner / suggester	Procurement management	IT – department (in-house)	* External RPA developer	RPA run management
Automation trainings	R	CI	I	A	CI	-	-
Identify potential use cases	R	CI	R	A	CI	C	-
Select use case and define KPIs	R	I	I	A	CI	-	-
Define process	R	C	RA	CI	CI	C	C
Create PDD	RA	C	RC	I	I	RC	RC
Develop RPA	C	C	I	I	RA	RC	RC
Test & Deploy	RI	I	CI	I	RA	RC	RC
Maintenance	RI	I	I	I	A	RC	RC

R= *Responsible*
A= *Accountable*
C= *Consulted*
I = *Informed*

Figure 26. RPA RACI-matrix for procurement.

Figure 26 demonstrates the RACI-matrix for the procurement department, internal IT-department and external RPA service provider consisting of RPA developer and run management, who are responsible for day-to-day operations of automated processes within the case company. Eight steps displayed on the left column in the figure represent a time flow of the process, starting from RPA and automation trainings within the procurement organization to maintaining an automated robotic process. The dashed line between "IT-department" and "RPA developer" represent the divide between in-house tasks and outsourced 3rd party service provider. Whereas, the dash line between "Create PDD" and "Deploy RPA" represent a stage in the automating process, where the RPA deployment can be easily cancelled without much capital invested yet.

One person within the corporate procurement organization is nominated as a main user, who is responsible for organizing RPA trainings with different procurement teams and educate and remind the personnel regarding RPAs capabilities. This person is responsible for driving the automation projects forward within procurement organization. Whereas, procurement user is a basic user, whose own tasks are reliant on the performance of the automated processes. This person can also be an back-office employee, who is responsible for the process to be running.

In other words, working with the robot, in order to complete the task. Process owners or personnel who suggest new ideas are procurement personnel, who can submit ideas through a SharePoint channel and assist, if a process is selected to be develop with RPA. Process owners are marked as accountable in defining the process step, since they are experts of the process.

Procurement management consist of management personnel and process experts who are accountable for selecting use cases for development and selecting KPIs for each robot. The main user is responsible for filtering suggested ideas and presenting them to the board, with KPIs prepared. In-house IT is marked to be mostly in the informed and consulted role until the robot is developed. RPA specific IT-personnel should be consulted when a process is identified, in order to receive their input of the desired outcome. The role of in-house IT increases significantly, when RPA process is decided to be developed. They have an important role in the development, test and deploy phases. In addition, internal IT processes, which are not listed in the RACI regarding RPA implementation should be done by IT-personnel, such as; creating process specific identification code for ticketing and cost allocation purposes. RPA developer and run management are third party service providers. Their role is not highly important, until the process is in the developing phase. Creating process definition document (PDD) both parties are marked as responsible and consulted. As stated before, crafting the PDD document is highly important step, when thinking of the whole life-cycle of the process, therefore RPA professionals should be consulted to when crafting the document. Developing the RPA is the phase, when third party service providers should be employed fully together with in-house IT. Testing and deploying can be argued to be one of the most important steps in the process. According to the interviews, the robot should be tested and pushed to the limits, in order to find the weak spots before putting the robot in-production. Flaws, failures and so-called broken steps in the process can be easily fixed in the testing phase, whereas, when in production, these errors are more costly and time consuming to fix.

As stated before, Centre of Excellence team should be established for RPA in the case company. However, CoE is not represented in the RACI, since the process of identifying and deploying robots is represented from procurement department point of view. CoE should still be consulted in each steps, since in theory the CoE team should consist of several RPA professionals.

5.8 Identified areas of need for automation at the case company

As a part of this master's thesis, the aim was to identify possible areas where RPA could be utilized further at the case company, in order to develop supplier data management. 24 procurement professionals were interviewed in semi-structured RPA workshops or individual interviews. In total 49 cases were identified in the interviews, which interviewees identified as a potential process or task for RPA development or needing further development with automation. However, number of the use cases could not be automated with RPA technology. Due to the complexity of processes, unstable external applications which are required in the processes, and the need for human intervention.

Table 5 below demonstrates the main categories and sub-categories mapped in the interviews and workshops. All of the 49 identified cases are narrowed down to the processes listed in the table. It is important to highlight that the sub-processes listed in the table are not all possible to be automated with RPA technology, however the high manual labor was identified in these processes and further development could be done in the processes. The sub-processes are placed on the x- and y-axis in Figure 27 based on the characteristics of the process, demonstrating the suitability for RPA piloting.

Category	Sub-process	Short description of need
Category Management	Analyze Spend	Consolidating invoice data, tracking overall cost against contract and providing overview of category spend
Category Management	Analyze and create category strategy	Assisting category strategy forming by analyzing supplier data
Contracting	Manage contract compliance	Check payment and delivery terms, invoice checking, certificate up keeping.
Contracting	Manage contract renewal and termination	Checking certificates and reminding to suppliers of renewal

Contracting	Register and archive contract	Metadata reading and archiving documents
Supplier relationship management	Manage supplier performance	Tracking service levels and gathering info regarding suppliers actions
Supplier relationship management	Take actions to improve performance	Informing personnel if supplier is needed to be contacted
Supplier relationship management	Collect and analyze supplier related data	Gathering info on performance, purchase volumes, orders and collecting info for segmenting purposes.
Supplier relationship management	Segmenting suppliers	Assisting supplier segmentation
Supplier relationship management	Manage supplier performance	Conducting mini-audits or assisting performance through data management
Sourcing	Qualify suppliers	Conducting a manual qualification for specific 50-70 suppliers between certain periods
Sourcing	Evaluate RFQs and suppliers	Gathering info on suppliers and checking certain certificates available online
Contracting	Sign contract	Assisting contract signing

Table 5. Overview of identified procurement processes for potential RPA development within case company.

5.8.1 Identified category management processes

In the category management related processes four use cases for supplier data management were identified by six procurement professionals. Currently, manual labor is intensive in the process of generating a structured category specific report of spend overview and used suppliers for stakeholders. These reports are imported from the spend analysis tool quarterly, displaying category specific suppliers, spend by country, and by business units. These reports are generated by five interviewees in several categories on at least quarterly basis. Hence, category specific spend reporting robot should be developed in the case company based on the interviews. In addition, in category management processes, interviewees highlighted that there is a need for developing the processes through automation in category and supplier specific spend tracking. Currently, invoices from specific categories and suppliers are checked and analyzed manually in order to achieve a broad picture of overall costs, such as installation costs, materials, travel costs, and other relevant costs which supplier charge. Furthermore, invoice reviewing process was highlighted in which RPA could be utilized to check if delivery terms, payment terms and other relevant information match the contract.

The process of managing contract compliance was identified as a field, which could be potentially developed with RPA. As mentioned, delivery terms and payment terms could be checked with robotics, since interviewees emphasized that currently it is time consuming and errors do occur. It was highlighted by eight interviewees, that the processes are lacking transparency especially in the payment term matching, freight compliance, and compering spend to contracts and purchase orders. In the interviews it was emphasized that these processes require development in the future and robotics could be one option, which requires further investigation. In addition, managing contract renewal and termination was identified as an area which RPA could be utilized in. RPA was suggested to check supplier's certificates by expiration dates and requested new and updated certificates from suppliers if required. Reviewing contract metadata and archiving contracts was identified as a need to investigate potential of automation further. Currently, metadata of contracts are inserted manually to contract management tools. Sadly, RPA without AI functions is not capable of reading and inserting metadata. However, other tools could be implemented in contracting processes to ease archiving of contracts. In the sourcing processes, supplier credit check and qualification process was highlighted as requiring need to be further developed with automation. In the fuel

purchasing department, a credit check for all suppliers are conducted on a regular basis and the process is highly manual. Automating a part of credit check is a process could be scaled throughout the case company, which would provide efficiency and savings to several business units.

5.8.2 Identified SRM processes

In supplier relationship management related processes, the areas which were identified as needing further development were; need for automation solutions regarding the management of supplier performance and taking actions to improve the performance of the supply base. Within certain businesses, supplier performance requires manual labor of reviewing delivery times, costs, quality and service levels. Nonetheless, these issues could partially be improved by using a proper ERP system and SRM tool, which would generate reports on supplier performance. In addition, auditing suppliers and claim management can be seen as a part of managing supplier performance and need for improving those processes were mentioned in the interviews. Tools which are required for such processes are; spend analysis tool, supplier data management tool, which is used for storing supplier information on audits, purchasing categories or certificates and supplier key performance indications (KPI) tools. RPA could potentially be utilized in these tasks, since all of the applications required for the process are internal and operate in a stable environment. In addition, segmenting suppliers was also identified as an area needing for automation. Additionally, segmenting suppliers is an iterative process, which requires continuously actions for developing with the category strategy and monitoring the performance of the supply base. In this process, RPA could potentially be utilized which would ease the manual labor of accessing multiple systems for data gathering purposes. In one workshop it was pointed out by several people that, supplier certificates are maintained manually, which is a labor intensive task. In the RFx phase, certificates are checked and marked to the systems, however if certificates expire, checking renewal of certificates is often done in the next RFx phase. However, as stated in the interview, some certificates do expire before the contract, making the company vulnerable in an audit. Therefore, the process of requesting renewed certificates from suppliers should be done either with RPA or improving the process some other way. Overall, in SRM processes there are potential to develop the processes through RPA or processes in general. As stated, that the overall spend of the case

company is approximately three billion euros, which means that if supply base could be improved even little, the cost of implementing RPA could be easily justified.

In addition, tasks in purchase-to-pay processes were identified as potentially needing development through RPA and other automation tools. For instance, approving orders in ERP and purchasing systems, reviewing and reminding on shipment statuses, and maintaining the spare parts inventory labels. Labels in the inventory are used for ordering, but in the interviews it was stated that the library in the ordering system has a significant number of labels in several languages which are not used. Also, the corporate procurement is responsible for handling the company credit card procedures, which requires a power of attorney from each separate company the person has purchasing authority in. It was emphasized that handling the power of attorneys could be supported with automation, since it requires repetitive and manual labor.

5.8.3 Process Suitability for RPA piloting

Figure 27 displays the sub-processes of category management, sourcing, contracting, and supplier relationship management placed on a x and y axis on the nature of the process and its suitability to RPA piloting. In the interviews, different processes were suggested for RPA and the suggestions are narrowed down to the 13 sub-categories shown in the figure.

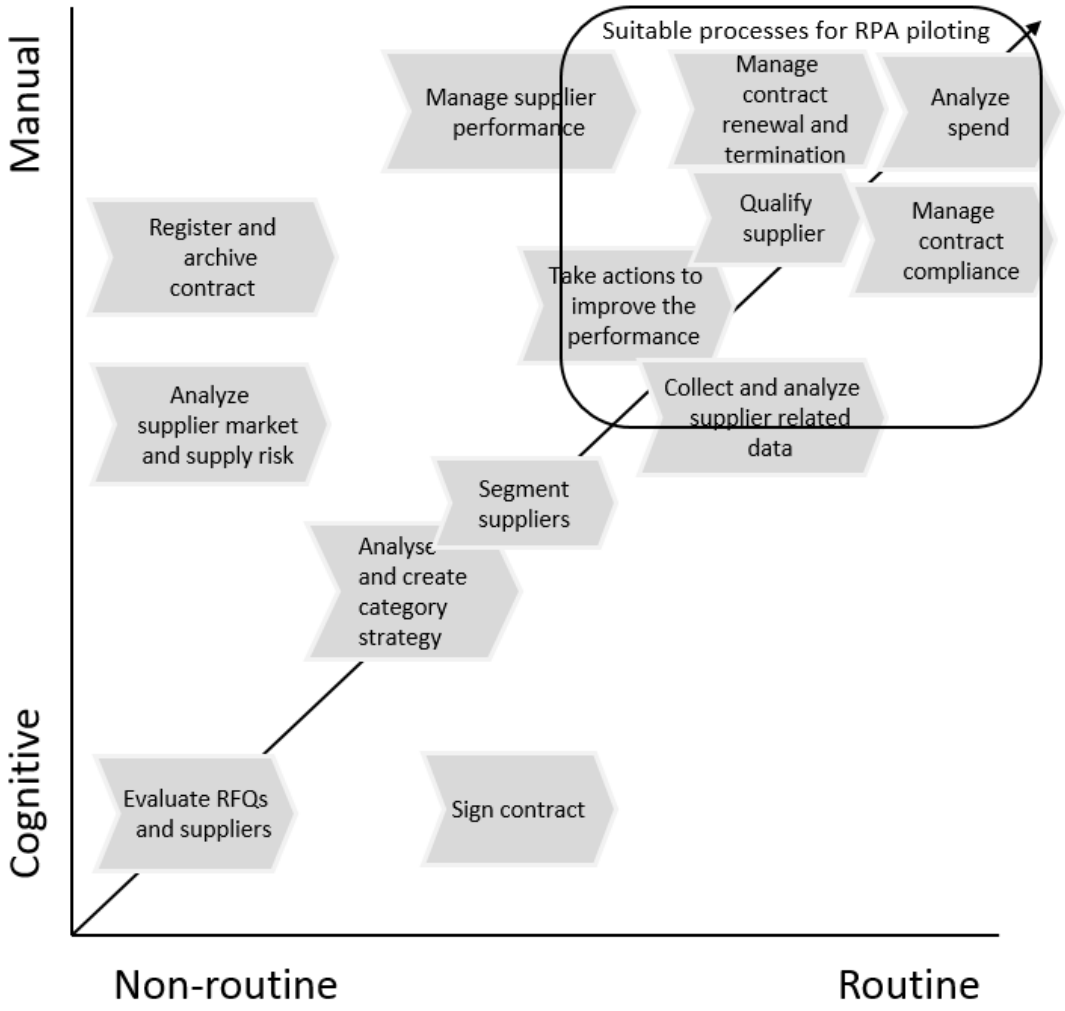

Figure 27. Mapped suitable processes for RPA within case company.

Analyze spend, manage contract compliance, manage contract renewal and termination, qualify suppliers, take actions to improve supplier performance, and collect and analyze supplier related data were mapped as suitable processes for RPA piloting based on the data gathered in the interviews and study on case company's procurement processes. These processes, could potentially be broken down into smaller tasks where RPA could potentially be utilized. The aim should not be developing a RPA to end-to-end processes. As stated before, RPA functions well, when it is built to work along humans. As an example, spend analysis was emphasized as an area in which, quarterly reports are needed on a category specific level and the process follows a repetitive and rules-based instructions. A simple RPA could be developed, which would generate category specific reports from the spend analysis tool, freeing up capacity from

several purchasing managers who are required to report category specific spending to stakeholders.

Register and archive contracts was identified as a highly manual task in the interviews. However, currently the process is not suitable for RPA since the process consist of inserting contract metadata, including several mandatory fields in the contract management tool. Archiving contracts could be develop with smart data capture and cognitive technologies, which is capable of understanding typewritten content, analyze data and act based on self-learning and inductive reasoning. Analyzing supplier market and supply risk was also identified as an area for development. However, RPA is not capable of handling the process. The process is highly cognitive and non-routine, where information is gathered from several external and internal sources to be analyzed. Although, RPA could be implemented for a small portion of this process, such as; gathering financial and claim related materials from internal applications for procurement managers. Similarly, in analyzing and creating category strategy is placed in the figure and RPA could be partially be implemented in a simple part of the process, if required. Signing a contact and evaluate RFQs in a RFx process was placed in an area where RPA is not seen as a tool which would provide value in the process.

6 Discussion and Conclusion

This chapter discusses and evaluates the case study and discusses the findings. Firstly, the findings are reviewed and discussed in detail, including findings from the current scientific literature and research conducted in the case company. Secondly the research questions are answered to which is followed by theoretical implications and conclusion of the study. Last, suggestions for further research are discussed. The focus of this research was to study the capability of Robotic Process Automation (RPA) in the procurement processes of the case company and especially how supplier data management can be developed and improved through RPA.

RPA does not solve the problems regarding automation of all unwanted back-office tasks and other manual tasks in the middle and front office. Implementation of RPA does not necessarily lead to cost reduction of FTEs. According to studies conducted, companies which have a large number of automated processes can offer more challenging tasks to the employees. In addition, the automated processes still require development and maintenance, which require process owners to understand the business logic behind the RPA (Lacity et al., 2015).

Even though, a process is not suitable for RPA, the process can still be re-engineered to be more cost effective, standardized, and harmonized. In fact, Lacity et al., (2016a) emphasize that the re-engineering should be part of the RPA implementation process. All processes should be re-engineered before RPA is piloted in the process and when identifying processes for RPA, the process still can be re-designed without RPA. Furthermore, all possible processes which require re-engineering should be listed and documented for further reference. Even though a process cannot be automated with RPA, the process can still be developed in the future with cognitive automation, which can handle more unstructured tasks. Hence, all suitable processes which could be developed with automation should be documented for further reference.

6.1 Answering the Research Questions

- ***How can supplier data management and procurement processes be supported and developed through implementation of RPA?***

RPA is fully capable to support processes regarding supplier data management and other procurement processes. The most suitable processes for RPA are processes which have attributes such as unambiguous rules, limited exception handling, high predictable volumes, stable working environment, access to multiple systems, and known costs (Lacity et al., 2015c; Kääriäinen et al., 2018). Most importantly, all information in the process has to be in digital and machine readable in order to be automated.

In the empirical section of this thesis the case company's procurement processes, which could be developed through RPA, were mapped and identified. The identified use cases, which were pointed out in the RPA workshops and individual interviews were categorized by the case company's procurement processes and sub-process categories. The main categories identified for RPA implementation were:

- category management,
- contracting,
- supplier relationship management,
- sourcing, and
- contracting.

The sub-processes were evaluated based on the nature of the process and its suitability for RPA piloting. Figure 27 represents the identified processes based on the characteristics of the process, which were cognitive, manual, non-routine and routine.

RPA without cognitive and smart data capture and engagement technologies is not capable of handling processes which require cognitive and human like thinking and are non-routine like. Hence, the case company's procurement processes were analyzed and placed on a y- and x-axis based on the cognitive and non-routine characteristics of the process. Processes such as

managing contract compliance, analyzing spend, qualifying suppliers, managing contract renewal and termination could potentially be developed through RPA. However, automating end-to-end process can be challenging for RPA. Therefore, parts of these processes could potentially be supported with RPA technology. For example, spend analysis might not be automate fully with RPA, but for instance automatic category specific reporting could be automated.

- ***How are the benefits of RPA assessed and RPA projects governed?***

Both in the literature review and findings sections, it was highlighted that Centre of Excellence RPA (RPA CoE), should be established within the organization to support businesses and with the help of IT in current and future RPA projects. By utilizing the provided framework for identifying and developing RPA processes within the procurement function, the CoE RPA team should support business functions in the RPA projects.

Each RPA process differs and therefore the benefits of automating a certain process should be assessed individually in the process assessment and business proposal phase. Process specific KPIs can differ from cost efficiency, error minimizing, customer satisfaction or any metric which is suitable for measuring the effectiveness of automating that specific process. In some cases, scalability can also be considered as a benefit or a reason to automate a process, even though other KPIs would indicate that the process should not be automated. For instance, the findings indicated that some processes, which could be automated within the procurement could also benefit the legal department. As an example, managing contract compliance could also be scaled to the legal processes of the case company and other functions within the case company. Overall, interviewees pointed out, that each RPA project should start from identifying what is the desired outcome from the automation. As mentioned, re-engineering a process can easily improve a process well enough without having to automate the end-to-end process.

One of the main questions in this research was the governance structure of RPA projects. Hence, the RACI-model, which was demonstrated in the findings section, was produced. The model represents how different tasks should be divided between procurement, IT, and external RPA personnel. The model represents how the procurement main user should contribute towards

educating the procurement department on how RPA can be utilized in the processes and encourage them to suggest use cases to be developed with the RPA technology. The RACI also displays how procurement management should be accountable for deciding on the KPIs for each project, which are suggested by the procurement main user. In addition, the IT-department should be closely involved from identifying the process to maintaining it. External RPA developers and run management is listed in RACI but they are not held accountable for any of the processes. They are responsible for developing, testing, deploying, and maintaining the robots since there is no capability to do it in-house within the procurement department.

Each automated process should have individual KPIs established before starting the automation process. KPIs and benefit measuring should be based on the desired outcome of the automated process. For instance, if the desired outcome of a robot is to minimize errors which is currently caused by humans, the KPI can be errors occurred in the process or time saved in the process due to low quantity of errors. Also, if there is a potential to scale up or down by demand the transactions of the robot, KPI can even be ignored, since one of the main features of RPA is its scalability to perform large number of transactions.

- ***How to organize RPA projects and roles within procurement organization?***

Organizing and governing RPA projects within the procurement organization at the case company is highly important in order to successfully identify and develop RPA processes. In the future, similar RPA workshops as during data gathering phase should be organized for all procurement teams in order to increase the knowledge of RPA capability and to identify potential use cases for RPA development. The workshops should be organized by one RPA main user taking responsibility for educating the capabilities of current automating tools. Additionally, procurement personnel should be encouraged to suggest suitable processes or use-cases which could potentially be developed with RPA.

Advocating the potential of automation tools for further reference is essential, since it eases the process of identifying suitable use cases when automation tools improve over time. Furthermore, even though RPA is not capable of improving a certain process today, future tools which have cognitive and smart data capture and engagement technologies embedded can be used to automate tasks which are more in knowledge work nature rather than transactional work

suitable for RPA. At this time, personnel should reflect their daily tasks to the capabilities of RPA and suggested use cases which are not possible to be develop with RPA should be documented for further reference.

The RACI-matrix demonstrates the tasks and roles within the procurement organization. The procurement main user is the main person responsible for RPA trainings and acts as an owner of RPA tools within the corporate procurement. The main user should be responsible for driving the automation projects forward within procurement organization. The procurement person is a basic user, whose own tasks are reliant on the performance of the automated processes. This person can also be an back-office employee who is responsible for the process to be running. In other words he or she would be working with the robot in order to complete the task. The basic user should not be responsible or accountable for any of the steps in the lifecycle of RPA process. However, basic user should inform RPA developers and third party service providers if a robot requires changes in the business logic for instance, since they work daily with the robot and are most likely to notice areas of development in an in-production robot. Procurement management should be accountable for ensuring that trainings are held by the main user and use cases are identified with defined KPIs.

6.2 Theoretical and Research Implications

The current scientific literature discussing RPA is relatively new and is not as comprehensive as a researcher could wish. In fact, the existing publications are mainly published by few researchers and the scientific papers mainly discuss RPA as technology highlighting few success stories, where significant savings have been achieved with RPA (Lacity et al., 2015c). Furthermore, it can be read between the lines that some articles published regarding benefits of RPA are sponsored by RPA service provider Blue Prism.

In addition, the current literature is lacking a discussion regarding robots' user rights to applications which the automated processes require. The user rights discussion is bypassed in the articles and white papers used in the literature review, besides legal and privacy risks of robotic user IDs being discussed by Rutaganda et al., (2017) and Kääräinen et al., (2018). In the interviews, it was highlighted that it can be quite time consuming and difficult to manage

the user rights to the robot accounts, since access rights have to be confirmed by several system managers.

Furthermore, it was stated in the interviews that some applications do not allow robots to operate in their applications. For instance, the criteria for invoicing for some application can be license based and if a robot is capable of handling transactions 24/7/365 lowering the need of licenses required for the organization. Therefore, some applications restrict the usage of robots by contract clause or having other sorts of restrictions preventing the usage. This matter was not mentioned in the current literature as a weakness of RPA.

Since this study was conducted as a case study and the goal was to identify possible procurement processes of the case company which could be developed and improved by utilizing RPA. The scope was in specific procurement processes and the governance model was drafted based on the case company's way of conducting business. Therefore, the research is limited to the procurement processes of a specific company and the results might not apply to similar procurement processes used in other companies. In addition, the data for research was mainly gathered from interviews and workshops from managerial positions, who do not conduct operational purchases. Therefore, use cases in operational purchase were not identified for this study.

6.3 Conclusion

RPA is a software robot operating like a human on commands based rules. It functions well in repetitive and rules based processes with no changes occurring in the process. RPA is a lightweight IT software, which interacts on the presentation layer of applications making RPA flexible and easy to implement software in the existing processes. RPA can minimize human errors and perform certain manual tasks faster than human would allowing personnel who previously performed the task to focus on more strategic and challenging tasks (Asatiani et al., 2016; Alberth et al., 2017). However, unlike what can be read from the literature, RPA is not the answer for automating all back-office related tasks and previously outsourced non-core processes.

RPA can be used for developing and improving procurement processes and supplier data management. RPA is especially suitable for processes which require reporting, updating and reviewing information and data. The metrics for measuring the benefits should be determined case-by-case. Hence, it is crucial that the desired outcome is known at the early stages of the project. It can be argued that RPA can be really complicated to implement for end-to-end processes therefore processes should be broken down into several sub-processes in order to identify if RPA could potentially be utilized.

In order to achieve more through RPA, the case company should establish as cross-functional Centre of Excellence RPA team, which would assist in identifying and developing use cases for RPA. The main RPA capability should remain in the IT department and the procurement function should have one main user who is responsible for RPA related tasks. The procurement function should also have basic capabilities regarding RPA development such as creating the process description document (PDD). The provided framework suggests that the main user within the corporate procurement should continue to arrange RPA workshops in order to spread knowledge regarding automation technologies available and to identify possible use cases to be developed with RPA. The suggested use cases should be documented in a SharePoint site. The suggested use cases should be mapped according to the case company's procurement processes in order to identify the areas which have a large number of manual processes. The main user in the procurement function should suggest use cases with pre-defined KPIs to procurement management who are accountable for selecting use cases for RPA piloting.

Overall, RPA is a light automating software which can be utilized in manual repetitive, rules based and no exception handling required processes in which all data is in digital format. RPA is most suitable for sub processes which uses stable internal applications. The processes should be highly routine like and manual with no requirements for human like thinking.

6.4 Suggestions for Further Research

Conclusions and findings of this case study apply only in the context of this case study. Findings are approached from the case company's perspective and might not be scalable to procurement processes at other organizations. Also, it is important to note that some factors

could have been ignored or have not been identified in the research, which could have impacted the findings, such as benchmarking on other large company's procurement department.

RPA is a relatively new technology and scientific literature discussing RPA is published by few individuals dating only few years back. Hence, further research could be conducted on RPA in different sectors and processes than presented in the current literature. Furthermore, RPA as a technology is developing on a rapid phase and cognitive functions are already being tested and added to RPA platforms. Therefore, for further research, the capabilities of RPA with cognitive and machine learning functions could be studied.

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Appendices

Appendix 1. Interview schedule

Appendix 2. RPA professional interview structure

Appendix 3. Purchasing manager interview structure

Appendix 1 - Interview schedule

Date	Title of interviewee(s)	Interview structure	Duration
14.10.	RPA Development manager	RPA professional	1 hour
19.11.	Purchasing managers	Purchasing managers	1 hour
21.11.	Purchasing manager	Purchasing managers	30 minutes
22.11.	Supply chain analyst	Purchasing managers	1 hour
26.11	Category manager	Purchasing managers	1 hour
26.11	Procurement manager	Purchasing managers	30 minutes
4.12.	Manager, Fuel supply	Purchasing managers	1 hour
10.12	Operational purchasers at power plant	Purchasing managers	1 hour
10.12	Category management team	Purchasing managers	1 hour
14.12	Indirect procurement team	Purchasing managers	1,5 hours

Appendix 2 - RPA professional interview structure

Background info

- Name and Position?
- How long have you worked in your current position?

Question related to RPA projects

- Could you shortly describe what RPA projects you have been involved with?
- Which business unit RPA was implemented in?
- What have you learned from projects?
- What would you do differently?
- Has there been any barriers for development? (people / data quality)
- How was the process identified for RPA implementation?
- How did the project go from pilot to production?
    - Did you re-use 'components' from previous robots?
    - How long the whole process took (from piloting to production)?
    - What was the estimate cost of implementation?
- What was IT-departments role throughout the process?
- How is the robot governed (in-production)?
    - Do you have any KPIs for robots in production?
    - What is business units role?
    - IT role?
    - Service provider role
- Have you driven down any robots yet?
    - If yes, what has there been common features and reasons for it?
- Benefits
- What problems have you occurred?
- Lessons learned in project management and governance of RPA projects?

Appendix 3 - Purchasing manager interview structure

Background info

- Name and position?
- How long have you worked in your current position?

Question related to Procurement and RPA potential

- In which procurement process you tend do manual, rules-based and repetitive tasks?

  (case company's procurement processes displayed)
- Are identified processes?
  - Rule based?
  - Can anyone with no previous experience perform the task based on instructions?
  - Is all information in the process in digital and structured from?
  - Decisions in the process are based on unambiguous rules (Yes/No)
  - What applications are used in the processes?
  - Do mistakes/errors by humans cause expenses in other processes than this?
  - Would 24/7 service ease the process / improve service?
- How do you categorize / segment suppliers? (for category managers)
  - Where do you get the information from?
  - External or internal sources?