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Master's Thesis

Robotic process automation as an automation tool for improving purchasing processes – Case study

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ABSTRACT

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The aim of this thesis is to deepen the understanding of new automation technology called robotic process automation (RPA). The study focuses on the opportunities, benefits, and challenges of RPA, and how it differs from traditional back-end system automation. The focus of the research is on supply management, especially the automation of purchasing processes. Previous literature regarding the use of RPA in the field of procurement is lacking, so this study can be seen very needed. However, earlier research has shown that the purchase process has a lot of potential for automation, as well as the fact that RPA already has a place to enhance business operations.

For the empirical research, interviews were conducted with the case company regarding the recent RPA adoptions. Also, RPA expert interviews were conducted to bring deeper insights into this technology. The study showed that companies are currently very interested in the use of RPA in supply management and there are many possibilities for RPA in the area of operative purchasing. The study also highlighted several achieved benefits and challenges faced in the RPA projects. The study also found answers to the fact that what factors should be considered when selecting the correct automation solution for the process. When answering the research questions, it was clearly evident that the previous theory supported the findings of this work, but new phenomena were also raised in this study with regard to RPA.

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Tämän tutkimuksen tavoitteena on syventää ymmärrystä suhteellisen uudesta automaatioteknologiasta nimeltään ohjelmistorobotiikka (RPA). Tutkimus keskittyy ohjelmistorobotiikan mahdollisuuksiin, sen tuomiin hyötyihin, kohdattuihin haasteisiin sekä miten se eroaa perinteisesti käytetystä järjestelmäautomaatiosta. Tutkimuksen keskiössä on hankintatoimi ja erityisesti ostoprosessien automatisointi. Aikaisempaa kirjallisuutta liittyen ohjelmistorobotiikan hyödyntämiseen hankintatoimen alueella ei juurikaan ole, joten tutkimus voidaan nähdä hyvinkin tarpeelliseksi. Aikaisemmat tutkimukset ovat kuitenkin osoittaneet, että ostoprosesseista löytyy paljon mahdollisuuksia automaatiolle sekä sen, että ohjelmistorobotiikalla on jo paikkansa yritysten toimintojen tehostamisessa.

Empiriaa varten suoritettiin haastatteluita case-yrityksessä liittyen RPA projekteihin sekä RPA-asiantuntijahaastatteluita tuomaan syvällisempiä näkemyksiä tästä teknologiasta. Tutkimus osoitti, että yritykset ovat tällä hetkellä hyvin kiinnostuneita RPA:n hyödyntämisestä hankintatoimessa ja erityisesti operatiivisen ostotoiminnan alueella on paljon mahdollisuuksia RPA:lle. Tutkimus toi myös esille lukuisia RPA projekteista saavutettuja hyötyjä ja kohdattuja haasteita. Tutkimuksen avulla löydettiin myös vastauksia siihen, että mitä tekijöitä pitäisi ottaa huomioon valittaessa oikeaa automaatioteknologiaa prosessille. Tutkimuskysymyksiin vastattaessa oli selvästi nähtävillä, että aikaisempi teoria tuki tässä työssä tehtyjä löydöksiä, mutta tässä tutkimuksessa esille tuli myös uusia ilmiöitä liittyen RPA:han

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Lastly, I would like to express my gratitude to my family for their support during my entire studies, from elementary school to university. Although it is time to move from school to working life, learning does not end there as it continues throughout life.

In Helsinki, 27.5.2019
Juho Muurinen

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1 INTRODUCTION

The role of supply management is changing and developing at a rapid pace. Supply management used to be only a supportive function, which main task was to provide raw materials or finished goods to the company. However, today it is taking a more and more strategic role within the enterprise. In many organizations, the low-hanging fruits have already been picked by procurement function and new value sources need to be searched. Business process automation is one potential source of value that can increase the productivity of supply management and create a competitive advantage for the firm.

Hughes and Ertel (2016) state that the traditional routine-based procurement activities such as purchase order processing and market analysis are increasingly being automated or outsourced. They defined a new “procurement paradigm” which idea is that the organizations should use their procurement in a more innovative and strategic way. The focus should be on maximizing the value from suppliers by leveraging assets, capabilities and capacities from suppliers to drive innovation, actively support revenue growth and deliver competitive advantage. This means that companies should increase the level of automation for operational activities in order to concentrate on strategic activities and actions.

The role of business process automation is only increasing. It is not a completely new thing, but new emerging technologies have raised a lot of new questions regarding it. First of all, one should find out which form of automation is best suited to the process and the purposes of the company. To answer it, different forms of automation should be examined and compared. These issues are most likely in the minds of many organizations, but there are very few answers existing. This research focuses on explaining and comparing traditional process automation; back-end system automation and new emerging process automation; robotic process automation.

Manufacturing industries have used industrial robots in their operations already several decades. Recently they have started moving into the back office of many

companies around the world. Robotic process automation (RPA) is one of the most recent technologies that is already shaping the way we work. Studies show that functional executives expect that mainstream adoption of RPA will increase significantly in the near future. For example, procurement executives foresee mainstream adoption to grow by over 4 times, from 7% to 30% within two to three years. (Dorr, Kumar & Morrison 2018) Therefore, it is clear that firms should be ready for exploring the aspects of RPA to avoid being left behind by a rapidly changing innovative market.

This study will provide useful information related to supply management and its business process automation for managers and their organizations. The study will explain the changing role of supply management and the importance of automation. It will examine how a company's supply management can create value for the company through business process automation. Robotic process automation is a very new technology that companies do not yet fully understand. Therefore, it needs to be looked at more closely. The study will also explore differences between traditional automation and robotic process automation.

1.1 Literature review

This chapter reviews the literature concerning the previous studies about supply management and its business process automation. In this chapter, the research gap will be revealed by reviewing what is already known and written on the topic. This chapter also highlights the importance of the study and leads to the topic and objects of the thesis. Finally, the findings of this literature review will help the formation of the conceptual framework of the thesis.

Earlier literature concerning improvement and automation of supply management processes has been mainly focusing on the concept of e-procurement. Therefore, the first part of this literature review looks at e-procurement as a solution to improve and automate procurement processes. The purpose is to find out how e-procurement has been utilized in the procurement area and what benefits it has provided. The second part discusses previous literature related to the concept of

robotic process automation. RPA will be at the center of this thesis, so it is important to get familiar with the previous research in this newly emerging area of technology.

1.1.1 Literature review on automation of supply management processes

Earlier academic literature on automation of procurement processes has mainly discussed the concept of e-procurement. E-procurement has been seen as a solution to automate operational tasks and improve procurement in terms of cost reduction, increased efficiency and reduction in processing time and transaction costs (Gunasekaran & Ngai 2008). There are a lot of academic articles on e-procurement and the concept is well researched. According to Pani and Agrahari (2007), e-procurement refers to the use of electronic communication about business processes between sellers and buyers. They state that the concept can be seen as a way of linking and integrating company's business processes and systems with the automation of the requisitioning, the approval of purchase order management and accounting processes via Internet-based protocols.

Kim and Shunk (2004) have studied different e-procurement systems and how they match to the procurement process. In their study, the focus is on indirect procurement and they examine both high-level and low-level activities in order to identify fields where different e-procurement systems can be used in a hybrid and seamless manner. Researchers emphasize also that not all e-procurement systems are equally applicable to supporting different procurement processes.

Gunasekaran and Ngai (2008) instead, have identified some critical success factors and barriers that have been perceived during the implementation of e-procurement. Their paper studies the current status of e-procurement adoption in Hong Kong, and they developed also a conceptual framework for the adoption of e-procurement. The critical success factors that they identified consist of decent financial support, availability of interoperability and standards with traditional communication systems, commitment and support of top management, having appropriate security systems, and understanding the priorities of the firm.

Bienhaus and Haddud (2018) have studied the impact of digitization on procurement and explored potential barriers to digitizing procurement and ways to overcome them. The findings show the several benefits that digitization of procurement can bring: supporting daily business and administrative tasks, procurement will become more focused on strategic decisions and activities, and procurement will become a strategic interface to support organizational efficiency. The researchers found also some barriers to digitizing procurement processes and these were related to existing processes, procedures, capabilities and capacities. They state also that the new strategic role of procurement requires to rethink roles, tasks, and responsibilities of every supply chain members and set-up cross-functional interdisciplinary roles to expedite processes and transactions in order to stay at the cutting edge of technologies and innovation.

Tai, Ho and Wu (2010) have studied the performance impact of implementing Web-based e-procurement systems and their paper presents a Web-based e-procurement impact model based on supply chain orientation, which includes both operational and strategic impacts. The results of their study verify that the electronic execution of purchasing activities improves both the operational efficiency dimension and the strategic dimension. Tai et al. (2010) states also that by implementing a Web-based e-procurement system a firm cannot only cut down the transaction and inventory costs and improve production plan but can also change the activities of purchasing, reshaping the procurement actions from an operative into a strategical function. This is related to the significant finding of the study, which shows that Web-based e-procurement can improve the partnership between buyer and supplier.

Piotrowicz and Irani (2010) have identified some benefits that e-procurement can provide in a B2B context. They used various benefits taxonomies to classify them, one of which was strategic, tactical and operational benefits. In this category, they found that most of the benefits can be classified as operational and tactical. The study showed that e-procurement and process automation had a positive effect on the procurement processes through simplifying flow, reducing decisions points and

decreasing exceptions. E-procurement reduced also some purchasing costs through buying centralization, order-pulling, and price negotiations. However, their study reported only a few strategic benefits and those were related to improving customer service and increasing control at the corporate level.

1.1.2 Literature review on robotic process automation

Willcocks et al. (2015a) have studied the role of IT function in the adoption of robotic process automation. Their in-depth casework and interviews have revealed that there is a lot of misunderstanding about RPA's features, and how it fits with corporate IT architectures, governance and security procedures, among other things. These issues have created gratuitous barriers to adopting RPA. Their study points out the five challenges that IT function may encounter with RPA adoption, and how to balance the needs of IT with the business demand. Finally, they present eight actions for the successful adoption of RPA.

Another study from the same researchers discusses the RPA implementation at Xchanging, a company that provides technology-enabled business processing, technology and procurement services globally to its customers from different industries. Researches illustrate the successful adoption of RPA in a case company and highlight the many benefits that Xchanging received from implementing RPA. In addition to cost savings, which were 11-30 percent depending on the process being automated, the company got also other benefits. These benefits included improved service quality, high accuracy, low error rates, faster turnaround times, increased compliance and strategic positioning. This paper also outlines eight lessons for companies looking to implement an RPA strategy. (Willcocks et al. 2015b)

Slaby's (2012) paper studies RPA technology called Blue Prism, and puts it in the context of classical IT-driven development process. His study highlights the potential of RPA to be highly disruptive and transformative technology for the whole outsourcing industry. In his study, Slaby (2012) uses business cases and interviews with early adopters of RPA to explain its possible benefits and limitations. Also, the

paper discusses challenges related to RPA implementation, such as internal skepticism and resistance.

Rozario, Moffitt and Vasarhelyi (2018), for their part, have been researching RPA from the perspective of auditing. In their study, they discuss the future of auditing and examines the usage of RPA in auditing. They outline the potential of RPA to revise the traditional audit model and how it may transform the role of the auditor by replacing routine work and highlighting higher-order thinking tasks that will finally lead to increased audit quality.

Lacity and Willcocks (2016) have studied the implementation and the benefits of RPA in a case company Telefonica 02, which was one of the earliest adopters of RPA. Their case study shows that RPA is able to provide yearly returns on investment of up to 200 % and a faster and more accurate performance of repetitive back-office processes. They state that in order to achieve the maximum results, firms must assess RPA's capabilities and take care of its thorough adoption. The paper also provides five action recommendations for future RPA adopters, highlighting the importance of involving IT function early.

Study written by Hallikainen, Bekkhus and Pan (2018), presents OpusCapita's RPA journey and the extensions of its operations to provide RPA services to their customers. The article identifies the challenges and issues faced by this BPO (business process outsourcing) provider and outlines the lessons learned. The latter consists of three lessons for internal RPA adoption and five lessons for BPO organizations to offer RPA services to clients. Authors suggest also that BPOs providing both RPA services and traditional outsourcing services should set up a hybrid organization to support both of the business models.

To conclude this literature review, it can be said that the benefits and potential of e-procurement have been widely recognized. Previous studies highlight that e-procurement can improve especially operative procurement by automating and improving purchasing processes. Many studies found also that e-procurement can reshape the role of procurement from an operative into a strategical function. The

second part of the literature review revealed that robotic process automation is a new and developing topic that still needs to be researched more to fully understand its purpose and capabilities. From the procurement point of view, there is very little if any academic literature and studies available related to the utilization of RPA, thus additional research is clearly needed. Also, it seems not to be clear enough, how the RPA really differs from traditional business process automation and how it could support e-procurement.

1.2 Research questions

The Objective of the thesis is to increase the understanding of the importance of business process automation for supply management. The purpose is to highlight the changing role of procurement and examine the procurement function and its processes to emphasize the need for automation. Also, the goal is to examine the concept of robotic process automation and understand how it really differs from traditional business process automation. The main research question of the thesis is:

How robotic process automation can be utilized to improve supply management processes?

The main research question is divided into three sub-research questions that are:

1) What kind of processes are best suited for RPA?
2) What are the benefits and challenges of RPA implementation?
3) How to choose between RPA and traditional business process automation?

These three sub-research questions separate the main research problem into smaller entities in order to form a clear answer to the research problem. In the first of these, the purpose is to describe the procurement process as a whole and examine the possibilities for automating different processes. The second sub-question deals with robotic process automation and the purpose is to open the concept of RPA as widely as possible. The last question tries to explain the

differences between RPA and traditional business process automation in order to ease the choice of right automation technology for a specific business process.

1.3 Conceptual framework

This chapter presents the conceptual framework to get a clearer look at what this study is all about. As figure 1 shows, this thesis is built under the concept of supply management. The main focus of the thesis will be on operative purchasing and business process automation.

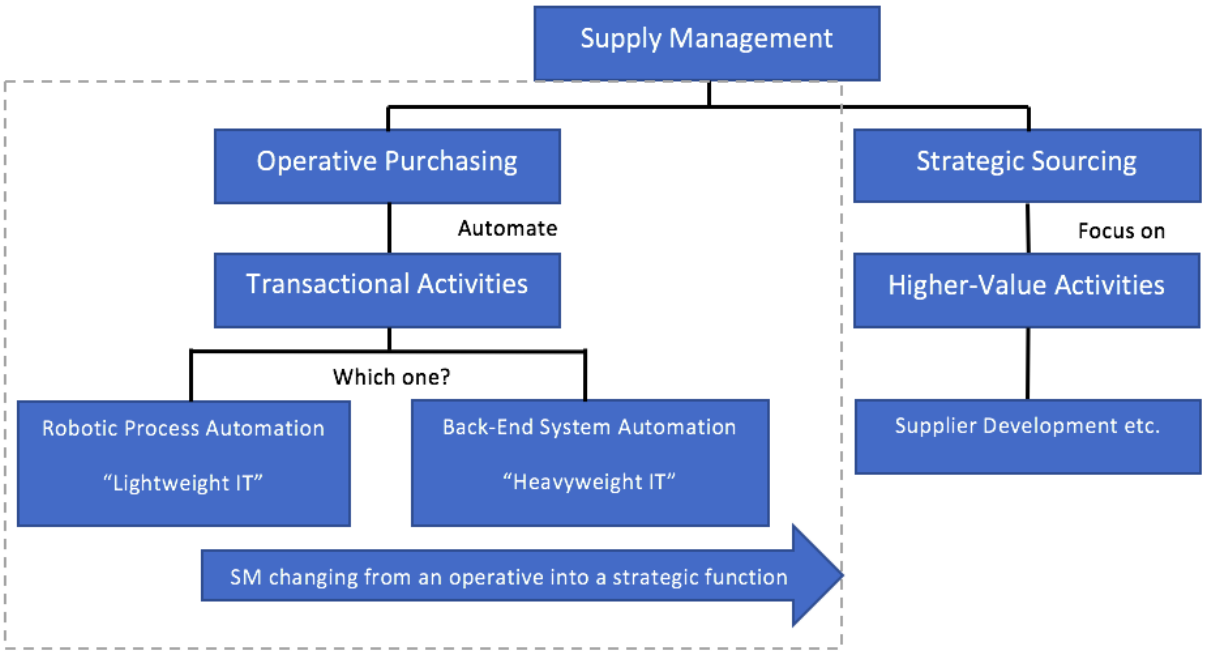

Figure 1. Conceptual framework

According to Trent (2007, 24), supply management functions are more and more getting out of the business of managing everyday tactical and operative transactions. He states that a shift toward strategical and externally focused supply actions and away from operative tasks have been present already a couple of decades. This idea is also a core of this study, as it can be seen from the conceptual framework. How can we get there then? Well, there are different paths towards more strategic supply management and one of the most powerful is to automate transactional purchasing activities, which this study focuses on. Technology plays a

key role when reducing and streamlining transactions, allowing organizations to focus on areas that provide major paybacks (Trent 2007, 279).

However, first, the basis for this study is built by presenting the changing role of supply management and examining procurement function and its processes in order to understand the need for business process automation. After that, the study will move towards the business process automation part, which will be examining previous automation solutions such as e-procurement and back-end system automation. This traditional back-end system automation is also called as heavyweight IT (Penttinen, Kasslin & Asatiani 2018).

After examining the traditional business process automation, the study will present the concept of robotic process automation and this new emerging technology will be discussed widely. When traditional back-end system automation is called as heavyweight IT, RPA can be called as lightweight IT (Penttinen et al. 2018). This study will be discussing both heavyweight IT and robotic process automation but the greatest emphasis is on the latter one, as it is a new and emerging technology. Theory part ends with a comparison of traditional business process automation and robotic process automation.

1.4 Key concepts and their definitions

This chapter will present the key concepts and explain what they mean in this study and in the taken perspective.

Robotic process automation

Robotic Process Automation (RPA) is an umbrella concept for technologies that work on the user interface of other computer systems in the way a human would do. RPA uses ”outside-in” automation approach to replace people, which differs from the classical “inside-out” manner to enhance information systems. Unlike traditional automation, the information system stays unchanged. (Van der Aalst, Bichler & Heinzl 2018) RPA can be also called as lightweight IT (Penttinen et al. 2018).

Back-end system automation

In this study, this term is presenting a traditional business process automation. Back-end system automation can be also called as heavyweight IT. This automation normally requires either system development or integration of disconnected systems, or both of them. (Penttinen et al. 2018)

E-procurement

E-procurement is a wide concept that relates to the application of Internet technology to the selling and purchasing of commodities. An e-procurement network offers a secure marketplace, sales platform, and transaction tracking system to sellers and purchasers. Electronic procurement usually consists of four elements: content management, requisition management, connectivity management, and transaction management. (Trent 2007, 73)

Supply management

All processes of supplying the firm with indirect and direct materials, services, machines, and equipment from sources external to the company, focused on delivering sustainable competitive advantage. This includes strategic and operational actions. (Kaufmann 2002, 12) Therefore, the concept of supply management is divided into operative purchasing and strategic sourcing in this paper. In this study, terms supply management and procurement are used interchangeably.

Operative purchasing

Traditional purchasing tends to be functional, reactive, assessed mainly on price reduction, and sometimes ranked lower in the organizational hierarchy. Involvement in new product development is not the priority and it tends to come late in the process. Relationship management is not the main objective, and the role of strategies is rather foreign. (Trent 2007, 7)

Strategic sourcing

This term has traditionally included the identification, evaluation, and development of potential suppliers. Today, strategic sourcing has extended to a wider level and consists of market understanding from which the purchase is being made, and also developing and applying different processes to improve competition. (Sollish & Semanik 2012, 34)

1.5 Limitations

This chapter will show the limitations of the study and explain what is excluded from the study and not taken into account. Also, the element that might affect the validity and reliability of the study are examined.

This study concentrates on automation of supply management processes, so other business functions are not considered in this paper. Robotic process automation as new emerging technology will be at the center of the study. This study focuses on examining the concept of RPA and how it can be utilized to improve supply management processes. RPA is different from cognitive automation (more advanced), so the latter is not considered in this study. Also, RPA is compared to traditional business process automation and the purpose is to find out how they differ.

Strategic supply management activities and processes are excluded from this study because automation actions are often targeted at operational purchasing. Therefore, this thesis is focusing on operative purchasing and automation of transactional activities. Also, this research is conducted as a case study, which means that the empirical part is mainly related to one single company and its purchasing processes. However, this study will include empirical data from external sources outside the case company, which is why some of the results can be generalized. Also, the theoretical part of the study contributes to the generalization of results.

1.6 Research methodology & data collection

The theory part of this thesis will be based mainly on academic literature such as scientific articles and books. These theory topics are related to supply management processes, especially operative purchasing processes, and business process automation with an emphasis on robotic process automation. As RPA is a new technology that does not yet have a lot of scientific articles, this study also utilizes other sources such as consulting reports.

The research method of this thesis is qualitative research. This method was chosen because it is most applicable to the research phenomenon that is still a very unknown area. Qualitative research aims to understand, describe and explain the concerned research phenomenon (Gibbs, 2007, 94). This qualitative research is conducted as a case study. According to Yin (2002) case study method is suitable especially when the purpose is to get answers to the “how” or “why” questions concerning the phenomenon of interest.

Empirical data will be acquired by interviewing employees from the case company and the company’s robotic process automation vendor. The purpose is to select the company’s employees who have been involved in the implementation of RPA projects and are working in the area of supply management. By selecting these interviewees, it is possible to get high-quality data related to recent experiences about the implementation of RPA in the purchasing environment. The purpose of choosing the company’s RPA vendor as one interviewee is to get a more detailed and professional viewpoint in order to understand the RPA technology and its capabilities on a deeper level.

2 PURCHASING AND SUPPLY MANAGEMENT

The importance of procurement for the company's competitiveness and financial performance has been emphasized in recent years, as companies are increasingly focusing on their core competencies, outsourcing their operations and acquiring the goods and services they need from other organizations. This means that the supply management has changed from operative support function to strategic function, and it has a greater impact on the company’s business than ever before.

In the past, the role of purchasing and supply management professionals was mainly related to effective processing of purchase orders, but the pace of today’s business environment has clearly extended its responsibilities to concern also the whole sourcing and acquisition process. In order to compete successfully in today’s dynamic markets, companies are required to understand and adopt new strategic methods and technologies, not forgetting traditional ways to manage their supplier relationships. (Sollish & Semanik 2012, 1)

At the beginning of this chapter, it is good to define the related terminology, which is relatively imprecise in practice, as well as in the literature. In addition to supply management, there are terms such as procurement, purchasing, buying, and sourcing, which are sometimes used interchangeably and may cause confusion. In this paper, the terms supply management and procurement are seen as similar concepts that describe this area at the broadest level as shown in figure 2. Kauffmann (2002, 12) defines supply management to encompass all processes of supplying the firm with indirect and direct materials, services, machines and equipment from sources external to the company, focused on delivering sustainable competitive advantage. This includes strategic and operational activities.

According to Huuhka (2017, 12-13) purchasing is considered more operational function than procurement, even they are sometimes perceived as the same term. She also points out the difference between purchasing and buying – while buying simply refers to making an order according to an agreement, purchasing is seen as

a wider concept including also responsibilities related to supplier selection and determination of product specifications.

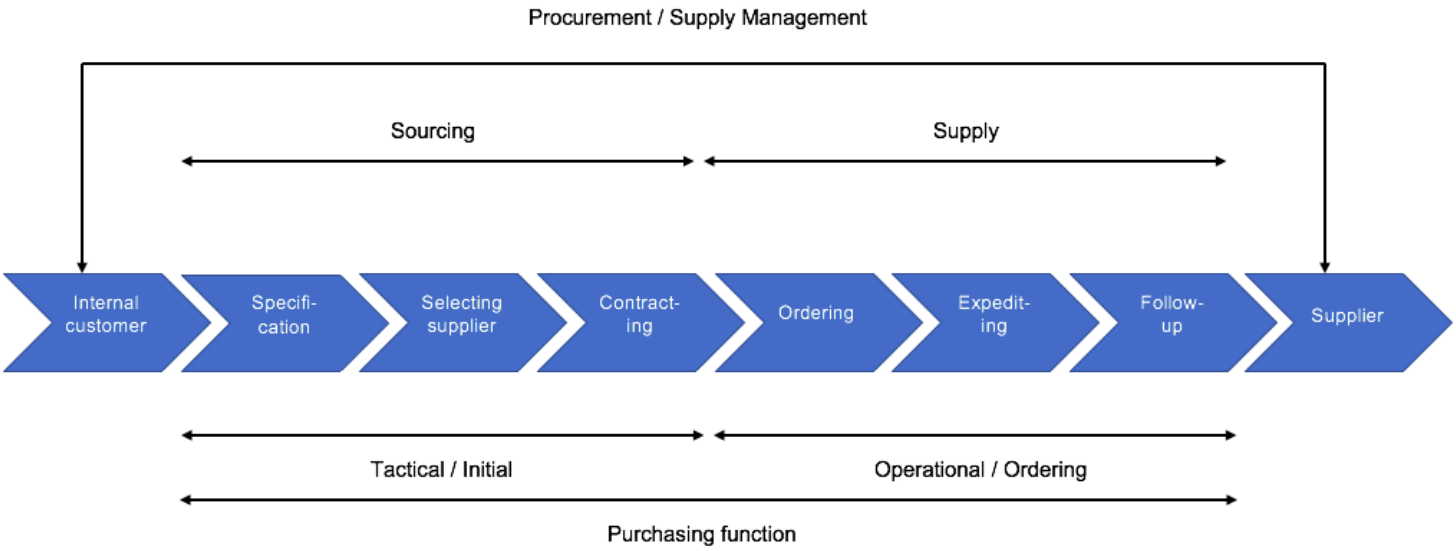

Figure 2. Terminology and purchasing process model (Based on van Weele 2014, 8).

Figure 2 illustrates how the terminology previously described can be linked with the procurement process. The right side of the process model is more relevant to this study, as the purpose of this paper is to study how the automation of operational purchasing activities can improve the efficiency of the entire procurement function and make it more strategic. According to this process model, operative purchasing includes ordering, expediting and follow-up. These actions generally include most of the transactional and routine work, making them suitable for automation. Because of this, these activities are examined in more detail later in this chapter.

2.1 Importance of purchasing to company and its impact on profitability

The importance of purchasing to companies can be easily noticed by examining the cost structure of manufacturing companies. In most of the cases, the biggest share of the cost of goods sold or sales revenues seems to be taken up by purchased raw materials and services. Studies show that normally the value of purchases is

approximately 50 percent in relation to cost of goods sold, even though it can be as much as 60 to 80 percent if other business costs related to purchasing are included to calculations (van Weele 2014, 12; Hallikas, Koivisto-Pitkänen, Kulha, Lintukangas & Puustinen 2011).

Table 1 illustrates the impact of purchase costs on company profit, and this simple example clearly shows the importance of purchasing function. As can be seen from the table, if you are able to save one euro, it will improve your business's profit by one euro. Instead, selling one euro more profit will also improve, but usually only a few cents. Huuhka (2017, 32) states that the share of purchases in turnover can be considered to be a determining factor in how significant a procurement function is for a company's profitability. As a general principle, the higher the share of purchases are in turnover, the stronger the role of procurement should be in the company's strategic decision-making.

Table 1. Impact of purchase costs on company profit (Based on Huuhka 2017, 31).

	Company 1	**Company 2**	**Company 3**
Sales	1000	1000	1000
- Purchase costs	700	650	600
- Other costs	200	200	200
= Gross profit	100	150	200
- Taxes (26 %)	26	39	52
= Net profit	**74**	**111**	**148**
Share of purchase costs in sales	70 %	65 %	60 %

The financial impact of procurement can be assessed by utilizing DuPont analysis. This tool can be used to illustrate how the purchasing contributes to enhancing the company's return on capital employed (ROCE). According to van Weele (2014, 12-13), purchasing can improve ROCE in three ways. Firstly, it can be improved through the reduction of all direct materials costs, which will lead to an enhancement of the firm's sales margin. Lower direct material costs can be achieved by various

actions, such as reducing the number of suppliers, looking for substitute materials or improving product standardization. Secondly, ROCE can be improved through a reduction of the net working capital employed by the company. Working capital can be reduced by using longer payment terms or reducing base material inventories, just to name a few. Thirdly, it can be enhanced by improving the company's revenue generating potential. For example, procurement managers should challenge their suppliers for new product ideas and process improvements, since it may create new customer value propositions that in turn lead to higher margin new products. (van Weele 2014, 12-13)

2.2 The role of purchasing function

The role of the purchasing function has changed significantly since the 1970s. Purchasing was regarded as a clerical function in the past, and its goal was to purchase goods and services for the company at the lowest possible price. (McIvor, Mulvenna & Humphreys 1997) At that time, organizations still considered purchasing as an administrative rather than a strategic function, what really had nothing to do with the corporate performance or competitive strategy (Ammer 1974). The importance of purchasing function was seen only in times of material shortages, for example during the oil crisis in the 1973-1974 (Farmer 1978). The strategic role of purchasing began to receive proper attention in the 1980s. At that time, Porter (1980) identified buyers and suppliers as two of the critical forces shaping the competitive business environment. Also, Kraljic (1983) adapted portfolio analysis to purchasing and supply management, which made it possible for management to develop supply management strategies.

From those days, purchasing and supply management has continued to evolve tremendously in the field of management, from category management to managing supplier relationships, payments and contracts, and finally strategy (Den Butter & Linse 2008). One of the key factors behind the development of procurement is globalization, in which era (1970-2000) industrial competition has become faster and more intense (Huuhka 2017, 17). Globalization has been also playing a major role when placing purchasing in a wider strategic context since global sourcing makes

supply management decisions to be also strategic decisions. Make or buy decisions – whether to move the firm's own operations offshore or outsource the production to other producers, is a good example that is made at the senior executive levels in many cases. However, normally procurement professionals take care of other important issues, such as supplier selection and contracting. (Den Butter & Linse 2008)

Nowadays, purchasing and supply management function has more responsibilities than ever before, due to growing purchasing volumes and increasing dependency on external suppliers. One of the most important tasks of purchasing professionals is to establish and manage long-term and strategic supplier relationships. (Feisel, Hartmann & Giunipero 2011) When this responsibility is well managed, it also helps to be successful in other purchasing tasks. According to van Weele (2014, 53), other primary tasks of purchasing are:

1. Operational excellence – securing the supply of products with consistent quality and reasonable total cost from trustable suppliers.
2. Cost control and reduction of all purchasing-related spend – purchasing goods and services at the lowest total cost of ownership (TCO) or best value from the best supplier available.
3. Risk management – reducing the organization's risk exposure in relation to its supply markets.
4. Continuous improvement – developing new product and process innovations together with suppliers.

So, as can be seen, the responsibilities of purchasing and supply management have grown from administrative tasks to strategic tasks. This new role of purchasing can truly create a sustainable competitive advantage and increase organizational value through the actions presented above. However, it should be taken into account that purchasing function often also needs support from other functions in order to maximize the benefits. According to research by Jääskeläinen and Heikkilä (2019), the integration between purchasing and the other functions of the company has the biggest potential for creating competitive value when company is identifying new

supplier offerings for the customer, enhancing supply flexibility to adapt customer preferences and mitigating time-to-market of new products.

2.3 Purchasing process

There are a lot of different purchasing process models presented in the literature by different authors. Some of them include multiple phases, while others have only a few process steps. Figure 3 shows one type of model about extended purchasing process presented by van Weele (2014, 28), and it shows the main activities of purchasing function. This process model includes many steps, but it can be divided into sub-processes: source-to-contract, purchase-to-pay or source-to-pay, for example.

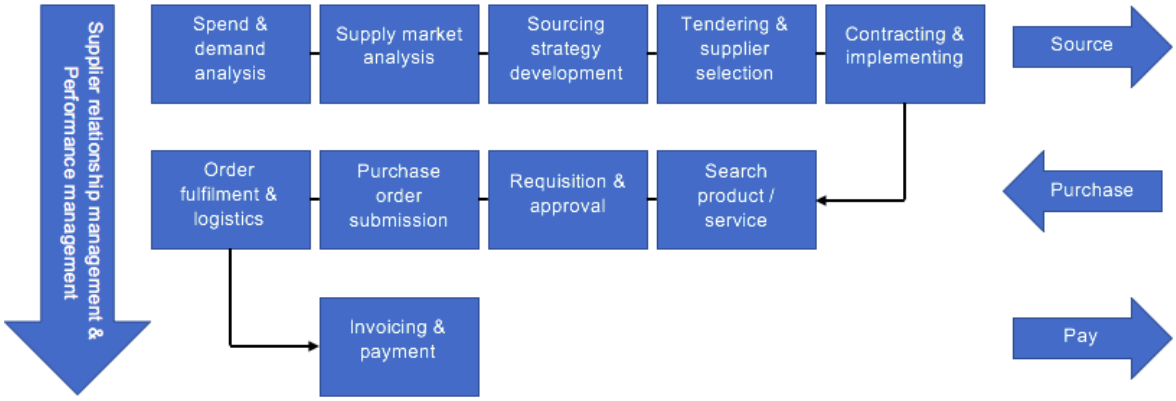

Figure 3. Extended purchasing process model (Based on van Weele 2014, 43).

Successful management of corporate purchasing function requires a deep understanding of purchasing processes. These processes often vary between companies, and organizations may also have different purchasing processes for different products and services. Van Weele (2014, 48) states that the involvement of the purchasing function is highest during the operational stages of the purchasing process, meaning the purchase-to-pay activities. These stages normally include a lot of transactional activities such as order handling, invoicing and claims processing. The automation opportunity is greatest in the more transactional steps of the process (Jain & Woodcock 2017; Kim & Shunk 2004): in making and receiving

orders, 88 percent of work can be automated, and in payment processing, even 93 percent of tasks are suitable for automation (Jain & Woodcock 2017).

Because of the high automation potential in the purchase-to-pay process, it is good to examine its phases more deeply. Usually, the purchase-to-pay process begins with the need for some product or raw material in production, for example. After the need is noticed, there are different ways of ordering. According to van Weele (2005, 57), purchase orders are often sent to the supplier via e-procurement systems and they are usually based on purchase requisitions made in production. Nowadays, ERP systems are so advanced that they can generate orders automatically, reducing the manual work done by a buyer.

After the purchase order is sent out, the supplier should confirm the purchase order by sending an order acknowledgment of purchase order. The buyer should then check and validate the order confirmation by comparing it to the original purchase order, and take the necessary actions if there is something wrong with the confirmation. (Johnsen, Howard & Miemczyk 2014, 47)

Once the order confirmation is received and the delivery confirmed, the buyer should monitor that the order fulfillment and logistics are executed as agreed. Van Weele (2005, 60) states that there are three different expediting actions related to this phase of the process, which are exception expediting, routine status check and advanced status check. The first one refers to reactive behavior and situation, where the purchaser starts to examine the situation when the delivery is already late. The second one refers to the situation when the buyer is proactively asking re-confirmations on the delivery times in order to prevent harmful disruptions. The last method, advanced status check, is often used to secure the deliveries of critical materials, which require that the buyer is actively collaborating with the production unit.

Lastly, invoices are received and processed after the goods are delivered in the final step of the purchase-to-pay process. Invoicing is an important part of the process as it consists of an enormous amount of transactions and work. Thus, automation

plays a crucial role in improving invoicing processes. (Keifer 2011) As stated above, tasks of payment processing can be highly automated. However, payment processing and invoicing can also cause unnecessary manual work even if the company has an automation solution in place if the invoice for some reason does not match the purchase order.

2.4 From transactional procurement to digital procurement

In the late 1990s, the Internet had just been commercialized and at that time many researchers were thinking about its impacts on the area of procurement. In 1998, Gebauer, Beam, and Segev (1998) stated that the Internet and related technologies will change the role of the purchasing function from a transactional department to a more managerial department focused on creating and maintaining relationships, with internal customers, third parties and suppliers, and leveraging company's purchasing power. Now, more than 20 years later, it can be said that they were right. Gebauer et al. (1998) mentioned also that the procurement will administer the technological infrastructure needed to either automate transactions completely or empower the end user to carry out several transactions without the necessary involvement of purchaser.

Technology has been the main driver and enabler for procurement to grow from a transactional function to the digital, strategically important business partner that it is today. As figure 4 shows, the first remarkable change happened in the mid-2000s and onward, when the establishment of e-procurement and e-sourcing became more common. The concept of digital procurement was truly formed in the mid-2010s when these tools were being coupled with predictive analytics. Since then, the area of procurement has changed at an ever-increasing pace, due to new emerging technologies such as AI, RPA, blockchain, and Internet of Things. (GEP 2018

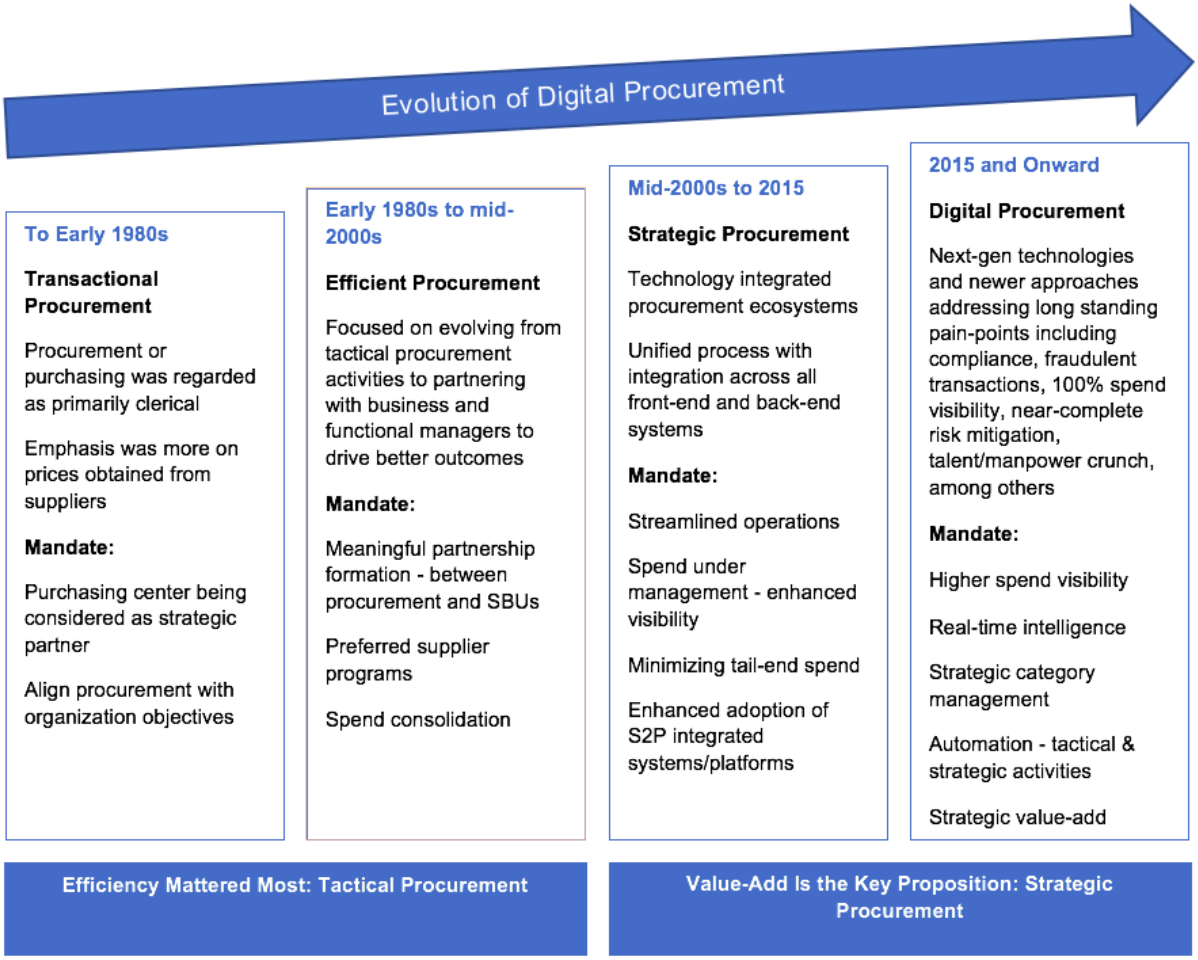

Figure 4. Evolution of digital procurement (Based on GEP 2018).

It can be said that procurement functions should consider adopting such transformative technologies and define an explicit strategy for implementation. Implementation of these groundbreaking technologies and leveraging them to answer long term challenges related to sourcing is what can be called as digital procurement. (GEP 2018) As stated earlier, it took a relatively long time for organizations to truly understand the strategic importance of purchasing function. That is why companies should at least now start thinking about the concept of digital procurement and its possibilities to further improve procurement processes and create value. Next chapter will focus on business process automation and examine robotic process automation that is one of the emerging tools in the digital procurement era.

2.5 Summary of the chapter

As this chapter has emphasized, the role of purchasing and supply management has changed during recent decades. Finally, the strategic importance of this function has been widely understood in different industries. The shift from an operative support function to strategic value-adding function is more clear day by day. However, operative actions are still there and will be there also in the future. Transactional routine work such as making purchase order requisitions, ordering and invoice processing are activities that still must be done in everyday operations. These tasks include a huge amount of manual work and take a major part of purchasing professional's working time.

Therefore, the most interesting question is, how can we do this operational work more efficiently in order to achieve sustainable competitive advantage and create value for the business. Today's technologies can bring many answers to this question, and automation has been seen as an important element to reduce non-value adding activities and increase the focus on strategically important tasks. In recent years, especially robotic process automation has been recognized in various organizations around the world. This new emerging automation solution will be examined more deeply in the next chapter.

3 BUSINESS PROCESS AUTOMATION

Improving purchasing productivity has been an important topic for decades. Already in the late 1980s, Scheuing (1989, 170) raised the issue of improving purchasing productivity by using hard or soft technologies. With soft technologies, he meant improvements like proper workplace organization, training or the formation of quality circles. Instead, with hard technologies, he meant the replacement of manual work by mechanical processes or the displacement of the human workforce by machines. These hard technologies will improve productiveness when mechanical devices are utilized to assists buyers and decrease the amount of cumbersome manual activities. These machines tend to be cheaper and operate quicker than the human workforce. They can also be called on to work whenever wanted, but they require maintenance. (Scheuing 1989, 170) Someone might be surprised that previous references about machines refer to a normal computer, and these statements could be said in the same way about today's emerging technologies.

Business functions are constantly looking for ways to enhance their business processes and one effective solution is to automate as many processes as possible. Automation has distinctly appeared as a crucial enabler of enhancing efficiency and running key business results while decreasing effort and the cost of manual and routine work (GEP 2018). The market size for business process development is expected to grow from USD 6.96 Billion in 2016 to USD 13.52 Billion by 2021 (MarketsandMarkets 2016). Therefore, IT departments often receive a lot of requests concerning the need for new custom applications or modifications to existing systems. These requests tend to fall due to expensive price and priority because IT-based software development usually focuses first on strategically important long-term projects. Hence, it has been tedious to respond to tactical requests of business units in a cost-effective way. (Slaby 2012)

Nowadays, business process automation does not necessarily require large and expensive system integrations. Today there are solutions available that enable the automation of business processes in a cheaper and more flexible way. These solutions, such as robotic process automation, should be considered as an

alternative choice for traditional IT-based software development. According to GEP's (2018) study, some of the new technologies are expected to have a more significant effect than others in the near future. The study states that AI and RPA are considered as two of the most important, but others such as blockchain and IoT are seen important as well. Figure 3 shows similar results that were found in SAP Ariba's (2018) CPO survey. According to their research, organizations are going to invest most in RPA and AI in the coming years. The same study also found that 83% of its respondents think the digital transformation will impact procurement, supply chain and finance more in next year, but only 5% of respondents had highly automated systems and processes. However, traditional IT-based back-end system automation and new "lighter" solutions have their pros and cons, so the right solution should be chosen carefully.

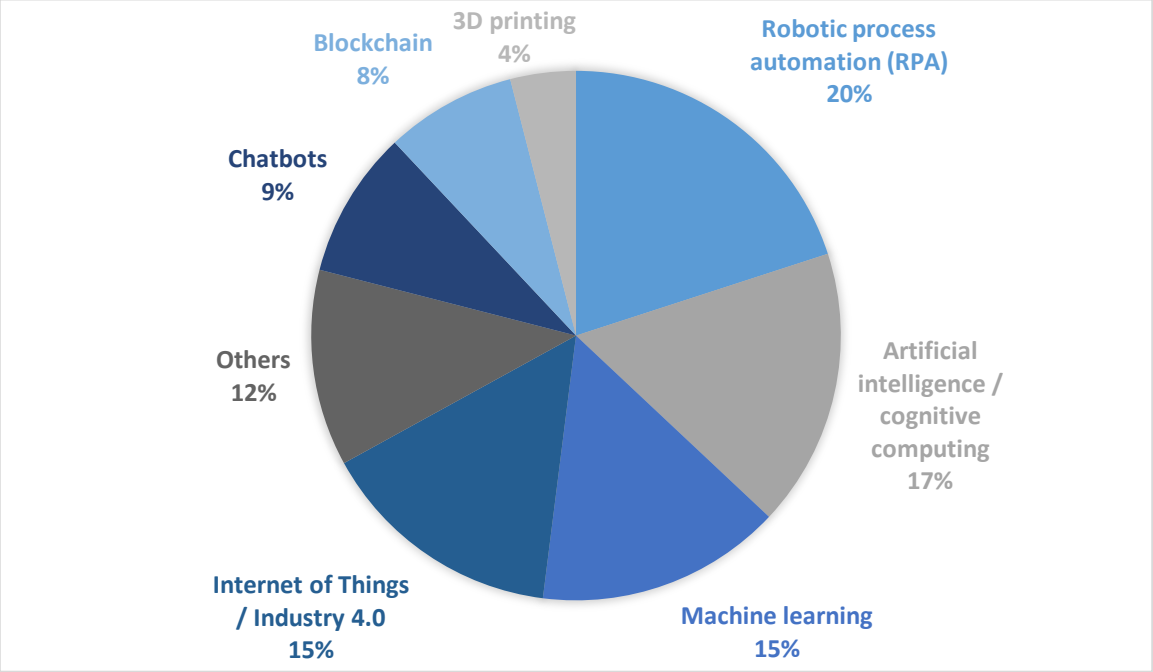

Figure 5. Planned future use of technologies over the next 12 months in procurement (Based on SAP Ariba 2018).

According to Willcocks et al. (2015b), there are six transformation levers that can increase the performance of back offices: centralizing physical facilities and budgets, standardizing processes across business functions, optimizing processes to deduct waste and errors, transferring from high-cost to low-cost destinations,

enabling technology, and automating services. Willcocks et al. (2015b) point out that large companies have extensively adopted the first five of these transformation levers during the past 15 years, but the real power of service automation has been truly introduced only a few years ago.

3.1 E-procurement

E-procurement is an essential concept in this study, as it acts as an enabler for process automation in purchasing. If the automated processes are not in electronic format, they cannot be automated either. Today, the internet provides real-time information and allows organizations to automate their supply management processes in order to enhance various processes and reduce procurement costs (Vaidya & Campbell 2016). According to Purchase and Dooley (2010) e-procurement consists of several processes such as online e-marketplace, reverse auctions and use of online catalogs.

Presutti Jr. (2003) simply defines e-procurement as a technology solution that facilitates enterprise buying through the Internet. It can truly transform the purchasing process because it can be utilized in every phase of the purchasing process. Hallikas et al. (2011) have studied the use of electronic systems to support procurement activities in Finnish companies. They found out that most of the respondents used electronic data transfer at various stages of the procurement process, such as ordering, invoicing and forecasting. A large part of respondents utilized Intranet and Extranet to support the collaboration with suppliers. Also, ERP systems were used widely.

As has been stated earlier in this paper, it is crucial to automate operational procurement processes with the help of digital solutions in order to focus more on strategic tasks. Alvares-Rodrigues et al. (2014) state that the organization should recognize the key procurement processes and then move towards the process automation. Sitar (2011) states that the e-procurement can bring various benefits to the company such as enhanced efficiency of the purchasing process, improved supplier relationships, time savings, cost savings, the enhanced influence of

management and better control over the whole procurement process. Research has shown that the companies using e-procurement systems have achieved about 42% savings in buying transaction costs (Davila, Gupta & Palmer 2003).

3.2 Robotic process automation

When talking about robotic process automation, many people may have an image of physical robots strolling around the office. However, it is not the case. Van der Aalst et al. (2018) define robotic process automation (RPA) as an umbrella concept for technologies that work on the user interface of other computer systems in the way a human would do. RPA uses ”outside-in” automation approach to replace people, which differs from the classical “inside-out” manner to enhance information systems. Unlike traditional automation, the information system stays unchanged. (Van der Aalst et al. 2018) According to Willcocks et al. (2015b), RPA usually refers to placing software to do the task earlier done by a human, for instance shifting data from various input sources like email and excel files to systems of record such as Customer Relationship Management (CRM) and Enterprise Resource Planning (ERP) systems.

RPA is used to automate highly rules-driven, high volume, standardized and stable business processes that do not need human judgment or complicated exception handling (GEP 2018; Slaby 2012; Willcocks et al. 2015a). Those can be back-office processes like creation of online access credentials for new employees and issuing of purchase orders based on material requirements planning system outputs (Slaby 2012). Robots are able to log in to systems using their own user accounts, move and click a mouse, interpret text and figures, write and send emails, fill various forms and check the quality and validity of data in different systems. Although they can perform these tasks independently, they are usually trained to work together with humans. For example, if the robot cannot complete a certain task, it can request human assistance or write and send an error report. (Hallikainen et al. 2018)

RPA is not the same as more advanced AI applications. As stated above, RPA takes routine tasks and leaves people to focus on work that requires more things like

emotional intelligence, reasoning, judgment and supplier interaction. This can be considered the most significant difference between RPA and cognitively intelligent machines because the latter one is able to learn these human attributes and automate them. RPA is used to automate more simple work including rules and precise guidelines. Especially downstream processes, such as purchase-to-pay processes are optimal for RPA. Whereas, upstream processes such as supplier or contract management, and production optimization are better to automate by utilizing AI. (GEP 2018)

RPA can be also called as lightweight IT, which refers to its cheaper price, better availability and easy to use technology. This technology can be developed by skilled non-IT users and vendors, who can build simple, specialized applications to support different tasks. These applications are developed typically to support business processes without changing the existing IT architecture, which means that their development usually bypasses IT functions. (Penttinen et al. 2018; Hallikainen et al. 2018)

3.2.1 Advantages and opportunities of RPA

Robotic process automation is an emerging technology, which utilization within organizations is only increasing year by year. This would not be the case at the moment if there would not have been any shown benefits that the technology has already provided to many companies. However, as with any other new technology, the solution must be adopted properly in order to achieve the benefits. This chapter aims to point out the most commonly known benefits of software robotics through previous literature and company case examples from recent years.

RPA can be seen as a comparably cost-effective way to automate business processes. RPA allows a fast return on investment since automation through RPA technology can be executed in a short time period, normally from a couple of weeks to a few months. According to Slaby (2012), while an onshore FTE costing USD 80,000 are able to be substituted by an offshore FTE for USD 30,000, a software robot can carry out the same work for USD 15,000 or even less. As we can see from

these numbers, robots enable the automation of those processes, which have been seen earlier as too expensive to automate. Moreover, due to the low price, smaller companies with fewer resources are able to increase the level of automation in their operations.

One of the most recognized benefits of RPA is that the robots release people to do higher-value tasks, which requires problem solving and complicated exception handling (GEP 2018; Slaby 2012). Also, RPA itself could create jobs such as robot management and consulting in the long run (Asatiani & Penttinen 2016). Robots can also work around the clock without getting tired, and they do it faster, more efficiently and with fewer errors than a human would (GEP 2018; Slaby 2012).

RPA can be utilized for example when the process automation is important and urgent for the business function to address, but not a priority of IT development (Slaby 2012). RPA is a technology that does not require any changes to existing IT system, because robots can work completely within the user interface (UI), meaning that current IT systems remain unchanged (Asatiani & Penttinen 2016). Therefore, it does not need expensive system integrations (Hallikainen et al. 2018).

Table 2 illustrates clearly the benefits that can be achieved by implementing RPA technology. This example describes the benefits that RPA provided to Xchanging, a company that provides technology-enabled business processing, technology and procurement services globally to its customers from different industries. The company implemented RPA successfully by utilizing Blue Prism software. (Willcocks et al. 2015b) Xchanging proved that RPA projects can provide benefits beyond cost savings. Willcocks et al. (2015b) state that the company got multiple operational benefits and strategic payoffs, with cost savings being one factor amongst many. By implementing 27 different robots to handle 120,000 transactions per month, the firm achieved such benefits as improved service quality and speed, increased compliance, higher accuracy, and lower error rates, in addition to 30 % cost savings per process.

Table 2. RPA capabilities and benefits gained by Xchanging (Based on Willcocks et al. 2015b).

Number of processes automated	**Number of RPA transactions per month**	**Number of Robots**	**Number of FTEs replaced**	**Typical cost savings per process**	**Other benefits**
14 core processes	120,000 cases	27	Automation not about replacing people with technology but about continuous improvement	30 %	• Improved service quality • High accuracy, low error/exception rates • Faster turnaround time • Multi-tasking • Scalability • Increased compliance • Strategic positioning

3.2.2 Challenges of RPA

As noted before, RPA has many different benefits that the previous living examples also proved. However, it has its limitations and disadvantages too, if compared to traditional back-end system automation for example. RPA normally works between different systems and web applications, such as ERP and Excel, which requires existing infrastructure built on heavyweight IT solutions (Penttinen et al. 2018). Even though RPA is said to be business-driven, IT function has an essential role in actions related to arranging access rights, process log maintaining, and setting up virtual resource agents. Robots can work around the clock in theory, but it should be noted that they are not able to work faster than the overall process allows to. (Penttinen et

al. 2018; Willcocks et al. 2015b) Thus, the existing processes can be considered as constraints for effective working time (Willcocks et al. 2015b).

RPA is a software-based tool, which means that the inputs are required to be in digital format and the process itself need to be rules-based. This also means that RPA solutions cannot make independent decisions or adapt to the changing infrastructure without effort. (Penttinen et al. 2018; Asatiani & Penttinen 2016) Also, RPA as a lightweight IT can be implemented fast and flexible, but it is still inferior to heavyweight IT developed for machine-to-machine communication (Asatiani & Penttinen 2016). Another disadvantage of lightweight IT tools is that they can make applications and gadgets disconnected, and also privacy and security problems could be more difficult to address with lightweight solutions (Penttinen et al. 2018).

Employee resistance and their preconceptions against robotics is another thing that may create barriers to RPA implementation. Employees may see robots as competitors and be afraid of losing their jobs, which in turn may cause tensions between employees and management. However, this effect can be minimized by introducing RPA projects delicately and communicated properly. (Asatiani & Penttinen 2016; Hallikainen et al. 2018; Rozario et al. 2018)

3.2.3 Adoption of RPA

Today, RPA is one of the most accessible automation technologies and that is why it has been leading the adoption of these new emerging automation solutions (GEP 2018) RPA can provide various benefits to organizations, but they have to learn to manage RPA adoption in order to obtain the maximum returns. In the RPA case of Xchanging, continuous improvement beyond deployments proved to be crucial when maximizing benefits. (Willcocks et al. 2015b) There have been different RPA journeys and adoptions in various companies, but similar best practices and action principles can be found in many of those cases. Lacity and Willcocks (2016) have defined five action principles for companies considering RPA adoption:

1. Test RPA capabilities with a controlled experiment
2. Develop criteria for determining which processes can be automated
3. Bring IT onboard early
4. Communicate the intended effect on jobs early in the process
5. Exploit new automation sourcing options

The first action principle means that the RPA capabilities should be tested in order to understand what it can or cannot do, and how it differs from traditional automation solutions. For example, a company can compare the capabilities and costs of different solutions by automating the same process using both robotics and back-end system automation. A controlled experiment can also be used to assess RPA provider capabilities. Giving the same process for two RPA service providers to automate in a controlled experiment can be a great practice to compare their capabilities. (Lacity & Willcocks 2016)

Secondly, the right processes have to be identified because all processes are not suitable for robotics. In general, certain RPA suitability criteria have been recognized widely. According to Rozario et al. (2018), companies should look for easy wins when starting their RPA journey, and avoid selecting complex and subjective processes. Usually, business processes should have enough volume and transactions, because high-volume processes enable the biggest opportunities for cost savings (Lacity & Willcocks 2016; Rozario et al. 2018; Willcocks et al. 2015b). Also, processes that are well-defined and rules-based are easier to automate, because robots still need strict guidelines to complete tasks (Lacity & Willcocks 2016; Rozario et al. 2018). Lastly, mature processes should be targeted, since they are stable, predictable and the costs are known, making them less risky to automate (Rozario et al. 2018; Lacity & Willcocks 2016)

Third action principle is that a company should bring the IT department onboard early in the implementation. RPA is often seen as business operations program and that is why many of RPA early adopters have excluded IT at the outset. In most of

these cases, excluding IT has proved to be a mistake. (Lacity & Willcocks 2016) IT department should be involved in the implementation both when it is developed internally and purchased as a service package. If the company chooses to develop RPA by itself, then IT function need to participate in the development, testing and production stages of RPA. If the organization chooses to purchase it as a service package, then IT should support the businesses in both building an RPA business case and participating in RPA provider negotiations. (Hallikainen et al. 2018) Lacity and Willcocks (2016) state that by understanding RPA's capabilities, the IT function can serve as an advisor to business units, and its role is also essential when considering things like validating RPA processes and optimizing IT infrastructure.

Another issue that Lacity and Willcocks (2016) listed is that RPA's intended effect on jobs should be communicated early in the process. Earlier research has emphasized the importance of creating a communication strategy to handle concerns about job cuts (Hallikainen et al. 2018). According to Lacity and Willcocks (2016), the most suitable time to communicate about the use of RPA is at the controlled experiment/proof-of-concept phase. It is crucial that employees feel convenient about the utilization of software robots as they have to work with the RPA developers to program the robots. An organization can give human names to its software robots because it may help business professionals see them as assistants (Hallikainen et al. 2018).

Lastly, the organization should consider different sourcing options for RPA. According to Lacity and Willcocks (2016), there are five different sourcing options that are illustrated in table 3. The organization should choose the most appropriate option for itself, and the selection could be based on the company's own resources and objectives. For example, insourcing can be a good option if it wants to have a high level of control and keep all the cost savings on itself (Lacity & Willcocks 2016).

Table 3. RPA sourcing options (Based on Lacity and Willcocks 2016).

Option	**Description**
Insource	Buy RPA licenses directly from an RPA software provider
Insource and consulting	Buy licenses directly from an RPA software provider, and engage a consulting firm for services and configuration
Outsource with a traditional BPO provider	Buy RPA as part of an integrated service delivered by a traditional BPO provider
Outsource to an RPA provider	Buy RPA from the new breed of RPA outsourcing provider
Cloud-source	Buy RPA as a cloud service

Outsourcing can be considered when the organization does not have enough capabilities or it wants to use the expertise of RPA provider. The most known RPA software providers include companies such as Blue Prism, Automation Anywhere, UiPath and IPsoft, which offer easy to use tools that can be also taught to business operations staff within a few weeks so that they are able to automate processes by themselves (Lacity & Willcocks 2016).

3.3 Trade-off between RPA and traditional back-end system automation

Penttinen et al. (2018) identified that there is a lack of studies addressing the selection issue between RPA and back-end system automation. According to Slaby (2012), IT's traditional software development process is more applicable to strategic process enhancements, whereas RPA is more applicable to processes that are excessively tactical or short-lived to fit IT's preferred mission. Asatiani and Penttinen (2016) stated that RPA cannot perform as well as back-end system automation when it comes to handling the heaviest transaction masses. In that sense, they argue that RPA is currently mainly a temporary solution closing the gap between running manual processes on old systems and developing heavyweight IT solutions.

According to Asatiani and Penttinen (2016), one advantage of RPA is that it can be integrated with virtually any software used by a human, in spite of its transparency to third-party integrations. They state that some enterprise IT systems have very limited ability to communicate with other systems because they are proprietary with no public API's. In many such cases, RPA is the solution. Implementation of corporate software integration can take months or even years when the implementation of a software robot can be done in a few weeks. This is a huge advantage of RPA technology. (Asatiani & Penttinen 2016) Also, processes automated by RPA are relatively easy to modify, even by the operator of the IT system. Heavyweight IT needs advanced coding expertise to do any major changes to the way it works. (Asatiani & Penttinen 2016) Some of the general attributes of lightweight and heavyweight IT has been summarized in table 4 (Bygstad 2016).

Table 4. Differences between robotic process automation and traditional back-end system automation (Based on Bygstad 2016).

Robotic process automation "Lightweight IT"		**Traditional back-end system automation** "Heavyweight IT"
Front-end, supporting work processes	**Profile**	Back-end, supporting documentation of work
Users and vendors	**Owner**	IT function
Process support, apps, BI Transaction systems	**Systems**	Transaction systems
Non-invasive solutions, frequently mesh works (heterogeneous networks)	**IT architecture**	Fully integrated solutions, centralized or distributed
Innovation, experimentation	**Development culture**	Systematics, quality, security
Isolated gadgets, security	**Problems**	Increasing complexity, rising costs
Business and practice innovation	**Discourse**	Software engineering

Penttinen et al. (2018) have studied the factors that influence the choice between software robotics and back-end system automation. In their study, they found that the stability of the environment where existing IT systems operate has a significant impact on the choice. Stability of the environment refers to the number of changes within the IT architecture or user interface. In that case, a stable user interface means that the design or layout of the user interface stays as similar as possible during the system's lifecycle. Heavyweight IT needs stable system architecture, but it is not vulnerable to user interface modifications on the presentation layer. In turn, lightweight IT such as RPA requires stable user interface but is not that sensitive if system architecture changes. (Penttinen et al. 2018)

It has been stated by different authors that RPA does not replace traditional business process automation solutions such as ERP but rather complements them (Lacity & Willcocks 2016; Bygstad 2016) Both of them are developed to automate a different kind of processes. Heavyweight IT solutions are developed by IT function and are optimal for business processes demanding IT expertise on higher value IT investments such as CRM and ERP systems. Lightweight solutions such as RPA do not disturb existing IT systems and it makes the automation of lower volume processes worth automating. IT staff are not usually involved in creating RPA solutions, but they should be involved in the deployment of RPA software to control its compliance with general IT governance rules. (Lacity & Willcocks 2016)

4 RESEARCH DESIGN AND METHODS

This chapter presents the research methods used and the justification for their selection. Then, the case company is introduced in order to know the basis of the research and to clarify the need for the study. Thereafter, data collection and analysis methods are presented. Finally, the reliability and validity of the research are evaluated in this chapter.

The empirical part of the study has been conducted as a case study using qualitative research methods. Qualitative research aims to understand, describe and explain the concerned research subject (Gibbs, 2007, 94). Qualitative research methods are used when the focus is on the phenomenon that is difficult to quantify (Hirsjärvi, Remes & Sajavaara 2009). This method was chosen because it is most applicable to the research phenomenon that is still an unknown area. Also, there are not yet so many RPA adoptions done in the field of purchasing and supply management, at least in Finland, so it would be challenging to get enough data for quantitative research.

The case study method was chosen for this study because it is often utilized when the aim is to create understanding about the prevalent phenomenon in a certain context (Saunders, Lewis & Thornhill 2009, 145-147). This method can be seen as very suitable for this study, as the purpose of the study is not to provide highly generalizable results but to increase a deeper understanding of the phenomenon being studied (Tuomi & Sarajärvi 2009, 28-30). According to Yin (2002) case study method is suitable especially when the purpose is to get answers to the “how” or “why” questions concerning the phenomenon of interest.

The arguments presented above support the selection of the research method. Additionally, the choice of a research method can be modeled on previous studies because the subject of the study is a relatively new phenomenon and there are not many previous studies available. As noted in the literature review of the first chapter,

previous studies on the use of RPA have also been conducted as qualitative case studies, so the method can be considered suitable for this research too.

4.1 Introduction of the case company

Case company of the thesis is UPM-Kymmene Oyj, and more specifically its sourcing function. UPM-Kymmene Oyj is a Finnish forest industry company operating globally around the world. Its revenue was EUR 10,483 million and it employed about 19,000 people in 2018. UPM's business structure consists of six business areas, which are supported by global functions. (UPM Annual Report 2019)

UPM Sourcing is one of the business integrated global functions, which provides profound supply market insight and access to optimized supplier base for UPM businesses. The function aims to secure the supply of cost-competitive, innovative and responsibly produced material and service solutions for UPM businesses – in all market conditions. UPM Sourcing contributes to bottom and top line by creating business value with the supplier network and pursuing business opportunities. As an organization, it applies sourcing and logistics expertise, business insights, supply market knowledge to the supply of materials, services, and innovative solutions in order to advance UPM businesses profitability and growth in bio-economy.

Digitalization has been identified as one mega trend in UPM's strategy. Its significance to UPM can be pointed out through three elements: new digital innovations to support value creation and growth, increased customer focus and transformation of processes and technology. The strategy has identified a number of digitalization tools that can bring opportunities to the company, including robotics and automation. (UPM Annual Report 2019) Digitalization has also had an impact on UPM Sourcing, which is currently changing at a rapid pace. The organization is running a major program called Digital Sourcing Ecosystem (DSE), which aims to enhance current ways of working, risk management, process efficiency, automation,

and digitalization. DSE will introduce a cloud-based platform SAP Ariba for managing Source-to-Invoice process and to build connections with the company's suppliers.

UPM Sourcing's RPA journey started already in 2016 when the organization began to explore the potential of this automation solution. In the following year, the first process was automated by using robotics. This process was manual order confirmation reading, meaning that suppliers send their order confirmations to the robot's email and it checks the correctness of order confirmation by comparing it to the order in SAP. The robot also attaches the confirmation behind the order and informs the responsible buyer if something does not match. After this successfully implemented process automation, there have been several other RPA implementations in UPM Sourcing. Purchase order creation, direct material price updates and service entry postings are examples of processes that are partly done with robots today. In addition, more than 120 RPA ideas have been collected from end-users to date.

Therefore, it can be said that UPM Sourcing's RPA journey is progressing well, and that is why this study is not focusing on finding new potential processes for robotics. Instead, this empirical part deals with two already implemented RPA projects and examines the benefits, challenges, and lessons learned. Thus, this study examines how RPA has been utilized in UPM Sourcing. In addition to these RPA cases, more specialized information is collected from RPA experts. This research also examines the choice problem between RPA and traditional back-end system automation solutions such as SAP automation and system integrations. This issue is topical due to the organization's ongoing Digital Sourcing Ecosystem project and investments in new information systems. All of the collected and analyzed data will eventually answer the main research question: How robotic process automation can be utilized to improve supply management processes?

4.2 Data collection and analysis

Data for this study was gathered with semi-structured interviews. Saunders et al. (2009) states that semi-structured interviews often include a preset of questions and various themes that can be linked to the objective of the research. This type of interview also allows the respondent to express more of his or her own thoughts and opinions because the conversation is freer in the interview situation. In addition to these interviews, the company's internal information such as RPA materials and process descriptions are utilized in this empirical part.

A total of five different interviews were conducted for the study. As can be seen from table 5, two of the interviews were case study interviews and three of them were RPA expert interviews. The purpose of the case study interviews is to go through two different RPA cases that were recently implemented in UPM Sourcing. Three RPA expert interviews were done to get a more detailed and deeper understanding of RPA capabilities and purposes.

Because both types of interviews have their own purposes, the interview questions were formed differently. Interview template of RPA case interviews can be seen from Appendix 1, and the interview template of RPA expert interviews can be seen from Appendix 2. Although the questions are not exactly the same in these templates, they have been formed by taking into account that the findings of UPM's RPA cases and the findings of RPA expert interviews could be compared as well as possible. For example, the question "How did you choose this process to be automated?" from RPA case interview template and question "How the selection of right process candidates should be done in your opinion?" from RPA expert interview template aim to examine the same phenomenon but from different perspectives.

Table 5. Description of respondents

Respondent	Type of interview	Role of respondent	RPA experience
Respondent 1	RPA case	Senior Business Support Specialist at UPM	Participated in a couple of RPA projects
Respondent 2	RPA case	Procurement Team Leader at UPM	Participated in a couple of RPA projects
Respondent 3	RPA expert	Head of Robotics and Process Automation at UPM	2 years
Respondent 4	RPA expert	Head of Continuous Services at DWF	4 years
Respondent 5	RPA expert	Consultant at DWF	5 years

Respondent 1 is working as a senior business support specialist at UPM. His responsibilities include the development of procurement processes and supporting the company's buyer network, especially with the issues related to the SAP environment. He has participated in a few RPA projects, but the biggest one has been a project that was related to automation of direct material price updates from Excel template to the ERP system. Respondent 2 is working as a local procurement team leader in the company's mill sourcing. She is responsible for procurement processes and their development in the Central Europe region, and she has about 20 years of experience in sourcing and procurement. Thus, she knows well local procurement processes and how they are built and synchronized with the back-end systems and SAP. She has been involved in two RPA projects, which are the automation of service entry postings and low-value purchases.

Respondent 3 is working as a head of robotics and process automation at UPM, and he has about two years of RPA experience. Previously, he has been working with IT's shared services and he has work experience related to different system integrations, Electronic Data Interchange, data warehouses, and digital archives. Respondent 4 is working for Digital Workforce that provides services related to

software robotics and intelligent automation. His role is head of continuous services and he takes care of their cloud services such as Robot as a Service concept and their Run Management, which purpose is to maintain, monitor and secure RPA automations. He has about four years of RPA experience in two different companies. Respondent 5 is also working for Digital Workforce and he has about five years of RPA experience. He works in the company's consulting and customer acquisition. In consulting, he charts potential RPA cases for customers and helps them to see if the process is suitable for RPA and how big a business case is.

The interviews were conducted as individual interviews. RPA case interviews were conducted with Skype, as the interviewees work in Germany. RPA expert interviews were conducted face-to-face at UPM's and DWF's headquarters in Finland. The interviews were recorded and transcribed. The findings of the interviews have been analyzed based on the same themes that the interviews follow. As there are two kinds of interviews, RPA case interviews and RPA expert interviews, the findings are analyzed and presented separately. The results of the RPA expert interviews are presented in such a way that answers from each interviewee are collected under the same main themes. The categorization of the answers facilitated the answer to the research questions as they were formed in the same way.

4.3 Reliability and validity

In scientific research, it is important to evaluate the credibility of the research by assessing its reliability and validity. The purpose of this evaluation is to mitigate the possibility of misinterpretations and mistakes related to the research process (Tuomi & Sarajärvi 2009, 134). According to Saunders et al. (2006, 603), the validity of research refers to the ability of the used research methods to precisely assess what they were supposed to.

Yin (2017) states that the quality of the case study should be assessed through four aspects: construct validity, external validity, internal validity, and reliability. The first test construct validity means that the researcher should identify correct operational measures for the phenomenon being studied. External validity refers to how

generalized the findings of the research are. In many cases, the findings of case studies are not so generalizable, as they are studying the subject in a limited environment. However, Yin (2017) argues that the form of research questions can help for seeking generalizations, and that is why the researcher should use “how” and “why” questions in case studies.

Yin (2017) states that the internal validity test is for explanatory or causal studies only and it tries to establish a causal relationship, where a researcher is trying to explain why and how certain event x leads to event y. Last aspect that (Yin, 2017) mention is the test of reliability, which objective is that a later researcher could conduct the same study and end up with the same results and conclusion. The purpose of this test is for the researcher to document their own research closely. The objective of reliability is to mitigate the biases and errors in the research.

In this study, these quality approaches were taken into account as well as possible and the necessary actions were taken to ensure the quality of the research. The research process was carefully documented, notes were taken in different phases and interviews were recorded and transcribed. The generalization of the study cannot be totally ensured as the case study focuses on a single event. However, in this study, RPA expert interviews were also conducted to improve the generalization of the research.

5 RESULTS

This chapter introduces the findings of the interviews. Firstly, the results of RPA case interviews are presented. These interviews are related to two RPA implementations that have been done in the company recently. The first one is the price update process and the second one is the service entry posting process. Secondly, the results of the RPA expert interviews are presented under each theme. Finally, the findings of each interview regarding the use of RPA in supply management have been compiled.

5.1 Automation of price update process

This chapter examines one of the RPA projects that was implemented at UPM Sourcing recently. The reason for the automation was that the price updates were taking a lot of buyers' time and required a lot of manual effort. The idea was to get an automated flow of agreed prices from a negotiated contract or price list to the procurement system. The wanted outcome was to have the right prices and terms used in the procurement system with the less manual effort involved in the update process. Next, the results are presented in such a way that they are divided into three parts: before the RPA implementation, during the RPA implementation, and after the RPA implementation. Respondent 1 was responsible for this RPA automation, so the results are based on his interview.

Before the RPA implementation

Respondent 1 said that at first, they thought about what RPA can do and what processes would be most beneficial. Then, there came a lot of comments from the buyers that manual price updates are taking a lot of time and always take place at the turn of the month when there are also much more tasks to do. Another reason was that the price lists were always in a different format (excel, pdf, email), so it was difficult to find a link between the price list and the procurement system. The biggest expected benefit was to save buyers time.

Figure 4 presents a high-level description of how the price update process was performed before automation. Respondent 1 stated that the last two steps of the price update process took most of the time of the buyer. The buyer had to open the correct price list and review it, after which he or she had to manually enter the correct prices into the system. Due to a large number of suppliers and materials, manually updating all prices was slow and sensitive to typing errors.

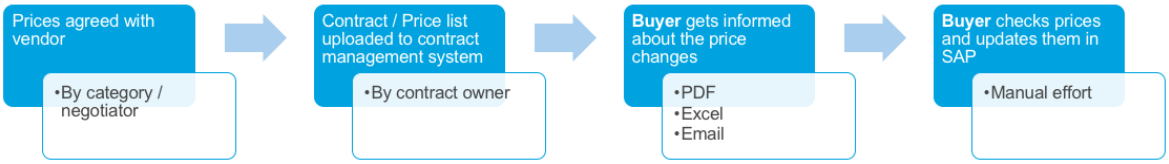

Figure 6. High-level description of the price update process before RPA automation

According to respondent 1, there were many reasons why RPA was chosen instead of back-end system automation. He stated that they had already a way to mass update the prices into the system using traditional automation, but the template used for this was not a suitable form to agree on prices with the supplier. In other words, the price lists were wanted in an easy-to-read format for people in a way, so that they could also be updated automatically. Also, this new standard price list was not suitable for mass updating in the old way. Respondent 1 said they saw RPA can bring added value to the process:

"We could not have done certain things such as sending emails and creating reports with the back-end automation. However, we wanted to continue the process workflow outside the back-end system, and with RPA it was possible." (Respondent 1)

During the RPA implementation

At the beginning of the project, there was a team of three people to start the project. In addition to respondent 1, there were process owner and RPA manager, who was leading the project and helping to break the barriers to start the implementation. According to respondent 1, first, they discussed the selection of RPA vendor, for example. The project was more business-driven, but there were also IT people needed to get the right access rights for the robot, among other things. After the

beginning, the organization's buyers joined the project to determine the process description. After the RPA vendor was involved in the project, then the project was mainly a collaboration between the procurement team and the RPA developer.

Respondent 1 mentioned some of the challenges that the project had to face. This project can be divided into two parts, and firstly, the formats should be standards in order to automate the process. As it was mentioned earlier, there was a lot of variance between the price list formats. According to respondent 1, getting the price list to the standard format and suitable for all purchasing categories proved to be a difficult task to do. Also, the introduction of the new price list for different categories required some input.

Another challenge was related to the implementation time of RPA. Respondent 1 said they assumed the implementation of RPA to be faster and more iterative than it really was. Transparency of development was also one of the challenges he mentioned. It was not always clear what RPA developer was really developing at that moment.

"When the robot was moved to production, the challenge was to get enough volume for it as quickly as possible to ensure and validate its work quality. If I would do something differently now, I would do more testing and involve more buyers in the testing to get more feedback from users at an earlier stage." (Respondent 1)

Respondent 1 said that the biggest learnings were related to RPA technology and its capabilities, as it was a new technology for them. The other learnings were related to the above mentioned challenges. He stated that if this technology is sold as a fast and iterative process then the developer should have more time to work with them and take meetings more often. Respondent 1 also mentioned that sometimes it seemed that the developer went too far and made assumptions about the process without asking for them first. However, he suggested a development idea for this issue:

“These things could be improved so that the developer would share the Kanban board with us, for example. This would increase the transparency of development, and everyone would know what part of the process is being developed and when.” (Respondent 1)

After the RPA implementation

At the moment, the robot is in production and independently handles price updates. But the robot will probably need some small improvements as the volumes grow and the shortcomings can be noticed. The robot is not yet widely used, as the introduction and adoption of a standard price list have slowed it down. The project lasted about four months for various reasons, and it is a too long time. Respondent 1 said they learned that such processes are easy for a robot that does not have to change the input file from the original.

“We started the project with one size fits all approach that eventually slowed down the project. Then, when you need to change some template that people have used to use for years, it seems to take a lot of time. Nonetheless, this new standard price list will certainly bring benefits in the long run.” (Respondent 1)

Respondent 1 also said that the duration of the project was affected by the fact that RPA was a new thing for them and this was one of the first RPA projects. However, a lot of barriers have now been cleared, such as how to get the right access rights for the robot. He stated that this kind of issues take a lot of time when you have to do them for the first time.

Figure 5 presents a high-level description of how the price update process is performed after automation. As can be seen from the figure, the new price list is sent to the robot’s email, from which the robot opens it and logs into SAP to update the new prices. After the prices have been updated, the robot sends the report to the buyer and the contract owner. The buyer is responsible for reviewing the report and make corrections manually if something goes wrong with the automatic update.

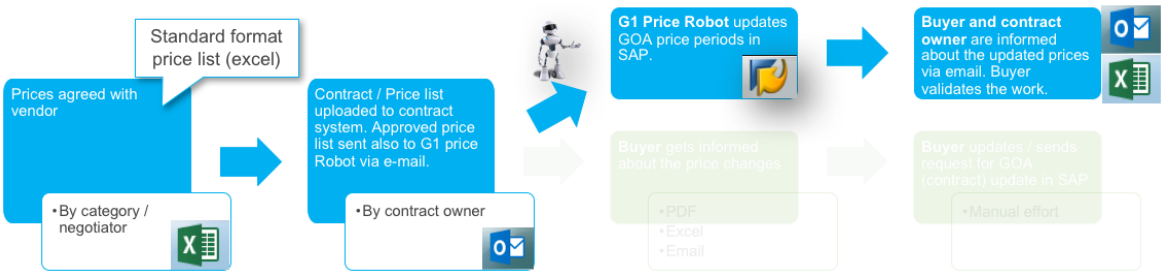

Figure 7. High-level description of price update process after RPA automation

Respondent 1 stated that it is difficult to say how the benefits have been realized because the robot has only been in production for a short time and the volumes have been low. However, probably the greatest benefit will be that the prices are correct and timely entered in the procurement system, so the invoices are also correctly and automatically posted for the purchase orders. He also mentioned that in the future it would be good to calculate the realized benefits. Respondent 1 said that the standard price list should be adopted more widely next and the robot's work should be closely monitored. Lastly, he said that the robot's functionalities will be further developed in the future.

5.2 Automation of service entry posting process

This chapter examines another RPA project that was implemented at UPM Sourcing recently. The reason for the automation was that the service entry postings were taking a lot of buyers' time and contained a lot of typing work. These service entry postings are usually done by the end of the month. The idea was to automate the regular service entries, which means that they are the same every month. These are constant monthly fees, for example, technical services, renting or leasing fees. Next, the results are presented in such a way that they are divided into three parts: before the RPA implementation, during the RPA implementation, and after the RPA implementation. Respondent 2 was responsible for this RPA automation, so the results are based on her interview.

Before the RPA implementation

Respondent 2 said that this process was chosen because it has quite the same steps always and there are a lot of postings in a very short time period during the

end of the month. Also, service entries are already based on the Excel sheet, so it was possible to automate this process with RPA. She stated that they wanted to start with the process that is simple, has not so much variance and has a lot of transactions.

According to respondent 2, before the automation, a purchasing person had to read certain information related to service entries from the Excel. Then the same person needed to manually enter certain information and fields from the Excel to the procurement system. So, the process consisted of a lot of reading and typing work.

According to respondent 2, there was one major reason why they decided to use RPA instead of back-end system automation. She stated that they have used to automate processes by using the back-end system, but in this process, they did not see a chance to do it completely in the back-end system. They had to use RPA because of the Excel file, as it cannot be uploaded or downloaded in the current procurement system, and it must be read field by field and the data must be entered field by field to the system. Therefore, there was no solution in place how it would have been done in the back-end system.

During the RPA implementation

Respondent 2 said that in addition to her, there were a couple of buyers who helped her to define and describe the process. This project was also a business-driven, and IT function was not involved that much. According to respondent 2, there were no major challenges during the implementation as the process is not so complicated. However, it was a surprise to her that you have to teach the robot each and every single possible scenario and decision in the procurement system, for example, every pop-up window that could happen. Also, respondent 2 was wondering that how much variance you could have in the one simple transaction. Because when you are doing the process manually, you do not really think about what fields you are clicking in the system.

Respondent 2 said that the main learning was that you have to have in mind that you really need to teach the robot each step and variance that can be possible. As

much as you can clearly define and describe the process already during the development phase, then it makes it much easier to automate. She also mentioned that they learn a lot of RPA technology itself, and how the RPA developers are doing the work and what elements are important for them to develop the process.

After the RPA implementation

According to respondent 2, it took almost half a year to develop this automation. The project took a bit more than she expected. She stated that they lose some development time because of the summer holiday period. Also, they had to teach the robot a bit more as they had expected. Respondent 2 said that this RPA process is already being used in the company's mills in Germany. It is also introduced to all other mills and it is ready to use for every mill that would like to use it. She stated that other mills are also doing the same kind of service entries, but the question is how many transactions they have there. So, the volumes should be analyzed in each mill first.

Respondent 2 stated that if the development time is not considered, everything else went according to plans. She mentioned that it was a surprise that the robot is not that much faster than a human doing the process. She stated that you have to have in your mind that the robot cannot always work that much faster than a human since it has to do the same steps and the system is limiting its working speed too.

Respondent 2 said that today the robot is doing the whole posting process in SAP completely by itself. After the posting, it sends the report to purchasing personnel, and it tells you the posted document numbers and if there were any errors during the process. So, nobody has to do anything if it goes smoothly. She mentioned that the Excel file is something that still must be done by a human. But for these regular postings, they can be prepared for the whole year in advance, for example, you can do them in January and prepare them for each month already. However, she said that they are planning to do some additional RPA developments, which would extract the Excel file automatically in the future.

According to respondent 2, the main benefit is the time savings that have been achieved already. She said that they have not calculated the time savings in terms of money, but it would be good to do it in the future. What it comes to faced challenges after the implementation, she said that there have not been any special ones. Sometimes there has been some new situations that need to be taught to the robot. Finally, she mentioned that they still have to develop a report to monitor which mills have how many service entry postings and to follow up how the robot is doing. Also, the additional developments should be considered, and the process could be implemented in other mills if they would like to use the same robot.

5.3 RPA expert findings

This chapter presents the results of the RPA expert interviews. The findings are presented under four different themes: typical RPA cases and process selection, benefits of RPA, challenges of RPA and RPA versus traditional back-end system automation. There was a total of three expert interviews, and they were able to provide a decent amount of data for this study.

5.31 Typical RPA cases and process selection

When an organization is starting to exploit robotic process automation in its operations and considers potential processes for automation, certain things should be taken into account. Respondent 5 stated that the RPA maturity level of the company determines which kind of processes can be automated with RPA. If the company is just starting to adopt RPA, they should choose easier and simpler processes that are mature, standardized, stable and harmonized. Respondent 4 stated that if the process is only in the creation phase or it has never worked properly, then it is pointless to assume that the robotics would fix it. A software robot can use multiple target systems, but you should start with a process that uses only a few different systems. The organization can move to more complex and challenging processes as its RPA capabilities increase (Respondent 5).

Rules-based, digitality and well-structured are the basic requirements for the process to be automated with RPA. The task must also have enough volume to make its automation reasonable. Enough volume means at least 0,25 full-time equivalent (FTE) per process, which is about 10 hours of manual work per week. This 10 hours of work can consist of work by more than one person. For example, 10 category managers who do the same task one hour a week. RPA is widely used in standard and regulatory environments such as banks, payroll, and finance departments. (Respondent 5) Typical processes that have been automated with RPA are usually related to different data inputs, checking data/tracking errors and controlling orders (Respondent 3).

"If you consider that I have been working at UPM six years now, and about 15,000 employees have left the company during this period. So, we have a lot of business processes in which the work has remained, but the people have left, and now we do not have enough resources to complete all of the tasks. Many of them are processes that do not affect our core business itself, so our product manufacturing and sales are working well. However, there may be tasks related to compliance or order closing, for example, which have not been considered enough. There may be a lot of potential for robotics." (Respondent 3)

The typical development time for RPA implementations is six to eight weeks. If the development time lasts longer than that, it is often too long time and not desirable, because target systems may have already changed or someone has developed the process. (Respondent 5) Difficult processes should be cut into parts and automated one part at a time. End-to-end automation is rarely even worth pursuing through RPA, rather large volume flows should be identified and automated. The idea is to get the automation to the production after one or two months of development and take the benefits out of it, after which you can do new automation. (Respondent 4; Respondent 5) The programming of the robot itself is often quick and can be done in a couple of days. However, different tasks take a surprising amount of time, such as defining the process, getting the necessary user rights for the robot, installing different software on the robot's workstation, creating enough test cases and testing them properly. (Respondent 3; Respondent 4)

5.32 Benefits of RPA

As it was stated in the theory part, there are many benefits that software robotics can bring to the organization. Respondent 5 said that the cost savings are more important to some companies than others. For example, in the banking world, RPA implementations are primarily driven by cost savings. Instead, in large Nordic industrial companies, these implementations are done for various other reasons. These organizations use RPA to do things more efficiently, speed up process lead times, reduce errors or reduce tedious and boring manual work. Respondent 4 stated that RPA allows people to do the work they were initially hired for because often an excessive amount of working time goes to different kinds of information retrieval and data entry.

"Of course, FTE reduction is always counted in the business case of industrial companies also, but rarely they can be actually reclaimed as staff cuts. Usually, the reason for these automations is that the company tries to cope with the same workload even when the employees retire. Or it does not want to increase the number of staff even though it is seeking growth. Or it wants to provide more services for a larger audience with the same number of employees." (Respondent 5)

"For example, RPA can ease the workload concerning the month and quarter changes by running the reports and error information in advance, so we know what is missing when the month changes. Also, we do not have to make decisions based on old information, because the robot runs the same data daily for us. In other words, RPA can do tasks that would be absurd and too expensive for people to do, as robots perform the same tasks cheaper." (Respondent 5)

Another benefit of RPA is that it allows lowering the bar for automation. In other words, companies are able to automate processes that would be impossible or relatively too expensive to automate with traditional solutions. (Respondent 5) RPA's value proposition is very good when it comes to the speed of development and the price tag. Robots are also able to work around the clock and they usually

work faster than humans, depending on the speed of the target system. (Respondent 3)

5.33 Challenges of RPA

As with any other new emerging technology, companies also face different challenges with RPA. Respondent 4 stated that organizations often have unrealistic expectations of software robotics, and sometimes they expect that RPA fixes a process that has never really worked. It is important to unambiguously understand and jointly accept what the robot should do. In addition to unrealistic expectations, companies usually face challenges related to technical issues, information security issues and platform setup issues. For example, getting the correct user rights for a robot, opening firewalls and installing the right software on the robot's workstation can be considerable challenges. (Respondent 3; Respondent 4; Respondent 5) Respondent 3 also mentioned that currently, RPA software are not yet very mature:

"For example, if some RPA market leaders do not have any proper reporting capabilities that it could make some nice dashboard reports on the performance of the robot, it means that we are still dealing with very immature solutions." (Respondent 3)

The next recognized challenge is that companies are sometimes greedy for automations. 80/20 rule can be a general rule for the automation level of RPA, meaning that 80% of the whole process can be entrusted to the robot and the remaining 20% can be left to humans. The robot should perform the tasks that are straightforward and easy to teach it, so people have time to focus on difficult cases. If a company tries to raise the level of RPA automation close to 100%, then there are usually too many rules, exceptions, and complexities that will slow down the development of RPA. This means that the targeted benefits are not quickly achieved and the payback time of the robot is considerably prolonged. (Respondent 5)

Respondent 4 stated that it may be challenging to get the right people involved in the RPA project. There must be employees who know how the process is performed

at a practical level. Respondent 5 said that challenges during the running time of the robot are often related to the complexity of the environment. For example, if the target systems change or some field changes location in the system or input file, then the robot will often stop working. All of the respondents mentioned that robot maintenance is a challenge for many companies. Respondent 4 said that companies do not think about maintenance enough when starting the RPA project. It must be clear that who will handle the situation if the target system changes or the robot receives new material for the first time.

”The manual work that the robot will be performing has probably been in the organization for a long time, and the assumption is usually that the same work will be still there after 12, 24 or 36 months. So then, you should have the idea of how you are going to maintain the robot for the next 12, 24 or 36 months. Because the benefits will be achieved over the coming months and years, not when the project is transferred to production.” (Respondent 4)

Another big challenge is related to process modeling. According to Respondent 5, organizations often have a rather poor understanding of their own processes and the number of possible exceptions. He stated that it can be hard to find suitable processes for RPA and understand their automation potential in a way that their automation would be reasonable from an organizational perspective. He also mentioned that employees do not always tell their automation ideas openly, because they are afraid of losing their jobs to robots. Also, there is usually a lot of tacit knowledge about the processes in the companies, as people have their own ways to perform some tasks, and these methods are not always written into any work instructions.

5.34 RPA versus traditional back-end system automation

Respondent 3 and 5 stated that one of the biggest differences between RPA and traditional back-end system automation is the level of investments and the time of development. The purpose of RPA is to utilize existing systems quickly and lightly. It allows organizations to automate processes with little effort and fast timetable

without changing existing business systems. Respondent 3 said that especially processes that require data transfer from system A to system B and validating or modifying the data between the transfer are the most optimal for software robotics.

Respondent 4 and 5 mentioned that the process volume and the number of transactions have an influence on the selection of suitable automation solution. RPA is not the right choice if the process has very large volumes and fast lead times. For example, if we think about mill orders, they are better suited for ERP, EDI, and traditional integration. However, they said that RPA complements the possibilities of automation when we are moving from the area of high volumes to medium volumes and smaller business cases. Those medium volume processes that are difficult to execute through back-end system automation are often good for RPA. Also, robotics may be a good option if we are dealing with third-party systems, where the system environment is not in our own hands (Respondent 4).

"But it is very difficult to say at first hand when to use what automation solution because each process is unique and must go through case by case. At UPM we are good and mature to do also system integrations, so they are often a potential automation option. System integrations may be a good option if the volumes are high and the data is standardized, but of course, it may require system development." (Respondent 3)

Previously, there was a trend that companies wanted highly customized ERP systems. However, nowadays companies want to keep their business systems "clean" without any special customizations so that the system updates are cheaper and easier to execute. Thus, the customizations are now being made outside the system, for example with RPA, meaning that existing business systems stay unchanged. (Respondent 5)

According to respondent 5, the maintenance costs of software robotics are often relatively higher compared to traditional back-end automation. This is because the environment is constantly changing, and if the business system or input file change, then the robot usually needs some kind of maintenance to keep it running.

Maintenance costs of traditional IT development are normally between 10-15% of total costs, but in RPA the corresponding figure is about 30%.

One of the pitfalls of RPA is that business system development should not be neglected, because RPA requires good systems to work well (respondent 5). Respondent 3 mentioned that the type of business system affects the choice of the automation solution. If your company uses some kind of software package in which there will be one release globally once a year and you cannot configure it as you want, then RPA can be a more reasonable option. But if your business system is such that you have an agile way to easily modify it and the price is reasonable, then it can be a better option. For example, in SAP you can do a lot of configuration and development by yourself. However, the price of SAP development has often been significantly higher than robotics at least at UPM.

"At UPM we can say after one hour that would the process be suitable for RPA, so if you have to automate some process, I would definitely at least take that yes/no comment and what would be the price if we do it through RPA. And the same questions can be asked from a system development partner that what this automation would cost and how long it would take. Then you would have at least some concrete numbers to compare that which one is more reasonable from the viewpoint of the amount of investment." (Respondent 3)

Organizations should also consider using robotics if their current business system is retiring and they do not want to make any changes to it anymore, because the business environment is dynamic and operations should still be constantly developed. So, RPA can continue the life cycle of old systems and bring new features to it. Also, it allows us to automate processes that are not yet supported by the back-end system but will be supported when the next release comes out after 6 or 12 months. In addition, RPA enables process automation at an earlier stage and, for example, the company can test new service concepts without having to invest millions of euros first. (Respondent 5)

5.4 RPA in supply management

This chapter will examine the interview results on the use of RPA in supply management. This section presents the findings of all five interviews. As it was stated, RPA is widely used in standard and regulatory environments such as banks, payroll, and finance departments. Respondent 5 stated that the use of RPA in procurement processes is only at the level of thought by many companies, but he believed that it will come in the next automation wave. Each of the respondents said that robotics can be extensively utilized in procurement processes. According to respondent 5, accounts payable and purchasing processes are often subject to automation because there is a lot of manual work done there. He said that the whole P2P process is the optimal target for automation and tasks like invoice verifications and approvals are often automated.

Despite the fact that robotics has not yet been extensively used in procurement, several procurement processes have already been automated with robotics at UPM Sourcing. In addition to the price update process and service entry posting process, the organization has automated processes such as purchase order creation from excel template, purchase order creation from purchase requisition, purchase order creation for low-value purchases, purchase order confirmation reading and chemical safety instruction reading and updates to the system. Also, there are several other processes in the implementation or feasibility phase. (Respondent 1; Respondent 2)

Respondent 3 stated that procurement processes that require a lot of data input to different systems are best suited for RPA. In such processes, people start making mistakes at some point, so RPA brings quality improvements to this. According to respondent 5, master data management issues and order-related processes are the most common RPA cases in procurement. Respondent 4 said that reconciling sourcing contracts with invoices, updating prices, request for information from suppliers and creating different reports and order forms are potential processes for robotics. According to respondent 5, it is a completely different thing to talk about direct or indirect purchases:

"Direct purchases are often EDI traffic with standard business partners, so they go from your ERP to the supplier's ERP. And in these cases, much is often already automated and you have all the demand forecasts, etc. in place. Instead, indirect purchases involve a lot of manual work, ordering and emailing, which could certainly be automated if only the volumes are sufficient." (Respondent 5)

Respondent 2 stated that the biggest benefit of RPA is that it can release purchasing personnel from manual typing work to more valuable work that requires human thinking. Respondent 1 said that robots could act as assistants to UPM's buyers, and would handle the boring manual work. This would lead to time savings and improved employee motivation. Another benefit he mentioned is that RPA encourages the organization to reconsider its processes. Although the process would not be automated through RPA in the end, studying the utilization of RPA will add value by considering the process flow and streamlining that particular process. Respondent 1 also mentioned that, despite the benefits of RPA, it is not suitable for all processes:

"RPA offers a lot of opportunities for us, but we have to think about which processes can be automated with it, and which processes should be automated with back-end automation. That is the biggest question mark at the moment. If the back-end automation is cumbersome, slow and expensive, it will of course, justify the use of RPA. These cases should be compared more in terms of price and capabilities." (Respondent 1)

Respondent 1 stated that if the company is going to utilize RPA more in the future, and if the robots will be working more within ERP systems, then it should be ensured that there is some kind of transparency and communication between RPA and ERP developments. Otherwise, this technology risk may be realized and the processes stop working. Respondent 2 also saw risks for RPA overuse:

"Robot needs clear defined rules to work properly, but of course then you have to predefine the process completely and it is not that flexible anymore. This can be considered a risk if we automate too much with RPA and the flexibility of the

processes is reduced too much. In certain cases, human thinking should be also available." (Respondent 2)

Respondent 2 said that the use of RPA in procurement should be considered whenever data is entered into the system and if the process is constantly the same and you have predefined rules for the robot. She noted that there are more such processes in operative purchasing, but the opportunities for automation in strategic sourcing should not be forgotten either. Respondent 1 agreed with her that there are more opportunities in operative purchasing because there are a lot of transactions and volumes that can bring cost and time savings. He also stated that when RPA technology evolves, it can be utilized even more in strategic sourcing. For example, a robot could collect supplier-related data from the Internet and make different reports of them.

6 DISCUSSION AND CONCLUSIONS

In this last chapter, the whole study will be summarized, and the research questions presented at the beginning of the thesis are being answered and discussed. The answers to the research questions are formed by utilizing both theoretical and empirical findings, and their connections are being compared. The comparison of theoretical and empirical findings will help to form as wide and precise answers as possible, and it can also be noticed if there came up with any new findings and novelties related to the topic.

6.1 Discussion

The objective of this thesis is to increase the understanding of the importance of business process automation for supply management. The purpose is to highlight the changing role of procurement and examine the procurement function and its processes to emphasize the need for automation. Also, the goal is to examine the concept of robotic process automation and understand how it really differs from traditional business process automation. In total, four research questions were formed, and the main research question was:

How robotic process automation can be utilized to improve supply management processes?

The main research question is divided into three sub-research questions, which help to form the answer to the main research question. For next, these sub-research questions will be answered and discussed.

1) What kind of processes are best suited for RPA?

The purpose of the first sub-research question is to find out what kind of processes are best suited for software robotics. The empirical results revealed that the process must be rules-based, well-structured and in digital format to be automated with RPA. As stated in the theory part, several authors have reported similar elements related

to the process characteristics. According to GEP (2018), Slaby (2012), and Willcocks et al. (2015a), the process should be highly rules-driven, high volume, standardized, and stable to be automated with RPA. While previous studies have emphasized that the process should be of high volume, an interesting finding of this study was that the process should have enough volume, at least 0,25 FTE per process, to make its automation sensible. In this study, it was also found that very high volume processes are often more suitable for traditional back-end automation.

According to empirical results, different data inputs, checking data/tracking errors, and order controlling are typical processes that have been automated with RPA. Willcocks et al. (2015b) also stated that processes that require data transfer from, for example, Excel to ERP are good for RPA. The empirical part of this research also found that end-to-end automation is rarely worth pursuing through RPA because it often leads to excessively complex rules and then, the development time is too long. The development time should not exceed eight weeks because the process or target systems may have already changed then. Thus, difficult processes should be cut into parts and automated one part at a time. The company should start with the easier processes that are mature, standardized, stable and harmonized. The use of robotics is not even worth considering if the process is only in the creation phase or it has never worked properly.

2) What are the benefits and challenges of RPA implementation?

The purpose of the second sub-research question is to highlight the benefits that the company can achieve and the challenges that it can face when implementing RPA solutions. Regarding the automated price update process, it is hard to say if there are already some realized benefits since the volumes have been low due to challenges related to the introduction of the new standard price list. However, it is expected that the automation of the process will save a lot of buyers' time and the prices will be correctly and timely entered in the procurement system. What it comes to the automation of service entry posting process, some time savings have already been achieved. Previous studies have also emphasized the benefit that RPA releases people to do higher-value tasks, which require problem-solving and

complicated exception handling (GEP 2018; Slaby 2012). Generally, it was stated in the empirical part that the RPA allows lowering the bar for automation because its development is cheap and fast. This finding was also supported by previous literature as Slaby (2012) stated that while an onshore FTE costing USD 80,000 are able to be substituted by an offshore FTE for USD 30,000, a software robot can carry out the same work for USD 15,000 or even less.

An interesting finding of the RPA expert interviews was that the cost savings are often not the first priority for large Nordic industrial companies. Instead, they are trying to reduce errors, speed up process lead times, and reduce boring manual work. However, FTE reduction is always counted in the business case of industrial companies also, but rarely they can be actually reclaimed as staff cuts. Usually, the reason for these automations is that the company tries to cope with the same workload even when the employees retire. Or it does not want to increase the number of staff even though it is seeking growth. Xchanging case presented in the theoretical part supported this finding, as its RPA automation was not about replacing people with technology but about continuous improvement (Willcocks et al. 2015b). In banking companies, the situation is different, as automation is driven by personnel savings.

There were also many challenges related to RPA implementation found in the theoretical and empirical part of the study. Previous studies have stated that employee resistance and their preconceptions against robotics can create barriers to RPA implementation (Asatiani & Penttinen 2016; Hallikainen et al. 2018; Rozario et al. 2018). RPA expert interviews also revealed that employees do not always tell their automation ideas openly because they are afraid of losing their jobs. However, there have not been any signs of employee resistance at UPM due to proper communication of RPA projects and emphasizing the fact that the purpose is not to replace people but to reduce routine manual work and focus more on higher-value activities.

As the project of automation of the price update process proved, it was challenging to get the price list to the standard format and suitable for all purchasing categories.

The robot was ready in production before all the price lists were harmonized and in the standard format. That is why it was challenging to get enough volume for the robot in order to validate its work quality in the beginning. The implementation time of RPA proved to be challenging in both studied RPA projects, and these projects took longer than expected. There were various internal and external reasons for that. For example, the RPA developer did not have enough time to work with the price update project. Also, getting the right access rights and other technical issues slowed down the implementation.

The transparency of development was another challenge that was mentioned regarding the price update project. It was not always clear what RPA developer was really developing and when. Another minor challenge that was mentioned was related to the relatively slow working speed of the robot in the service entry posting process. This issue was also mentioned by Penttinen et al. (2018) and Willcocks et al. (2015b) that the software robot cannot work faster than the overall process allows to.

3) How to choose between RPA and traditional business process automation?

The purpose of the third sub-research question is to examine how RPA differs from traditional back-end system automation and what things should be considered when selecting the right automation solution. In the empirical section, it was found that the RPA is not a competing technology for traditional business process automation but is used for a different type of processes and purposes. The same argument was also stated in the theory section that the RPA does not replace the back-end system automation solutions but rather complements them (Lacity & Willcocks 2016; Bygstad 2016).

RPA expert interviews supported the theoretical findings that RPA implementations are quick and cheap to implement compared to back-end system automation. However, as both RPA cases pointed, it is not always that quick in practice. It must be kept in mind that many elements affect development time such as process complexity, company’s RPA capabilities and the amount of time that the RPA

developer has for the project if the development is outsourced. Previous studies have not discussed the relatively high maintenance costs of RPA compared to traditional IT development. Thus, an interesting finding of this research was that the maintenance costs of RPA can be as much as 30% of total costs, whereas in traditional IT development, it is normally between 10-15%. It is because the RPA solutions cannot make independent decisions or adapt to the changing infrastructure without effort (Penttinen et al. 2018; Asatiani & Penttinen 2016).

As stated earlier in this chapter, the automation of high volume processes such as mill orders is often more reasonable to implement by utilizing ERP system, EDI messages and traditional integration, whereas RPA is better suited for medium volume processes. The type of the business system affects also the choice of the automation solution. RPA can be a good option if you cannot configure your business system easily and as you want. As it was stated by Hallikainen et al. (2018), the robot can write and send emails and reports regarding the conducted work. This was also one of the main reasons for the selection of RPA in the price update and service entry posting processes as it was stated in those cases that with RPA, the process workflow could be continued beyond the back-end system. In other words, you should consider RPA if you want to receive reports related to the executed process automatically.

How robotic process automation can be utilized to improve supply management processes?

Finally, the purpose of this main research question is to explain how RPA has been utilized and how it can be utilized in the area of supply management. As stated in chapter 2.3, the automation opportunity is greatest in the operational stages of the purchasing process, which include several transactional activities such as order handling, invoicing and claim processing (Jain & Woodcock 2017; Kim & Shunk 2004). Empirical findings also supported this statement as it was found that the whole P2P process is the optimal target for automation since it consists of a lot of manual routine work. Also, all the implemented RPA processes at UPM are mainly related to purchasing activities. Furthermore, the research of GEP (2018) stated that

especially downstream processes, such as purchase-to-pay processes are optimal for RPA. Whereas, upstream processes such as supplier or contract management, and production optimization are better to automate by using artificial intelligence solutions.

Supply management processes that require a lot of data input within different systems, and where the process is constantly the same, are best suited for RPA. Thus, strategic sourcing activities such as different actions in source-to-contract process should not be neglected when considering potential targets for RPA. It was also stated that there may appear new automation opportunities in the area of strategic sourcing when the RPA technology evolves. For example, a robot could collect supplier-related data from the Internet and make different reports of them.

It was also stated that there may be more opportunities for RPA in the area of indirect purchases as it involves a lot of manual work, ordering and emailing. Whereas, on the direct procurement side, the processes are often well automated through ERP systems and EDI messages.

When considering the utilization of RPA, the possibility to use back-end system automation solution should be considered carefully too. The choice problem between these automation solutions has proved to be a difficult thing to do for UPM also. For some processes, the company has found that the robotics is a good temporary automation solution before the new cloud-based platform is established. Asatiani and Penttinen (2016) have also argued that in many cases the RPA is mainly a temporary solution closing the gap between running manual processes on old systems and developing new heavyweight IT solutions.

6.2 Recommendations

This study provided useful information for companies looking to adopt RPA solutions, especially from the viewpoint of purchasing and supply management. The research also revealed crucial information related to the benefits and challenges of

RPA, and what elements should be considered when choosing between RPA and traditional back-end system automation.

It was found that there are many automation possibilities in different phases of the procurement process, but the greatest opportunities for RPA are in operative purchasing. Thus, companies should examine their purchase-to-pay processes first when considering adopting RPA. They should also start with the easier processes that are stable, mature, harmonized, standardized and do not have too much complexity. When the RPA capabilities increase, then the company can consider implementing more difficult processes.

This study also found concrete elements that can help the case company to improve its RPA operations. One of the challenges was related to the transparency of RPA development. This issue could be solved easily by sharing a Kanban board between the company and the RPA developer. By this way, it would be always clear to both parties what phase of the process is under development and when, and it would reduce the development mistakes.

Another significant issue that could be handled in the future was related to the selection of the right automation solution. It was found that it is not always clear which solution to use. However, as this study pointed, it is an easy and simple task to find out the prices and development time for RPA and back-end system automation at least at UPM. Nonetheless, the company could develop a template that could be used for comparing these automation solutions and make the selection easier. This template could include questions related to price, development time, capabilities and first if the process is even suitable for the specific solution.

As the automation of the price update process showed, it would be good if the processes are already harmonized and standardized before starting to develop automation solution. In the future, when the company is planning to implement new RPA processes, it should be considered more carefully whether the process needs to be more standardized and institutionalized before starting the automation development. This would reduce many challenges related to RPA development and

problems after development. Also, if the price list would have been already standardized and introduced to all categories, there would have been more volume for the robot straight in the beginning, and its quality of work could have been ensured faster.

The last recommendation for the case company is that they should start mapping all the challenges and issues that have happened during the RPA projects, and the used solutions for them. This would help to solve these challenges if they happen again in the future. These mappings and best practices could be also shared across the business functions as they all have their own RPA projects.

6.3 Limitations and suggestions for future research

This study was conducted as a case study and the data was gathered by case company interviews and RPA expert interviews. Case interviews were related to the use of RPA in the case company, which means that some of the results could be different if studied in other environment and company. For example, if thinking about the benefits and challenges of RPA, there are various elements affecting them such as company's RPA maturity and type of the RPA implementation. However, the purpose of RPA expert interviews was to provide a generalization to the findings of the research.

In future research, it would be important to further explore the potential of RPA in strategic sourcing more deeply. It would be interesting to study if there have been RPA implementations in the area of strategic procurement and what kind of processes in that area could be suitable for software robotics. For example, a robot could be used in the RFQ area if the templates are in a standard format. Another thing that could be studied in the future is related to different RPA sourcing options. For example, it would be interesting to study if the challenges and benefits of RPA are different if the automation of process is insourced or outsourced.

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APPENDICES

Appendix 1: Interview template – UPM case interviews

Questions about the interviewee and his/her experience:

- Could you tell about yourself?
    - What is your role in UPM?
    - In which department are you working?
- What is your experience about RPA?
    - What kind of projects have you been involved with?
    - What processes have your department automated with RPA?

Questions about the selected RPA case

Before RPA implementation:

- What was the process in question?
- How did you choose this process to be automated?
    - What were the selection criteria?
- How the process was performed manually before automation?
    - What systems were used in the process?
    - In which part of the process human involvement was needed?
- Why did you choose RPA instead of traditional back-end system automation?

During RPA implementation:

- Who were involved in the implementation?
    - What was the role of IT department?
- What were the main challenges during the implementation?
- Did you get any benefits already during the implementation phase?
- What were the main learnings during the implementation?

After RPA implementation:

- What is the status of this project at the moment?
- How long did the project take?
    - Did it take more or less time than you expected? Why?

- Did everything go as planned?
    - Which things surprised you?
- Can you describe the process after implementation?
    - Which part of the process is performed by robot?
    - Is there still a need for human involvement in the process? Where?
- What kind of benefits did you get from implementing it?
    - What kind of cost savings have been achieved or can be expected?
    - Other benefits achieved than cost savings?
- Have there been any challenges after implementation?
- What are the next phases with this project?

RPA in purchasing and supply management

- Do you think RPA should be utilized more in operative purchasing or in strategic sourcing? Why?
    - At what stages of the purchasing process would there be the greatest potential for RPA?
- Based on your thoughts, what kind of opportunities and risks are related to RPA usage in purchasing and supply management?
- What benefits can RPA bring to the practical work of a purchasing professional?

Additional questions and comments

Do you have any other comments that you would like to say about this topic?

Appendix 2: Interview template – RPA expert interviews

Questions about the interviewee and his/her experience:

- Could you tell about yourself?
    - What is your role and responsibilities in company x?
- How long have you been working with robotic process automation?

Questions about typical RPA cases

- How the selection of right process candidates for RPA should be done in your opinion?
- What kind of processes have you automated with RPA?
    - Have you automated any procurement or purchasing processes for your customers? What kind of?
- What is the typical development time for RPA solution?
    - What factors affect this?

Questions about benefits and challenges of RPA

- What are the benefits that companies usually get by implementing RPA?
- What are the challenges that RPA implementations usually face?
    - Challenges before the implementation?
    - Challenges during the implementation?
    - Challenges after the implementation?

Questions about RPA vs. traditional back-end system automation

- What are the main differences between RPA technology and traditional back-end system automation?
- What are the advantages and disadvantages of RPA compared to back-end system automation?
- When RPA should be considered instead of back-end system automation?
    - Based on your experience, what kind of situations / processes are more suitable for RPA? And for back-end system automation?
- Do you see these two different technologies as competing or complementing solutions? Why?

Additional questions and comments

- How do you see the future of RPA?
- Do you have any other comments that you would like to say about this topic?