

LAPPEENRANNAN-LAHDEN TEKNILLINEN YLIOPISTO LUT
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Challenges of scaling robotic process automation

Master's thesis

Examiners: Professor Timo Kärri and Post-doctoral researcher Lasse Metso

Abstract

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Digitalization has pressured companies to constantly improve their products and services while running cost effective processes. Many organizations saw robotic process automation (RPA) as an enabler for these objectives. While companies have enjoyed successes in their initial RPA projects companies are now reporting challenges of scaling RPA to all business areas. This thesis aimed to identify these challenges companies are struggling with and to provide a model for growing capabilities in RPA to better avoid or overcome identified challenges.

The thesis started with a comprehensive review of current RPA utilization and challenges that companies have had in the past. The literature review findings were set to be compared with the data gathered in the empirical section. This thesis used semi-structured interviews to gather data from Finnish companies of their RPA utilization, challenges of scaling and best practices that they had learned. A total of 12 interviews were conducted to a variety of industries and company sizes.

The results from the interviews show that companies have moved past the initial stage of RPA usage and are now looking to scale the technology to all meaningful business areas. Companies faced different challenges during this transition namely with complex business processes, combining RPA with business, employee engagement and lack of process knowledge. This thesis provided a model to support process development before automation, capturing all the benefits of RPA by proper metrics, finding more use cases with democratization of RPA and motivating process harmonization with RPA.

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Digitalisaatio painostaa yrityksiä jatkuvasti kehittämään tuotteitaan ja palveluitaan samalla, kun toiminnan pitäisi olla kustannustehokasta. Aluksi ohjelmistorobotiikka (RPA) nähtiin työkaluna, jonka avulla nämä tavoitteet voidaan saavuttaa, mutta kokeiluvaiheen jälkeen yritykset raportoivat haasteista sen laajamittaisessa hyödyntämisessä. Tämän diplomityön tavoitteena on tunnistaa yritysten haasteet RPA:n skaalauksessa ja luoda malli sen kyvykkyysien kasvattamiseksi.

Diplomityö alkaa kirjallisuuskatsauksella RPA:n hyödyntämisestä ja skaalaamiseen liittyvistä haasteista. Kirjallisuuskatsauksen tuloksia vertaillaan empiirisessä vaiheessa kerättyyn dataan, joka kerättiin puolistrukturoiduilla haastatteluilla. Haastatteluissa keskityttiin selvittämään, miten suomalaisissa yrityksissä hyödynnetään RPA:ta ja mitä skaalautumisen haasteita heillä esiintyy. Lisäksi haastatteluissa selvitettiin RPA:n skaalaamisen parhaita käytäntöjä.

Haastattelujen tulokset osoittavat, että yritykset ovat siirtyneet RPA:n kokeiluvaiheen ohi ja haluavat nyt laajentaa RPA:n käyttöä yrityksessä. Yrityksissä koetaan skaalauksessa monia erilaisia haasteita, kuten liiketoimintaprosessien monimutkaisuus, vaikeus yhdistää RPA ja liiketoiminta, työntekijöiden vähäinen sitoutuminen ja puutteellinen prosessiymmärrys. Tämän diplomityön lopputuloksena tarjotaan malli, jossa painotetaan prosessikehitystä ennen automaatiota, pätevien mittarien asettamista kaikkien hyötyjen kaappaamiseksi, RPA:n demokratisoimista käyttötapauksien lisäämiseksi ja motivoimaan prosessien yhdenmukaistamista RPA:lla.

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ABBREVIATIONS

AI	Artificial intelligence
API	Application Programming interface
ATM	Automatic Teller Machine
BPO	Business Process Outsourcing
CD3	Cost of Delay Divided by Duration
CoE	Center of Excellence
ERP	Enterprise Resource Planner
FTE	Full Time Equivalent
GPS	Global Positioning System
ICT	Information and Communication Technology
IT	Information Technology
KPI	Key Performance Indicator
ML	Machine Learning
OCR	Optical Character Recognition
PoC	Proof of Concept
R&D	Research & Development
ROI	Return on Investment
RPA	Robotic Process Automation
UI	User Interface
WSJF	Weighted Shortest Job First

1 INTRODUCTION

This introductory chapter guides the reader through the main objectives of the thesis. The background of the thesis is discussed before presenting the main research questions in which this work aims to provide answers for. The research methodology and data gathering techniques are presented in brief. Lastly, the overall structure of the thesis is presented before proceeding to the actual research.

1.1 Background

Software robotics, or robotic process automation (RPA) offer a promising solution for increasing routine work by automating simple business processes using software robots. The technology behind these robots has developed to the point where companies can quickly adopt them to their existing ecosystems with a low initial investment. Thus, many organizations have started their RPA journey in hopes of cost reductions, streamlined processes and allocating employee work to more value adding tasks (Rutanganda et. al. 2017). Many have succeeded in this journey with significant benefits to business that has attracted even more companies to the field. This interest can be seen in estimations of RPA market value which is expected to reach 4 billion USD globally in the year 2025, growing about 30% annually (Grand view research 2019)

Advancements in technology has pressured companies to change their business models and activities to cope with the growing consumer demands and requirements. This phenomenon is referred as digitalization and it's pushing companies to make digital transformations in order to keep up with competition. Digitalization is not about transforming business processes to digital form, but reevaluating processes through the possibilities, those new technologies offer. (Kääriäinen et. al. 2017, p. 68). Digitalization is one of the drivers behind RPA popularity and many processes nowadays construct behind the idea of automation. Many successful implementations later the expectations for RPA has risen to the level of being described as the "silver bullet" of solving the major challenges faced by modern businesses today like cost reduction, productivity gains and customer acquisitions (Rutanganda et. al. 2017).

Popularity and successful implementations have only been one side to RPA and early adopters have struggled to scale up from their initial pilot projects. Ernst and Young found in their global study that 30 -50% of initial RPA projects are stalling, not scaling, moving to other technologies or being abandoned (Ernst & Young 2017, p. 4). This is not necessarily a technological problem, but a problem with emerging technologies in general. The media hype creates unrealistic expectations for the new technology, which leads stakeholders to set goals that are impossible to reach (Rutanganda et. al. 2017).

In recent years, there has been a growing number of studies around RPA. The greater part of these studies focuses on the implementations, benefits and use cases of robotic process automation. This thesis focuses on the problems of scaling RPA, which hasn't been researched all that much. In addition, this thesis brings suggestions to growing organizations capabilities in RPA, which adds the novelty from academical and business perspective.

1.2 Research objectives and scope

This thesis is done on the behalf of a Nordic technology company Knowit Oy. Knowit is a consultancy firm that creates customer values by offering digital and cross-functional solutions from three business areas: Experience, Insight and Solutions. Design and communication, management consultancy and technology competencies are combined in Knowit's services. RPA has been a growing field within the company and there have been efforts to enhance its service offerings. This thesis aims to develop RPA service products to better meet the needs of client companies and serve as informational material for clients on scalable utilization of RPA.

Knowit sees that majority of Finnish companies utilizing RPA to have reached its "second wave" where companies are aware of the technology and how it can benefit their business. The next "wave" would be to scale the number of automated processes across relevant business areas. Knowit has recognized that this transition has been challenging to many clients even with resources and previous experience with RPA. This work's main objectives are to recognize these challenges and offer a solution of how to overcome those challenges. In order to meet these objectives three research questions were formed:

Q1: How are companies utilizing RPA and what are the common investments associated with it?

Q2: Why is it challenging to scale robotic process automation?

Q3: How to increase organization's capabilities in RPA to get the most out of it?

The first research question evaluates the utilization of RPA, investments made and how companies are realizing the benefits of RPA. The second research question identifies the challenges faced during scaling. These questions aim to study the subject from a theoretical point of view to be compared with the empirical data gathered from the interviews. The third research question analyses the findings in the first two research questions and the data collected in the interviews. This research question also tries to find causal relationships to identify the possible solutions for scaling RPA effectively.

The output of this work will be an analysis – based on the data collected – of how companies can increase their knowledge of RPA in order to scale the usage effectively. To support this transition this thesis provides a model of the most common challenges faced and how to overcome them. This can help companies to identify the fundamental issues behind failed RPA projects. Additionally, this thesis provides insights from the current RPA market of how companies are utilizing RPA and what maturity stages they are currently in.

This thesis is scoped to the Finnish market of companies utilizing RPA. In order to gather generally applicable data any particular industry is not scoped out. The scope aims to find out if companies in different industries or different sizes are struggling with the same challenges, or do they vary depending on these parameters. That is why the interviews target a wide spectrum of industries and company sizes.

1.3 Methodology and data

The methodology of this thesis is divided to two sections. The first section is the literature review that researches RPA utilization and challenges of scaling. This thesis provides a

comprehensive view of RPA utilization, investments, benefit measuring and best practices. This supports the understanding of the challenges described in the next section and how could companies change their behavior to get better results with RPA. This section lays the groundwork for the empirical section by providing case examples of RPA utilization and possible challenges during this process.

The second section is the empirical part of the thesis. The main research method in this section is semi-structured interviews. A total of 12 companies participated in the interviews. These interviews were targeted for companies that are utilizing RPA and to both management and operational level employees. Based on the research and data gathered, an analysis was conducted to evaluate the major challenges in scaling RPA and how can organizations grow their capabilities in RPA to overcome these challenges.

1.4 Structure of the thesis

This thesis consists of six main chapters: introduction, evaluating the utilization of RPA, challenges of scaling RPA, research design, results & analysis and conclusions & discussion. The introduction chapter introduces the reader to the topic and aims to provide a clear understanding of research process. The second chapter goes through the fundamentals of RPA and evaluates the current utilization of RPA. The third chapter focuses on the main challenges of scaling RPA. In these literature review chapters the main goal is to get an academical view of the subject. The fourth chapter goes through the research methodology and reasons why it fits the thesis. The fifth chapter analyses the findings in the interviews and compares them to the data gathered in the case studies. The final chapter answers the research questions, presents conclusions and further research suggestions. To clarify the research, the structure of the study was created to highlight the main phases of the research in figure 1 below.

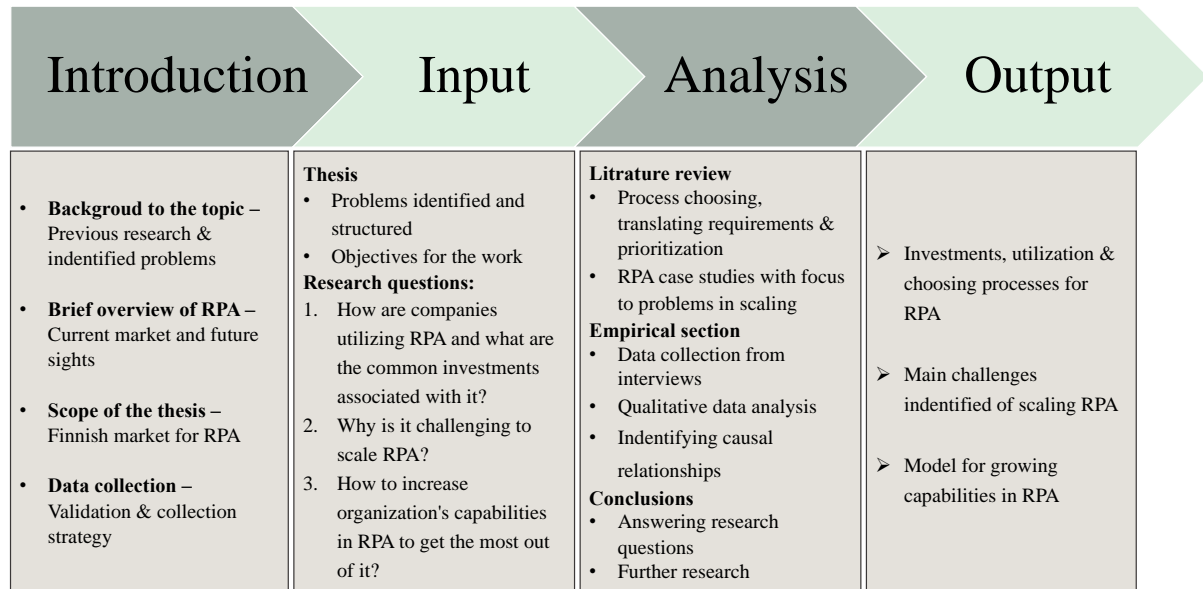


Figure 1. Structure of the study

The structure aims to visualize the research process and how the conclusions are drawn. The introduction identifies problems and the preliminary research starts with studying previous researches, current RPA market and data collection strategies. In the input section, the problem iterates to a structural form with the three research questions. The analysis section researches the subject more fundamentally and tries to find answers to the research questions. The combination of the literature review and empirical section aims to bring new ideas to the narrowly researched area. The output provides the results of the thesis which will introduce further research that is needed in the scope of the subject.

2 EVALUATING THE UTILIZATION OF RPA

This chapter is a part of the literature review. This chapter evaluates the utilization of RPA and how to choose processes for automation. To familiarize the concept of RPA this chapter starts with a brief overview of RPA and terms associated with it. The overall theme of the chapter is to guide the reader through the process of RPA utilization and translate the requirements and limitations of the technology to business objectives.

2.1 Overview of RPA

The concept of robotic process automation can be misleading since the first association, to many people, is to actual physical robots. When in fact RPA is a software tool used to automate business processes using configurable computer software or a ‘robot’. Software robots can perform human like actions in the user interphases of information systems. These robots are programmed to perform time-consuming, error prone and rule-based tasks normally carried out by employees. One of the key business values of RPA is to enable more cognitive work on critical business areas by reducing the number of routine tasks performed by humans. (Madakam et.al. 2019, p. 4).

Although RPA is a young technology business process automation has been a part of our lives for much longer. Technologies like ATMs, GPS and self-service checkouts are examples of that. The key difference between is that RPA is lighter in terms that it can operate on existing systems without interfering with the underlying infrastructure. The fundamental idea of RPA is to mimic human-computer interactions and replicate them with higher accuracy, volume and speed. The rule of thumb is that if there is a logical rule behind these interactions, it can be automated with a software robot. (Lacity & Willcocks, 2015a, p. 3).

In the age of digitalization, the exponential growth of computing power has enabled multiple new technologies like RPA, machine learning (ML) and artificial intelligence (AI). Companies are now competing of harnessing the full potential of these technologies namely to cut down on costs while still running effective processes. Alongside digitalization, the tapped-out potential of outsourcing and offshoring supporting business functions is one of the drivers

behind RPA. With the efficiency that RPA brings companies can bring back actions that were previously outsourced. In the long run RPA might be seen as a temporary solution of filling gaps between information systems, but it acts as a foundation for ML and AI for creating even more autonomous companies. (Torlone et.al. 2016, p. 3-6)

RPA's brand as the easily deployable cost cutter has taken a hit as rising number of companies' report struggles at scaling the usage of bots. Some sources have even declared the technology dead, as they move towards alternatives or more intelligent solutions (Fersht 2020). The market studies still show that the RPA software market is growing with pace (60% in 2018) and investors have taken notice of the growth by investing more than 2 billion dollars in the technology. RPA vendors are now focusing on R&D to redefine their products and services based on the customer feedback. The market continues to mature and consolidate as 90% of smaller RPA vendors are expected to exit the market or merge together in the next three years. This will lead to an RPA renaissance far evolved from simple rule-based automations. (Gartner 2020).

2.2 Translating RPA requirements and limitations

RPA brings technology closer to our everyday activities. It is the first low-code solution to have bypassed traditional IT in process digitalization. RPA is designed to support operational business users with their routine tasks. RPA has enormous potential not just in cutting costs but enabling new services that could not be possible earlier. Businesses need to search for processes that could be suitable for RPA to get the most out of the technology. That is why RPA should be business driven because even though it's just another "software" the process and product owners are responsible of implementing and capturing the value that RPA brings. Many RPA cases have failed to capture this potential because companies have siloed the RPA development too far from the actual business. Compared to traditional information systems RPA needs much more input from the business users since it's not a "plug and play" solution. (Rutaganda 2017, p. 113-114)

RPA is a software tool used to automate simple business processes in the user interphases of information systems. Basically, these robots operate as "digital workforce", they have

credentials, access to information and an ability to perform actions like clicking, copying and pasting. The major difference between RPA and traditional IT is that RPA uses existing systems as employee would. Operating from the front of information systems creates a set of new problems for the robot; changes in the UI cause breakings, communication faults and information security concerns. (Osmundsen et.al. 2019, p. 6920)

Due to this partially fragile nature of RPA the processes must be selected carefully, and great part of the work goes before the actual development of the robots. Since these bots don't have the ability to adapt to changes all the business and system exceptions must clearly be defined so that the robot can be configured to deal with these exceptions. Process maturity and lifecycle are things to consider before the development of bots. RPA can be a costly tool to implement and it's important to focus on the processes that can bring long term value to the company. Processes that are prone to change due to external factors can lead to high maintenance costs since the process is constantly changing. Processes that are mature don't completely depend on external factors and follow the same logic repeatedly. Process lifecycle considers how long will the process be viable for the company before it will be replaced or changed. (Bortolotti & Romano 2012, p. 519; Burnett et.al. 2018, p. 12). For example, a new ERP system might replace old manually executed process. Analyzing these factors help companies to realize what processes would be stable enough for RPA or what are the required changes in the process so that it would be viable

RPA is a technology investment among others. It has unique features that differentiates it from other technologies, but companies need to consider how it will fit in their existing ecosystem. Buying additional software just because it's novelty and hype doesn't create a solid foundation for the investment. Companies need to consider their IT-resources and how to allocate them effectively to business users. Usually these resources don't act alone in creating / maintaining the competitive advantage and its especially true for the IT-sector. In almost all of the cases IT-resources need to be combined with other organizational resources to fully capture the competitive advantage. (Woudstra et.al. 2017). In the figure 2 below the IT-value capture process is visualized.

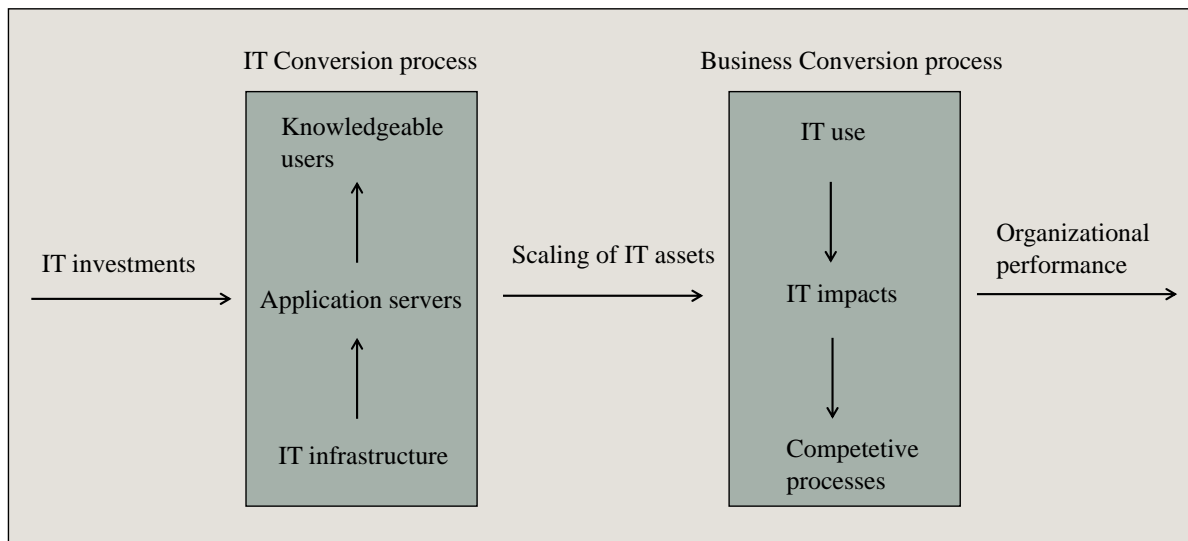


Figure 2. Framework of IT value capture (Adapted from Woudstra et.al. 2017, p. 188; Soh & Markus 1995, p. 37)

The model shows the IT value capture process which starts from IT investments turning into IT assets (IT conversion). IT assets lead to IT impacts which lead to organizational performance (Business conversion) (Soh & Markus 1995, p. 37). The framework explains the value creation process where IT investments convert to useable applications that business users can use to create value in their business process. Maximizing organizational value of implementing a new system one has to gain synergy between existing infrastructure. The idea being systems complementing each other to create more value as a whole rather than individually (Wade & Hulland 2004, p. 108-110). In contrast, RPA can provide harmony to existing IT ecosystem by filling the gaps between systems. Due to this nature RPA impacts the business conversion but doesn't change underlying systems.

The objectives of RPA tend to change when the maturity level grows. Protiviti conducted a global survey reaching 450 companies utilizing RPA. In the survey companies answered questions of RPA and how are they utilizing it. Protiviti divided these companies in three different categories based on their maturity in RPA; beginner, intermediate and advanced. Beginners biggest focuses where increased productivity and better quality of processes. More mature companies had a bigger perspective of RPA benefits since their answers were more deviated. The major differences compared to beginners more advanced companies focused

more on gaining competitive market position and employee satisfaction along with increased productivity and better quality of processes. (Protiviti 2019, p. 11). The advanced companies also communicated that they had similar targets than beginners when they were starting. Reflecting on their experience they suggested to align RPA objectives to bigger strategic objectives to gain maximum support from business leaders.

2.3 Choosing and prioritizing processes for RPA

Before the actual development of RPA robots' companies decide on the technology, operating model and strategy for RPA. The RPA software market has grown with pace and sizable number of vendors offer expanded portfolios of products around software robotics. The most popular vendors are UiPath, BluePrism and Automation Anywhere. When choosing the technology companies usually evaluate price, scaling possibilities, add-ons and intelligent services. It all depends on the needs of the company and generally it's a best practice to use only one RPA technology for better reusability and maintenance. Operating model is usually the component that changes when RPA maturity grows, but when starting companies need to choose whether to develop in-house or buy third-party consultancy. With a continuing automation strategy an in-house development model lowers the costs and brings better support for business initiatives. Third party consultancy can help companies to get started or offer trainings within the organization (IRPAAI 2019a). The decision to develop in-house or outsource usually follows the existing IT-strategy if management hasn't decided a separate strategy for automation. RPA should be business driven supported by existing IT-strategy.

Most common processes for RPA are usually some form of invoicing, reporting or ordering processes. These processes are rule based, repetitive and usually transfer data from one system to another. Processes like this are textbook examples for RPA and with decent volumes have very quick payback time. Especially when starting with RPA companies need to look for simple processes that sell the idea of automating business processes to the whole company. Starting off simple enhances the image of the technology and makes it more acceptable within the organization. (Willcocks et.al 2017, p. 22).

Organizations have reported different approaches to finding potential processes for RPA. Techniques include workshops, trainings, seminars, process mining or gathering organic ideas. Operative employees have the best view to the actual work and educating them of RPA can flourish into profitable ideas. In the initial stage companies might want to choose a simple process or a part of it that has visible benefits when automated. Creating a positive image of RPA is important not just for acceptance of the technology but committing business into investing and using RPA. As a technology RPA is competing with more traditional approaches like system development or integrations. In order to get more cases for RPA it needs to be considered as a valid alternative compared to the more traditional approaches. (Asatiani et.al. 2018, p. 10-11).

One of the techniques mentioned, process mining, is a data-driven technique that reconstructs the actual activity flow of business process by gathering transactions logs from information systems. It enables companies to analyze processes based on data of how the information systems are used. This can help identifying undesired actions, bottlenecks and compliance issues in the process. These identifications are important especially when choosing processes for RPA since it's best combined with processes that are stable and mature. If a process shows an immense variance in actions, it needs to be standardized before automation in order to increase transaction volume and speed up implementation time. (Geyer-klingeberg 2018, p. 2). RPA is best suited for processes that have high volumes and repetitive tasks; or are otherwise too expensive or impossible to make. It's important to give weight to other options like back-end automations, integrations or system changes to find the best possible solution for the process. Ultimately the goal is to improve the process efficiency regardless of the technology used.

Lean management can support finding more suitable cases for RPA. The basic idea of Lean is to eliminate waste, reduce process time and simplify processes. This should be the mentality before utilizing RPA since it's a tool that brings speed and accuracy to the process. If the process is not streamlined or it has waste in it the robot will only amplify these deficiencies as it would do to a leaned process. In the figure 3 below the "lean first, then automate" model is presented. In this model the basic idea is to lean the process before automation. The model takes a process for evaluation by defining "As is" and "To be" stages to design the architecture for automation.

Comparing these stages process owners can evaluate the efficiency of their process. After the evaluation the tasks for RPA should be defined with the actions excluded from the automation. (Bortolotti & Romano 2012, p. 517).

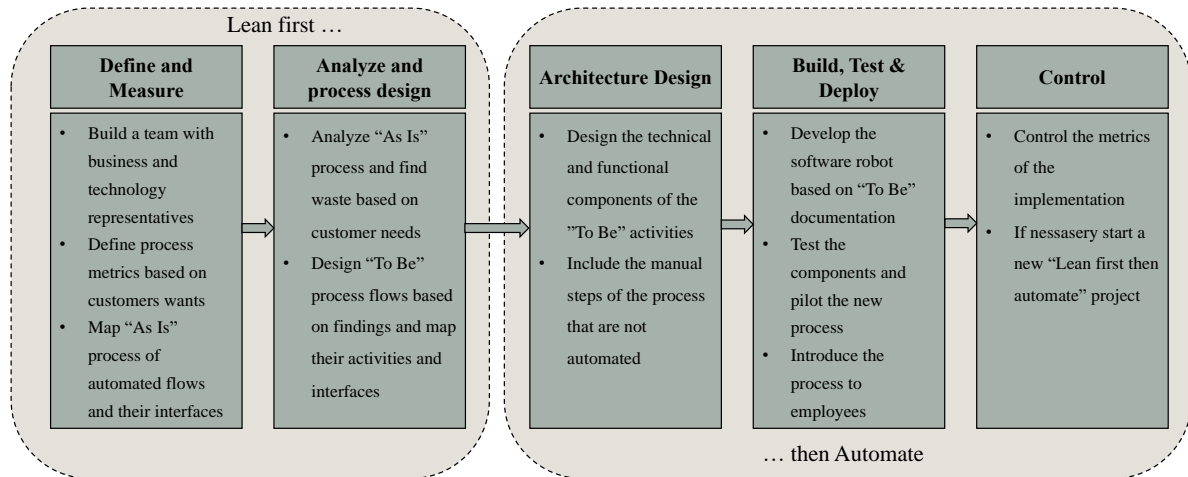


Figure 3. Lean first then automate model (Modified from Bortolotti & Romano 2012, p. 517)

Lean introduces a proven model for streamlining processes which will benefit the RPA cases when the process has little or no waste in it. The above model forces a continued development mentality which is beneficial for RPA since the systems or processes might change. The biggest benefit of this model is to challenge processes before automation. Every process owner must have an opinion if the process is good or bad when thinking of automation. RPA offers a great opportunity to lean the process before automation to gain the maximum value.

When the processes are leaned, and the automation backlog starts to grow faster than the development capacity prioritization becomes a central component. Finding objective metrics to evaluate and compare different projects assists companies to gain maximum value from RPA projects. The market is filled with models and metrics to consider when evaluating what processes to automate with RPA. Companies can fine tune these models to match their specific needs, but the model presented in the table 1 below gives ideas of what to measure. (Workfusion 2017)

Table 1. RPA case scoring (Modified from Workfusion 2017)

	Process Criteria	Criteria definition	Pts	KPI's
Impacts	Materiatiry (Scope of Impact)	<ul style="list-style-type: none"> Process requires significant resources and is performed frequently (Weekly, Daily) 	+ 10	<ul style="list-style-type: none"> FTEs Transsaction volume
	Suitability (Automation Candidate)	<ul style="list-style-type: none"> Process has repeatable business rules that can be automated Process involves manual data transfer between systems Process includes rules based on changing variables 	+ 5	<ul style="list-style-type: none"> Frequency Rules vs. Judgement calls
	Financial	<ul style="list-style-type: none"> Automating the process drives additional revenue, grow business volumes or result in recovery of cost that wasn't possible earlier. 	+ 5	<ul style="list-style-type: none"> Increased revenue Quantified value of cost recovered
	Process Complexity	<ul style="list-style-type: none"> Process includes logical actions regardless of the employee that performs them Process is stable and not undergoing major changes 	+ 5	<ul style="list-style-type: none"> Number of major process variants Number of process roles
Implementation complexity	Technical Complexity	<ul style="list-style-type: none"> Data required for the process is poorly defined or inconsistent Process requires data from over 5 systems 	- 3	<ul style="list-style-type: none"> Number of screens Number of systems Number of data sources
	Data Privacy	<ul style="list-style-type: none"> Process involves actions that may cause cross-border data-privacy issues 	- 2	<ul style="list-style-type: none"> DPO requirements
	Organizational Complexity	<ul style="list-style-type: none"> Process includes multiple disparate teams and/or isn't standardized. 	- 2	<ul style="list-style-type: none"> Number of teams involved in process
			Total	

In the table above different criteria are divided to impacts and implementation complexity. Each criterion is given a point score based on how important the criteria is to the development of RPA. Criteria's are linked with a relevant KPI that measure how the process activities match the criteria definitions. With this model companies can evaluate and prioritize RPA processes. Companies can add more criteria to the model to better match them to their existing processes.

The above represents one angle to prioritizing RPA projects. Agile development methods like SAFe offer options for feature prioritization. WSJF (Weighted Shortest Job First) is a prioritization model that maximizes economical value gained from implementing a specific feature. The model calculates which features give the most value in the shortest time by dividing the cost of delay by the duration of the development. The formula 1 presents the WSJF parameters. (Scaled agile N.d) The fundamental idea is to calculate a financial number for cost of delay which represents the value that company would gain when the feature is done (Numerator).

$$WSJF = \frac{User-Business\ Value + Time\ Criticality + Risk\ Reduction\ and/or\ Opportunity\ Enablement}{Development\ Duration} \quad (1)$$

The idea of the equation is to add up three different variables to find out the value that the feature could bring to the company. User business value can be a relative number that usually is based on previous data of similar features. Time criticality refers to the importance of doing the feature first. If the feature is time critical it usually means that competitors are already doing it. The final variable evaluates how the feature positions the company after it's done. Feature might not by itself deliver much value, but it reduces risks or enables other features to create more value. (Scaled agile N.d). The model has received criticism for combining relative values that aren't connected with each other. In the scope of RPA, the equation forces long term planning by evaluating what does the automation enable for the company.

An example of the model could be to compare two features A and B. Feature A would create 5000 € revenue when completed weekly so its cost of delay is 5000 €. Feature A takes 3 weeks to complete. Feature B has a cost of delay 8000 € and development time of 7 weeks. Feature A gets a CD3 (Cost of Delay Divided by Duration) value of 1667 and feature B 1142. Based on these calculations feature A should be completed first since its CD3 value is higher.

3 CHALLENGES OF SCALING RPA

This chapter is a part of the literature review. The chapter will start by going through the economies of scale and how RPA maturity effects scaling RPA projects. The chapter will also analyse case studies of RPA utilization and gathers information on the best practices and possible challenges of scaling. The requiring theme in the chapter is to identify the challenges of scaling and evaluate the fundamental reasons behind these challenges.

3.1 The economies of scale

The idea of economies of scale is to combine specialization with congruent work volumes to gain competitive advantage. In the IT-industry an example of the utilization of economies of scale would be to outsource a stable business process to large scale application provider (Lacity & Willcocks 2001). The cost-advantage gained through economies of scale is presented in the figure 4 below. As the quantity of output's increase the cost-per-unit decreases (Q1 vs. Q2). The increased cost at Q3 is described as diseconomies of scale where at a certain point the costs start to increase. (Canback, Samouel, & Price, 2006, p. 3).

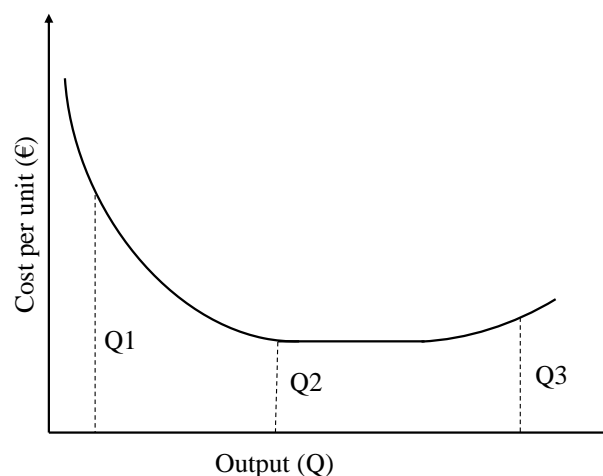


Figure 4. The economies of scale (Modified from Stigler 1958, p. 59)

Economies of scale apply to RPA in terms that while the number of automated processes increase the development cost decreases due organizational capability growth and reusable components. The diseconomies of scale hasn't been researched in the scope of RPA, but as the

number of systems increase the probability for big maintenance costs increase. The risk of having to cut down on new automations increase in order to maintain the existing automations.

The most common area that companies are taking advantage of economies of scale is through service centers. Service centers provide value for companies by consolidating and standardizing high volume activities such as cash applications to one centralized department. Traditionally these shared service centers are outsourced to low-cost geographies to drive cost reduction and process improvement. Advancements in technology and automation have forced shared services organizations to adapt these technologies quickly to stay competitive and 80 % of them are already utilizing RPA (Jordan 2019). RPA provides an option to companies to keep the service center in-house with the cost reductions that RPA offers.

According to the SSON report of 2019 shared services are moving towards insight-driven knowledge work from the traditional transactional work. The transactional work is given to the “digital workforce” leaving human employees focusing on giving innovative insights from the process. According to the study half of the shared services that have implemented RPA are already scaling. (SSON 2019). This is a prime example of employee work shifting towards more meaningful work as the bots manage the manual work.

3.2 Quantifying RPA impacts

RPA’s impact on organizations cost structure is usually measured by the number of saved FTE’s (Full Time Equivalent). The formula to calculate an FTE is presented below. FTE of an employee can be compared to the FTE of a robot to calculate the freed-up FTE hours. (IRPAAI 2019a)

$$FTE = \frac{(Time\ spent\ on\ process\ (min) * Process\ executions\ (year))/60(min)}{Average\ working\ hours\ per\ year} \quad (2)$$

FTE provides an objective metric for RPA project evaluation but should not be used alone determining the value gained from an RPA project. To maximize the ROI companies, need to look beyond the cost savings and evaluate what does automation enable for the company and

convert that to a numeric value. (IRPAAI 2019). Quantifying RPA metrics helps to justify the future investments on RPA which is crucial in order to scale.

RPA can be seen as a cost-cutting tool or a quick fix to revive a legacy system. This mentality leads companies wanting to get the robots running as fast as possible with minimal investments. First automations might deliver expected results since RPA is designed to be quickly implemented. Focusing on the quick wins leads organizations not dealing with change management, organizing around RPA or strategic planning. This might leave companies struggling with stalling RPA projects, lack of investments and process ownership. (Willcocks et.al. 2018, p. 19)

Quantifying the RPA cost metrics also enables companies to objectively rate different processes. Depending on the process different metrics might be needed in order to present the full benefits gained from the automation. In the figure 5 below a model for calculating the total value for RPA is visualized. The model is divided to two sections total cost and benefits of ownership, which combined form the value gained. The model appoints not only the costs saved, but also the costs avoided due automation. An example of this could be enhanced data quality in order handling and not having to correct mistakes. On the costs side there's a lot more included than the development and license costs. Organizational trainings, infrastructure and change management can all be linked to robotic process automation. (Willcocks et.al. 2018, p. 16-18)

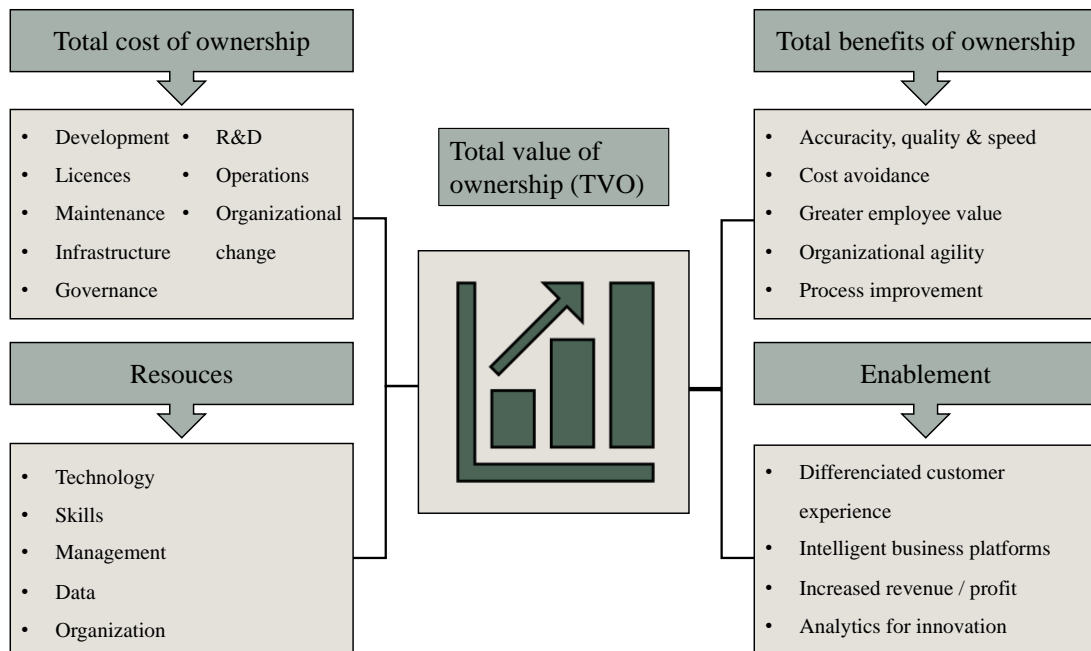


Figure 5. Total value of ownership (Modified from Willcocks et.al. 2018, p. 17)

Looking beyond the cost savings and recognizing all the benefits associated with RPA helps organization to identify the beneficial processes to automate. This also promotes the mentality to think first about the process improvement and then how automation can help to achieve it. The TVO model analyses all the factors associated with RPA and brings organizations to a mutual understanding of the RPA business cases.

One of the most decorated RPA benefits is to free up employee capacity. Although recognized as a major benefit of RPA few companies have quantified this metric to be included in the business case calculations. One of the reasons for it might be the difficulty of anticipating what the employees will do with their freed-up time. (Protiviti 2019, p. 25). To improve a process, business owners need to define tasks suitable for a robot and tasks for employees. This differentiation helps to quantify the freed-up capacity and allocate employee work more effectively. More importantly business needs to be committed to for capturing the value that RPA brings.

3.3 RPA maturity

RPA maturity measures how well does a company adapt to the technology in terms of development and utilization. After the initial stage organizations need to take a more systematic approach to RPA and start to look beyond the cost savings. In order to bring automation to an organization wide level companies need to look at their automation backlogs and development processes. In order to scale, companies need to identify profitable processes for automation. Standardizing the idea gathering process assists to capture all the relevant data from processes consistently. Closing the silos between business and RPA can lead to natural ideas within organization once the concepts of RPA are understood. (Lehtinen et.al 2020, p. 7).

Once enough potential cases for automation have been recognized companies need to evaluate their “idea-to-deployment” -processes. How RPA projects get picked, does business analysts challenge the process, what’s the business case for this project, what are the goals for this automation, how long does the development take and how is the process going to be monitored after deployment. Compared to PoC’s scaling RPA needs more standardized processes and well-defined practices to be able to automate processes efficiently. In the figure 6 below the RPA maturity journey is visualized.

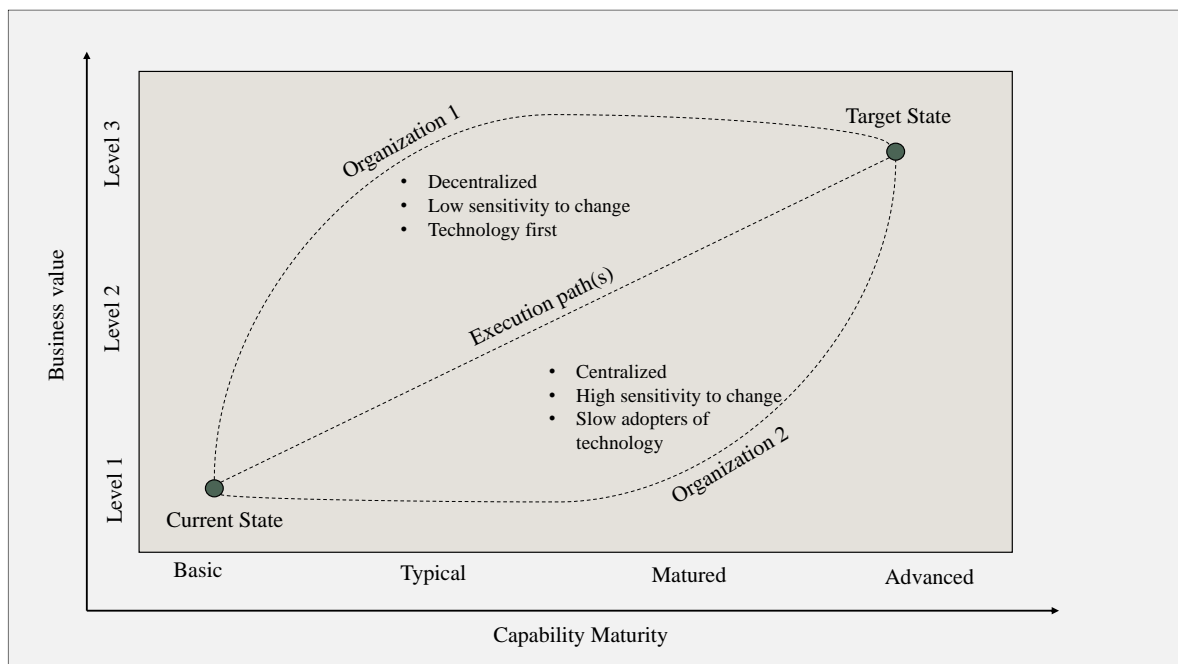


Figure 6. RPA maturity journey (Modified from IRPAAI 2019b)

Companies looking to scale up their automations need to first evaluate the current state of their RPA maturity. Then they need to define the desired target state as presented in the figure 6. Based on these definitions' organization needs to make plans for executing the required actions to reach the target state, which is visualized as the execution path in the figure above. RPA maturity depends on multiple environmental determinants, e.g., organizational structure, adaptability and technology savviness. That's why it doesn't follow the linear line and companies with similar starting points can have very different routes to similar target states. (IRPAAI, 2019b). Growing organizations capabilities and maturity in RPA will lead to more profitable cases since the process is more standardized. The goal is to take the actions from the achieving RPA projects and try to replicate that successes in other RPA projects.

RPA is a young technology and it's maturity will grow as software providers are investing more in R&D. Gartner posts a study each year of emerging technologies in different categories, and places them on a hype cycle seen in the figure 7 below. In this hype cycle there are five different states that each technology goes through in their lifecycle. The first one being "innovation trigger" where the technology is introduced to the market and first successful PoC's attract attention to the new technology. The second state is the "peak of inflated expectations" where success stories pile up and early adopters take initiatives on the technology. The third state is the "through of disillusionment" where interest wanes as the technology fails to deliver to larger audience. Garther has placed RPA in this phase and it's in line with EY's (Ernst & Young, 2017, p. 4) and Lehtinen et.al. (Lehtinen et.al. 2020, p. 5) findings that companies are struggling to find the means to scale their initial RPA projects.

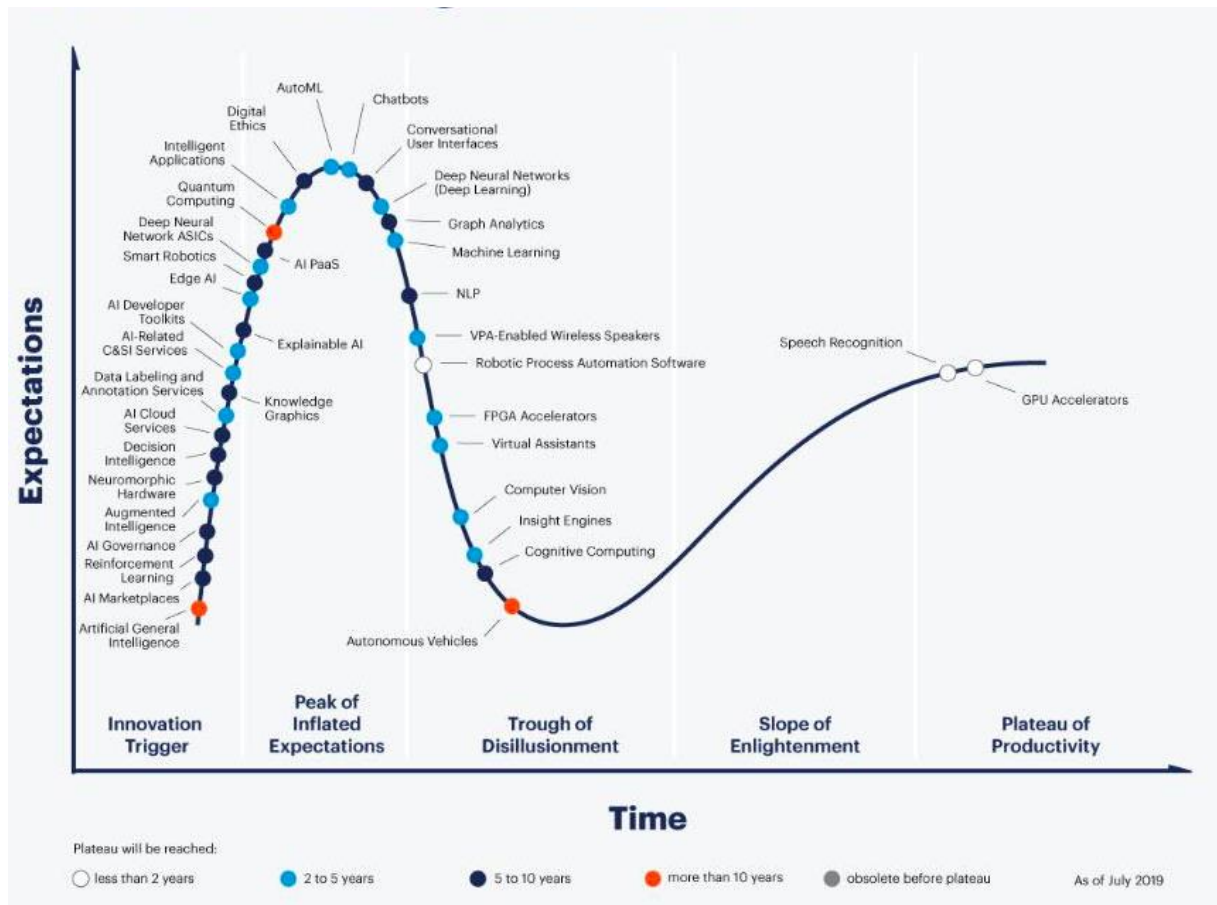


Figure 7. Gartner Hype cycle for Artificial Intelligence technologies (Gartner 2019)

The last two phases in the figure 7 above are “slope of enlightenment” and “plateau of productivity”. These phases represent the mobilization stage where the technology is widely accepted and it’s becoming a norm in certain business area. In the final stage companies use the technology enterprise wide and integrate it to their business strategies. Although RPA is now struggling it’s very close to reaching its full potential as organizations gain more experience and start focusing on the combined benefits that RPA can bring. Organizations can now make the shift to capture the full potential of RPA and avoid the disappointments in peaked expectations as they grow into more systematic approach to RPA. (Gartner n.d).

3.4 Case studies

This chapter introduces three different case studies of RPA implementations and continued utilization. All three case studies were external studies of RPA utilization of a specific company. Case studies aim to highlight the challenges faced in these RPA projects and how

companies have overcome those challenges. At the end of the chapter a table of the common challenges faced and solutions is compiled. This table will be used to compare the data gathered in empirical section.

3.4.1 Case Deutsche Telekom

This chapter summarizes the process and findings of the study conducted by Schmitz et.al. in 2019 of Deutsche Telekom's digital transformation using RPA (Schmitz et.al. 2019). Deutsche Telekom (DT) is a telecommunication company with over 200 million customers in over 50 countries. DT's employees conduct millions of manual operations in a year including customer contact handling, fault clearances, product provisions and installations. DT had recognized inefficiencies in these processes and as a part of their digital transformation strategy. Their goal was to reduce the customer waiting time, increase customer satisfaction and effectively swift employee work to valuable tasks. RPA was recognized as an enabler for these goals as it was quickly adaptable and could scale rapidly. DT set an overall target of finding an automation level that would reduce a total of 200 FTE's annually.

One of the main challenges that DT faced in their first RPA projects was the interrelation between project and line organizations. Different working methods and technological entry levels made it difficult to cooperate in an RPA project. The overall responsibility for the automations was handed to the automation and development department, which was extended to include more of the line organizations employees. In the figure 8 below the current organizational figure of DT's RPA development is presented.

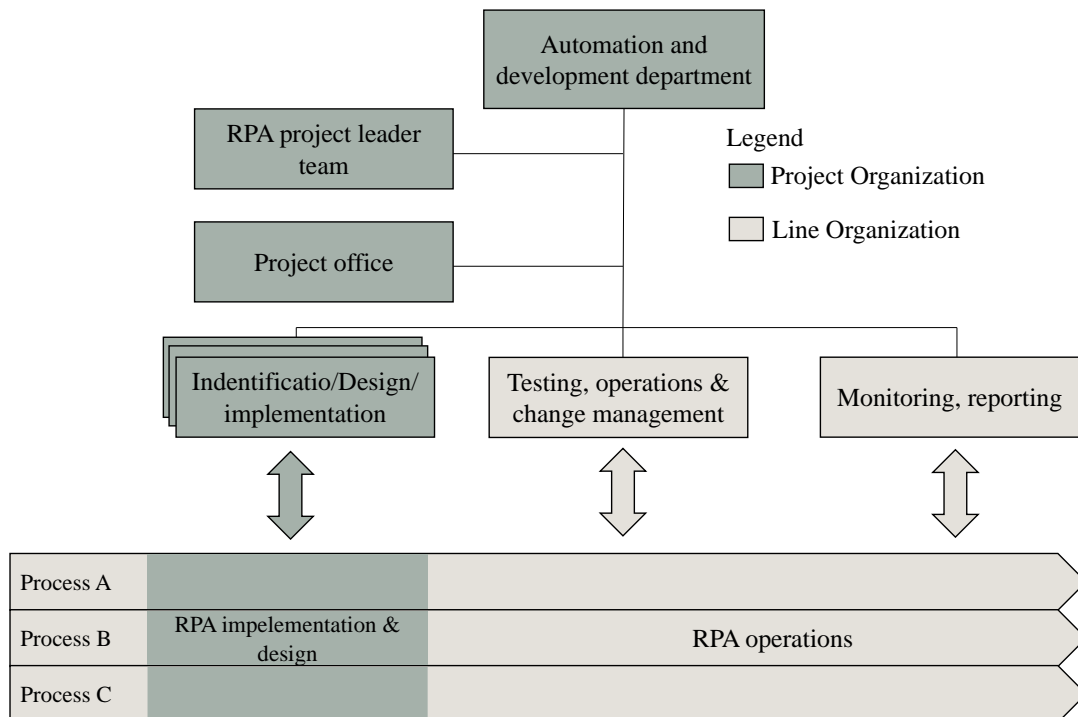


Figure 8. RPA organization in Deutsche Telekom (Modified from Schmitz et.al. 2019)

In the organization figure above every automation project had an RPA project leader which was supported by a project office. The main responsibilities of a project leader were to control the project and implementing an agile developing method to all project members. The automation itself was managed by the project office which supported implementation and operations teams to reach commonly agreed objects. The operational tasks like design, implementation, testing and maintaining was divided between project and line organizations as seen above. The idea was to include both parties early on in the project and to maintain the cooperation after moving to production.

DT had its first robots in production in 2016 and since they have achieved over 800 FTE's with the use of RPA. In the research conducted by Schmitz et.al in 2019 they found five main successes factors for scaling RPA.

1. Agile design and implementation
2. Understand technical innovations as an enabler of digital transformation

3. RPA is more than a cost cutting tool
4. Consider technical and organizational interrelations
5. The impact of RPA to the people dimensions should be managed carefully from the beginning (Schmitz et.al. 2019)

The first factor focuses on the idea that companies should become more agile in each of their business units and RPA development is a part of that. Agile implementation lowers the development times which leads to more profitable RPA business cases. The second success factor links to the first one as realizing the potential of different technologies to reach the goals set in the organization's strategy. Include experts of the technology early on in the project. The third factor realizes the benefits of RPA which is not just to cut down costs. In DT's case it enabled to reinvent the existing process to much more effective form. DT for example was able to put a robot to handle subscription exchange around the clock, which wasn't possible before. The fourth factor highlights the transparency between organizations developing and using RPA. It's important to share a common knowledge RPA for employees to adapt to working with "digital workforce". The final factor suggests that change management should be a part of the RPA journey from the beginning. Employees affected by automation will have more time to process the changes coming and possibly see RPA as an opportunity to focus more on their core competence.

3.4.2 Case OpusCapita

This chapter summarizes the OpusCapita RPA journey. The summary uses two sources the first one being Asatiani & Penttinen 2016 "Turning RPA in to a commercial success – Case OpusCapita" and the second is by Hallikainen et.al 2019 "How OpusCapita used internal RPA capabilities to offer services to clients". OpusCapita is a Finnish BPO (Business Process Outsourcing) company that has customers in Europe and US. OpusCapita had revenue of 300 million in 2015 and it employed over 2000 professionals. The business model for BPO companies is their ability to provide services to customers more efficiently than they can do in-

house. OpusCapita focuses financial transactions and it completes over 600 million transactions annually.

OpusCapita first started their automation journey in 2014 when high executives began investigations on how to increase efficiency in their processes. RPA was chosen to a program to be tested for in-house processes. The program can be divided to three different stages described in the figure 9 below; Pre-implementation, Pilot implementation and Expansion. The first stage began with preparations for RPA utilization by educating employees of key business processes suitable for RPA. OpusCapita saw that process owners should be educated of RPA so that they could “speak the same language” with RPA developers and project managers. After the trainings project manager was assigned to deliver the pilot program who hired a project worker to help delivering the automation. The first line of business was to choose the RPA software vendor. OpusCapita went with UiPath because of their capabilities of starting light but ability to scale if necessary. OpusCapita took their time to choose the first process to be automated and they had two main criteria for it; simple enough process to be automated quickly and the improved process efficiency should be clearly visible.

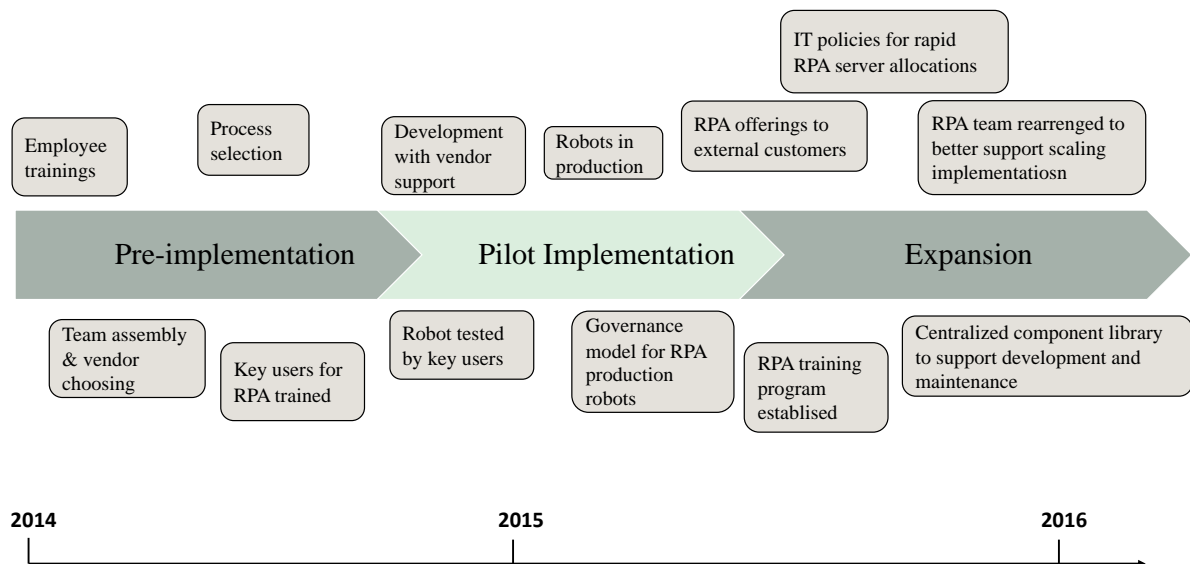


Figure 9. OpusCapita RPA journey (Modified from Hallikainen et.al. 2018)

The first processes selected for RPA where new employment relationships and changes in employee details. The employees who executed these processes where heavily involved in the

development phase helping RPA developers with the business logic of the process. Later these employees received additional training to spread information about RPA to the rest of the team. OpusCapita had an iterative approach to the development of RPA. The work done by robots where constantly monitored by employees and after they gained confidence of the robot more of the process was automated. After several robots where put to production a governance model was created to ensure actions in unexpected situations.

After successful implementations of RPA in-house OpusCapita started getting inquiries from external customer of RPA and how to get started with it. OpusCapita quickly grew their in-house RPA team to match the high demand of automation requests internally and externally. OpusCapita recognized that in order to serve both clients effectively RPA processes would need to be organized. IT policies for rapid development, coding best practices and process identifications where all part of the governance model for RPA. At this time OpusCapita formed their training center to spread knowledge of RPA. All employees received basic trainings of RPA and more advanced trainings where focused towards “RPA champions” to promote RPA to their peers. In the final stages of the study OpusCapita started forming centralized component library to decrease the development times and to share knowledge among developers. They also rearranged their RPA team to better support both internal and external customers.

In their RPA journey OpusCapita formed their view of important lessons learned from both internal and external RPA development. In their internal development OpusCapita saw that involving IT early, addressing concerns of RPA and selecting processes carefully where all major factors for successful utilization. Involving IT early and in all stages of the automation helps to assess the used systems, calculate run costs and developing supporting mechanisms such as service desk. Addressing the concerns of RPA closely relate to the change management of digital processes of managing employee expectations and involving them in the change process. This will lead to quicker adaptation of the technology. The final internal lesson relates to finding profitable business cases for RPA and actually measuring it’s benefits after the deployment.

External customers introduce a different learning curve for OpusCapita, and they found three major factors for their successful implementations for external clients. The first one was to use

new and existing capabilities to offer services for clients. This meant harnessing the IT, developers and managers to provide an organized and efficient service to customers. The second lesson was to establish a strong model for automating processes with external customers. OpusCapita first grew their capabilities internally in the technological and process improvement perspective before moving to external customers. The third lesson related to encouraging IT department to engage with external customers. This helps delivering the servers for robots and addressing information security issues early.

3.4.3 Case Xchanging

This chapter is a summary of a case study conducted by Willcocks et.al. in 2015 (Willcocks et.al. 2015b) of Xchanging automation journey. Xchanging is a business-process and technology services provider who focuses on improving their customers back-office functions by integrating it to their platform which provides cheaper and more efficient handling. Xchanging had a revenue of 400 million in 2014 of which over half came from shared services that this case study was scoped to. Xchanging had recognized that if they want to be more effective in their outsourcings, they have to improve through times of back office tasks with a cost-efficient manner. Xchanging recognized that RPA could provide an answer to their problem and they started their first RPA projects in 2013.

Xchanging had a long history in lean culture and their project manager for the RPA projects had a lean six sigma black belt. The journey started with identifying the first processes to be automated. In Xchanging case there were many ideal processes to choose from since the processes were centralized and highly repetitive. From the start Xchanging had a strategy of building a structured organization and governance model around RPA. After the first projects Xchanging recognized that continuous development beyond deployment increases the benefits the most. Another lesson learned that even though the RPA bots are faster and more efficient than humans it can only work in the pace of the overall process.

After first RPA projects in 2013 Xchanging started to ramp-up their automations in 2014. One of their drivers for scaling automated processes was an increased level of employee knowledge of RPA and what it can be used to. This was enabled by “project champions” who acted as an

evangelist of the technology and brought further insights to the operational level. Xchanging learned that RPA should sit in the business, but IT should be involved from the beginning. RPA was seen as a business-driven tool, but IT helped to build and maintain the infrastructure. Xchanging noticed that a governance model helped to stabilize the automations even after deployment with SLAs, environment checks and maintaining the robots to match the current information systems. Even though the automation potential was massive in Xchanging some otherwise potential processes were left out because they weren't mature enough. Lack of documentation, changing actions and unstable systems left out projects since they need a lot of refactoring before automation could effectively bring value to it.

At Xchanging RPA was seen as a tool to enable more mobile processes which was in line with their strategy to "putting technology at our core". Xchanging benefited from a long-standing lean culture which made their processes ideal for automation. The analysis concluded that Xchanging succeeded with RPA because they started with a strategic mindset towards RPA and what it could do to benefit the business. As they started to scale the RPA projects were standardized in order to enable fast deployments which lead to even more cost-effective processes.

3.5 Case study compilation

Scaling RPA automations is a complex process involving many entities throughout the RPA lifecycle. RPA can be seen as the "gateway" towards companies' digital strategy objectives. This study approached the problem of scaling by looking at previous case studies of RPA implementations and their experiences in scaling RPA. These case studies were summarized and the key issues and solutions of RPA scaling related problems are conducted in the table 2 below.

Table 2. Issues of scaling RPA

Issue	Solution	Appearances
Silos between RPA project teams and business units lead to unfilled expectations and increased development costs.	Educating employees of RPA capabilities and including them in the development.	Deutsche Telekom, OpusCapita, Xchanging
Scaling RPA is hard with solely “cost cutting” mentality	Dealing with change management from the beginning and managing employee expectations	Deutsche Telekom, OpusCapita
Inefficient development model slows down the deployment time.	Forming a centralized CoE, including IT early and building centralized component library	Deutsche Telekom, OpusCapita, Xchanging
Process documentation isn't at a level required for RPA.	Challenging and leaning the processes before automations	Xchanging

The first issue identified in scaling RPA was silos between project and business organizations. The people designing, developing and implementing RPA solutions had different understanding of the technology than the people whose jobs were being automated. This caused misunderstandings and unfilled expectations towards RPA. All three companies recognized this issue and started educating their business of RPA. Operative employees were also included in the design of the robot to manage the expectations and ensure that the robot would do the tasks assigned to it.

The second issue related to the “cost cutting” mentality often described as the strategy to get maximum ROI as fast as possible. RPA as a technology has the capability to be implemented fast and with its efficiency and deliver results almost instantly. This strategy ignores aspects of RPA that will need to be dealt if company starts to scale. Change management and employee expectations are harder to handle when the technology is already at their desks. OpusCapita recognized this issue and they used their first RPA projects as an example to the whole staff of the benefits and nature of RPA. RPA managers organized trainings to employees and how it will change their working environment. With this approach both OpusCapita and Deutsche Telekom found that it padded the way towards organization wide utilization.

The third issue that all three companies found was an inefficient development model. Most RPA projects depend on three entities: business users, IT and RPA developer. Business users define the process to be automated, IT sets up the environment and the RPA developer is responsible for the implementation and deployment of the robot. The truth was that RPA developers were mostly responsible for all three factors. To ensure smooth flow for the “idea to deployment” companies formed an RPA CoE to manage development, process choosing and best practices. IT was involved early to ensure all the credentials, environments and security issues before the development. Business was included from the beginning and they were responsible of realizing RPA benefits. This organizing streamlined the automation process and shortened the deployment times.

The final issue was related to the existing process documentation. RPA requires detailed documentation of the process including all the exceptions and their handlings. Xchanging had a strong lean culture already in the company before RPA and managers had experience in streamlining processes. This led to the ease of finding potential cases for RPA since processes were centralized and removed from waste. Xchanging recognized that when processes were lean they provided better results than expected since the process could be scaled with little effort.

Two of the case studies companies (OpusCapita & Xchanging) are BPO companies which was discussed previously in the study as the optimal place for RPA. The studies proved that point since both companies started early and very quickly scaled RPA. Their standardized and streamlined processes made it easy to find new potential cases for RPA.

4 RESEARCH DESIGN

This chapter explains the main research method, semi-structured interviews and its design. Additionally, this chapter explains why the chosen methodology complements the empirical section and the objectives of the work. This chapter also links the literature review to the empirical section of the study.

4.1 Research approach and methodology

The empirical section is constructed around the data gathered in the semi-structured interviews. In semi-structured interviews a pre-defined set of themes and questions were formed before the interviews. During the interview the use of these questions may vary which tilts the tone of the interviews to be conversational. The benefits of semi-structured interviews that it can systematically gather comprehensive data even from broad topics. (Eriksson & Kovalainen 2008, p. 6-7). These interviews gather qualitative data of the current RPA utilization, challenges and how companies are adapting to these challenges. Qualitative research method enables the researcher to answer “how” and “why” questions of the phenomenon while reflecting on the context in which it’s situated (Baxter & Jack 2008, p. 551). Challenges of scaling RPA is a complex phenomenon that doesn’t have one objective solution to it. Thus, the research aims to find patterns that can explain the challenges mentioned in the interviews. Qualitative data collection helps to research the subject in-depth, which benefits the objectives of the thesis.

When attempting to build arguments from qualitative data, researches should have a systematic way to collect specific data. Systematic approach helps maintaining the consistency which is needed in order to justify the findings in the analysis of the qualitative data (Barratt et.al 2011, p. 330). Researches must provide enough detail of the methodology used in the study that readers can validate the trustworthiness and quality of the study. As a basic foundation to achieve credibility researches must provide evidence of study objectives, appropriate research method, systematic data collection and analysis. (Baxter & Jack 2008, p. 556).

Qualitative data collection has received criticism of being “selectively bias” because of the freedom that researches have over formulating hypotheses and looking for evidence that fit the

hypotheses. Avoiding such problems researchers can link the data collection to existing studies to either falsify or confirm the findings of the study (Barratt et.al 2011, p. 332). This thesis uses previous case studies of the subject to bring comparative approach and creditability to the findings in the study.

4.2 Interview design and data collection

The semi-structured interviews were targeted towards Finnish companies that are utilizing RPA in their processes. A shortlist of companies was created based on the connection network that Knowit has to companies that are utilizing RPA. The persons targeted in these companies had previous experience from RPA in terms of managing, developing or coordinating RPA tasks. Overall design of the interviews followed the principles of qualitative research focusing on the “what” and “how” questions and not making questions too prescriptive (Eriksson & Kovalainen 2008, p. 6-7). The criteria was to target companies that are in different stages of RPA maturity to get data from different perspectives and challenges faced. These companies were contacted with predefined cover letter (Appendix A1) via email suggesting an interview about the subject. In total, 12 interviews were held during February and March of 2020.

In order to systematically gather data from selected companies a predefined set of questions were formed. These questions were formed based on the research questions and the literature review. The literature review helped to direct the questions to areas that were challenging, significant or otherwise interesting to the research. The interviews were based on these 16 questions that can be found in Appendix A2. The flow of these interviews generally followed the pre-defined questions, varying based on the knowledge level and position of the interviewee.

5 RESULTS AND ANALYSIS

This chapter is a part of the empirical section and it analyzes the results gathered in the semi-structured interviews. The chapter starts with a quick analysis on the interviewees and their companies. The rest of the chapter is organized around the research questions; RPA utilization, challenges of scaling and growing capabilities in RPA.

5.1 Company and interviewee backgrounds

The interviews were targeted to a wide range of industries that included telecommunications, industrial, power, building, logistics, retail, insurance and staff leasing. The company sales were between 100 million and 10 billion. Anonymized information about the interviewed companies and interviewees can be found in the appendix A3. The interviewees had different backgrounds working directly with RPA or managing a team that was responsible for RPA. In the figure 10 below interviewee positions and experience with RPA is presented. Based on the findings below one can say that interviewees were quite experienced with RPA. With this experience interviewees were able to reflect to their past experiences and how the company has gained experience in RPA when the maturity level grows.

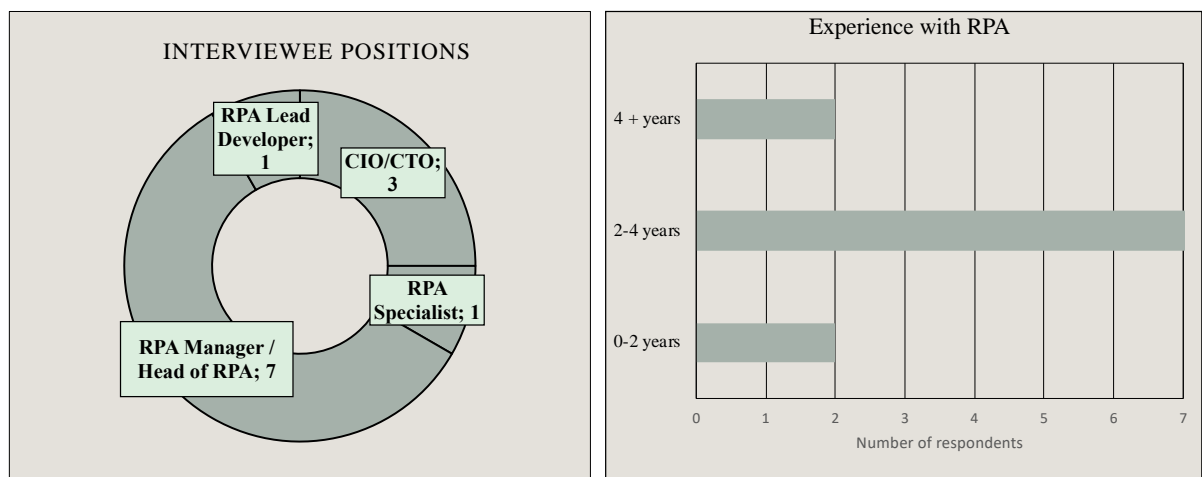


Figure 10. Interviewee data

The interviewee positions included c-suite level executives as well as RPA lead developer. These people had different backgrounds and viewpoints of RPA within their companies. This

variance enabled to approach the problems of scaling from multiple angles. The top-level executives were able to provide insight from the decision process of investing and utilizing new technologies, operative level employees explained the practical challenges of scaling the RPA and managers shared insights on how to commit employees to RPA.

5.2 Current utilization RPA

After half a decade of RPA utilization companies have gone very different paths trying to harness the promised value of RPA. During this journey companies have faced several obstacles adapting to the new technology and its working ways. This work has interviewed 12 companies and discussed this journey with each in detail. With this data this work aims to define the journey that companies usually go through firstly to identify the possible pitfalls along the way and secondly to benchmark the best practices used with RPA utilization. Based on the interviews a roadmap for RPA success was created which can be seen in the figure 11 below. This thesis will go through each of the success factors presented in the model in more detail later in the chapter to showcase the thoughts shared in the interviews.

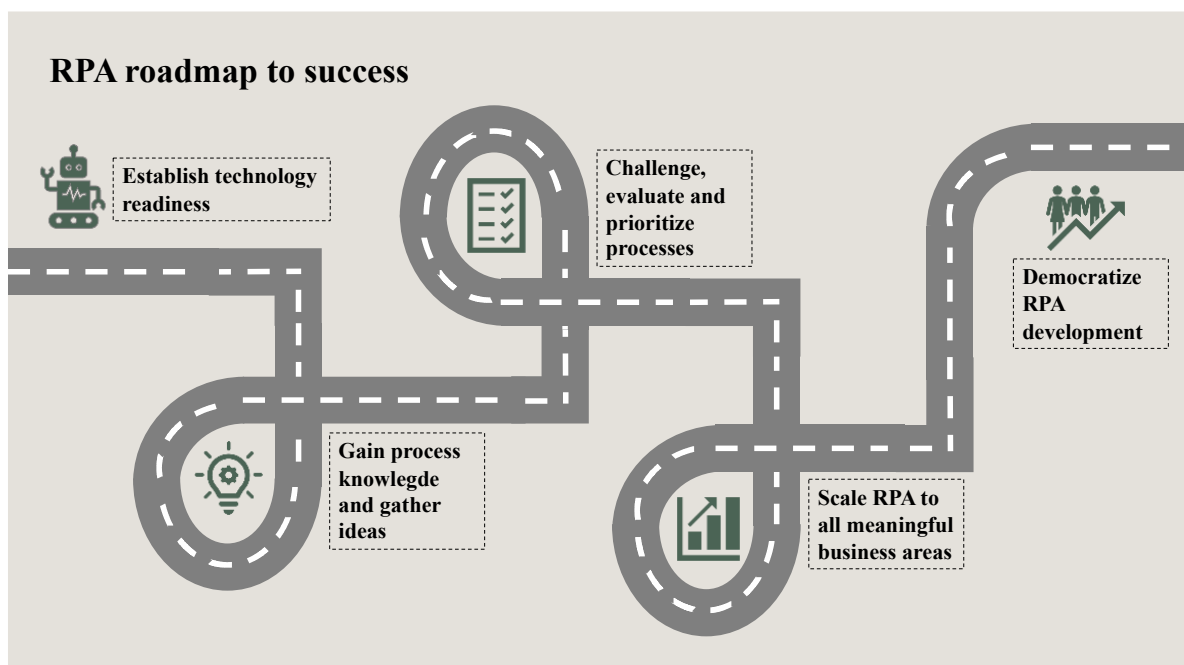


Figure 11. RPA roadmap

RPA has reached a point in its lifecycle where companies are utilizing the technology and focus starts to tilt towards scaling, standardizing and benchmarking. As a young technology RPA is still developing to be more mature in terms of where and how it can be utilized. In the meantime, companies want to position themselves for the second wave of automation by developing competencies in RPA and spreading automations to all relevant business areas. Several companies in the interviews mentioned that they wanted to build a strong understanding of RPA in-house in order to effectively complete projects. RPA's nature of being business centric made it clear to companies to invest in in-house competencies to be able to provide close support to business users.

Companies utilizing RPA had similar objectives what they want to achieve with it; running effective processes while reducing costs, streamlining processes and allocating employee work to more value adding tasks. In the table 3 below the most commonly mentioned objectives for RPA that the interviewees mentioned are presented. The most commonly mentioned goals were productivity growth and cost efficiency. These were also highlighted in the literature review which confirms generally companies are reaching for realistic objectives. Companies also mentioned that the pressure for hiring new employees erupted because of the efficiency that RPA brought. One company shared that their revenue was growing 25% annually and to match the growth would ultimately mean hiring more employees. Staff growth puts pressure on efficiency. RPA reduced the amount of recruitments and made the company even more profitable. Companies were also improving their process quality and removing manual work with RPA. For some companies RPA brought new services and revived old legacy systems. These variance of use cases and objectives show that RPA has many applications to existing processes and it enables companies to create new business value that wasn't possible earlier.

Table 3. Answers for RPA objectives

What is your company trying to achieve with RPA?	Mentioned in > 60% of the interviews	Mentioned in > 40% of the interviews	Mentioned in < 20% of the interviews
Productivity growth	X		
Cost efficiency	X		
Release the pressure of hiring new employees		X	
Remove manual work		X	
Increased process quality		X	
Increase the output of volume processes without investing more resources		X	
Legacy system revival			X
Raise the automation level			X
New services for external clients			X

Almost every company interviewed started their RPA journey with external consultancy providing the first use cases and help in the implementations. Companies have turned to consultation since the technology is fairly young and there was not a lot of experience in the market. After the PoC stage companies phase a decision whether to continue using external consultancy, start to develop in-house competencies or a combination of these. Fairly popular model among the interviewed companies was to externalize the actual development and maintenance of the robots, but to keep process discovery, analysis and environments in-house. The model chosen was usually tied to the organizations strategy that the RPA was originally founded. In most of the companies RPA CoE (or similar) was founded under ICT-organization. If the ICT was already utilizing external partners, the RPA development followed the same line.

The extent in which companies utilized RPA varied based on the interview data. The majority of the companies had aligned RPA to enable their digital strategies as a central component of process development. These companies had higher initial investments in RPA technology, employees and creation of the RPA operating model. Other companies had a more conservative approach to the technology mainly because first RPA projects didn't deliver the value anticipated.

Couple organizations explained that RPA had changed the dynamic within the company of how processes were developed. One interviewee explained that “RPA has lowered the bar for solving technical problems”. Several companies believed that these low-code solutions (like some RPA solutions) will bring process development to the individual level. Operative employees will have more say in the core business processes and how to improve them. Another example of how RPA was changing the organizations process development was that RPA acted as a motivator for larger process harmonization’s. RPA was marketed to these projects to keep their processes as similar as possible in all regions in order to capture most of the value that RPA brings to the process.

Few companies explained that after acquiring a new ERP the business processes underneath didn’t match the system anymore, which translated to temporary solutions creating a lot of manual work. RPA was identified to reduce the amount of manual work that employees were doing because of this process inefficiency. Utilizing RPA in this type of scenario solves the problem of manual work but does not create a solid foundation for RPA. The problem underneath is inadequate process design. To make RPA solutions more sustainable the process underneath must be leaned in order for RPA to efficiently execute processes. Yes, this sometimes kills the use case for RPA, but the mentality in these scenarios should be to find the best possible solution to the problem, which always isn’t RPA.

A popular business area for RPA utilization was in service centers. Companies explained that they had either a regional or an offshore center for their specific business area. The idea of a service center is to gather processes from a specific business area that are highly repetitive and have large volumes. Before these processes are moved to the service centers they are leaned and streamlined in order to create value from centralization. One company even explained that they started utilizing RPA through a service center partner that offered RPA services. In these service centers companies explained that RPA was a central piece of creating the value calculated in the business calculations. RPA enabled companies to form these service centers much closer to their core business which made the governance easier and costs lower.

As a technology RPA is still developing and becoming more universal in businesses. The interviewed companies articulated that the best results with RPA are achieved with combining multiple technologies. As the technology matures a platform to combine all these technologies together will boost the usage of RPA. In the meantime, companies are finding use of RPA with technologies like ML & AI. RPA can act as enabler for other technologies and it can measure company's adaptability towards new technologies.

Based on the interviews any particular industry didn't stand out in terms of their automation potential. The most popular areas for RPA are HR, financial management and payroll which are universal in businesses. Although B2C-companies that have transaction or order-based business usually have higher automation potential, but nowadays they have modern ERP-systems that are already highly automated. Company size (Employees) correlated with automation potential in terms that they have larger volumes in their administrative tasks and they usually have a higher number of information systems. When evaluating the automation potential within a company one should consult the automation level within the ERP and the number of information systems. The higher the number of information systems the greater potential of finding inefficiencies between systems and processes.

5.3 Challenges of scaling RPA

Several companies indicated that their automation backlogs showed visibility for maximum of six months. This made resource allocation hard since the workload changed often. Companies described this to be difficult in terms of scaling since the financial basis for hiring a new developer wasn't justified. In a scenario where the employment is financially justified the scaling follows a linear graph which at a certain point will reach its maximum marginal benefit. Hiring a lot of developers to match a temporary need will become a liability when the workload eases. This decreases the profitability of RPA. One of the interviewees summed up the problem "No one is going to give me enough money to scale RPA solely on new developers".

As the nature of RPA is to work in the front-end of information systems it becomes fragile to any changes that happened in the UI. When scaling RPA, it usually means involving more information systems. This creates an obstruction for companies when multiple systems undergo

major changes. Best case scenario it can deal with little maintenance, but in the worst-case scenario it eats up the resources otherwise used to scale. Two companies explained that they were facing this type of issues and it slowed down their scaling capabilities.

Scaling RPA has proven to be difficult in the literature review and the interviews confirmed this. Companies reported several issues that slowed down the scaling of RPA projects or in the worst-case scenario stopped some projects. The interviewees were asked to answer in their view what slows down the scalability of RPA the most. These questions had pre-defined answers and the results are presented in the figure 12 below. The answers were formed based on the literature review and our experience of the scaling RPA. The deviation of the answers show that companies are struggling with different problems. The deviation can be explained by the different maturity levels that the interviewed companies were currently in.

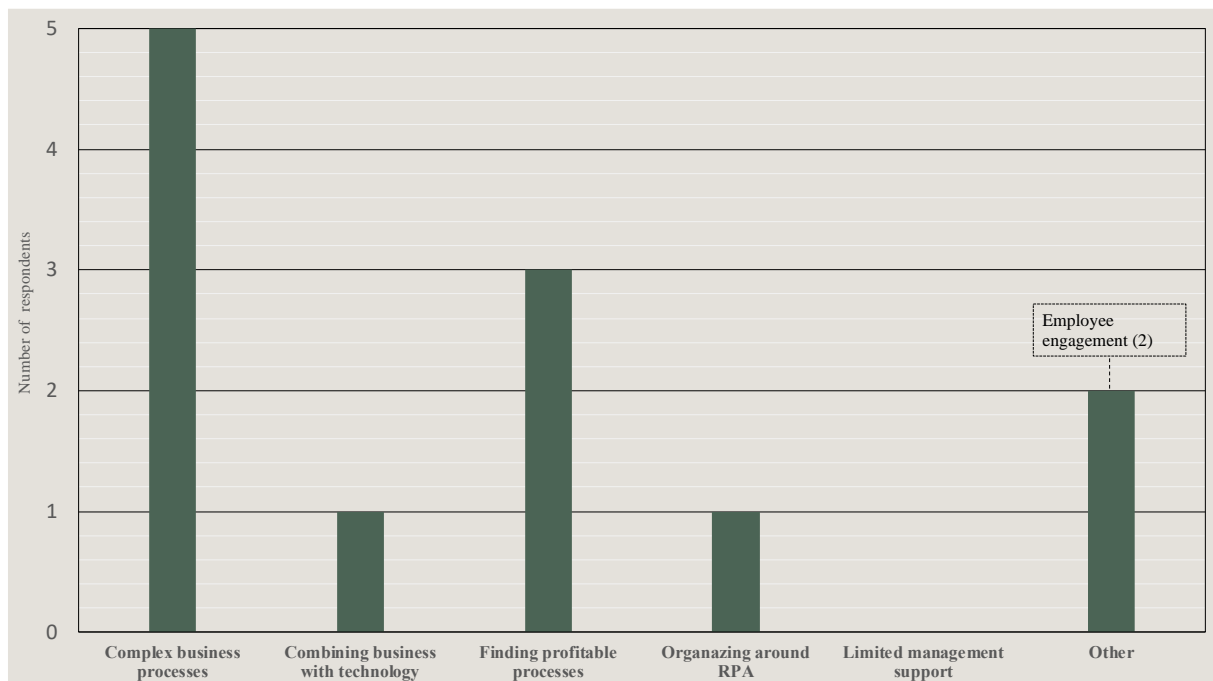


Figure 12. Challenges in scaling RPA

The most mentioned problem in the query was complex business processes. Especially international companies reported that business processes differed in the local offices which made scaling difficult since almost everyone had their own practices of doing similar processes. The lack of centralized processes were the volumes would also increase was a setback for several companies. Organizations still believed that processes could be harmonized, but that

could take years in a large enterprise. Few companies indicated that the nature of some of their processes were so expert depended that RPA didn't have the capabilities to do some of the actions.

The second issue was related to combining RPA to existing business considering employees, processes and systems. One company mentioned that their business users didn't have the same understanding of RPA when starting the automation project, which lead to unfilled expectations. The silo between the project's organization developing RPA and the actual business users made it difficult to design projects to best meet the needs of the business users. Process documentation was lacking in many cases and getting enough detailed process descriptions was time consuming.

The third issue was finding profitable business cases for RPA. Four companies highlighted the fact that to even enable scaling enough potential cases should be in the backlog ready for development. Many aspects affected the business calculations that companies emphasized to not be profitable enough. The major issue was related to decentralized business processes and before they were harmonized the volume was not enough to make the business calculation profitable. Other factors that made it hard to find profitable use cases were already high automation rate, inadequate benefit metrics and poor realization of RPA benefits.

The fourth issue was organizing around RPA. One company described that RPA's organizational positioning effects the scaling capability since the strategic goals are most likely bind to the organization it was originally founded. The team was agile in terms of producing automations to this specific business function but made it hard to scale to other business areas. Interviewee explained that they became "blind" for utilizing RPA in other business units. Company explained that they had a collection of roles that weren't thought through. This made the development process sometimes inefficient.

The fifth issue was limited management support. The fact that none of the companies mentioned this to be an issue in scaling validates the assumption that companies have recognized the benefits of RPA and are willing to invest in it. Some interviewed companies even highlighted

the fact that without their management supporting RPA they wouldn't have grown at the scale they have.

The sixth issue was a possibility for interviewees to bring some other issues to the table. Both companies that went with this option had the same problem; employee engagement. These companies had the technology readiness to develop several RPA projects simultaneously, but the lack of employee engagement meant that RPA projects weren't started and new automation ideas were hard to come by. This issue is central to the successful implementation of RPA since it's a technology designed to work along with business users. Employees and managers need to have faith in the technology in order to fully capture it's value and find new potential cases for it.

RPA is proven to be an efficiency tool for companies, but several companies are finding it hard to fully capture the promised potential of RPA. As companies gain more experience with RPA their maturity with the technology grows which leads to more efficient usage. RPA maturity is a measurement of how well a company is adapting to the technology to bring value to business. It can also be a measurement of company's digital progress since it requires tight co-operation between areas that have different technical capabilities. In the figure 13 below RPA maturity stages are described by a "checklist" of capabilities that a company has in a specific stage. The interviewed companies were classified to a stage based on the data gathered in the interviews. Due to the classification the problems can be categorized to a specific stage which makes it easier to communicate the problems to a specific entity.

The maturity graph was formed based on the interviewee data, findings in similar graphs and authors judgement. The interviewed companies were in different maturity stages which gave this thesis a unique view on how advanced companies reached their current stage and is it similar to a company who is currently in that specific stage. Based on these findings the checklists were formed as they were the milestones that interviewed companies highlighted and also appeared in similar graphs.

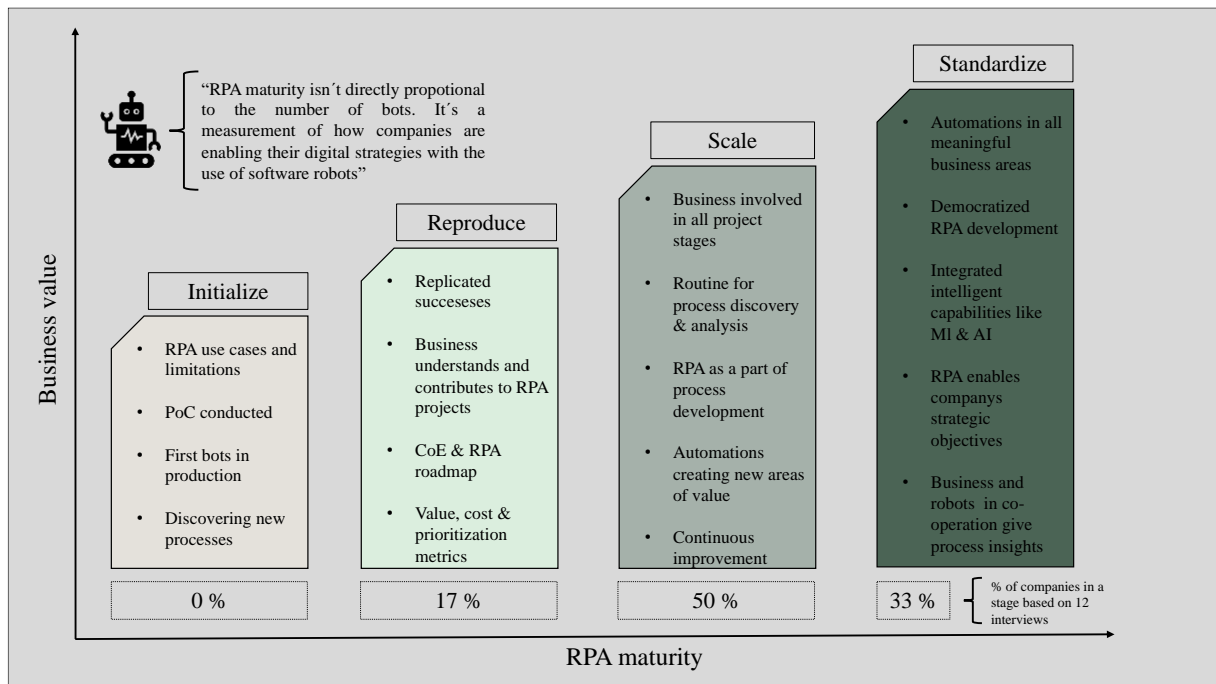


Figure 13. RPA maturity stages

Initialize is a stage where a company is starting to gain knowledge of RPA, where it can be utilized and what are limitations. Companies usually start with a PoC and after that the goal is to get first robots in production. Finding a process that's not too trivial or complex is one of the main challenges of this stage. The importance of successfully implementing the first process reflects on organizations' acceptance of the technology. After first implementations, companies need to start looking for the next processes suitable for RPA. This is crucial for future investments in the RPA since it indicates the value potential for management.

Reproduce is a stage where companies start to focus on the quick wins after the first trials of RPA. The goal is to seek processes that have major impact on process efficiency. These processes have large volumes and highly repetitive tasks. In this stage, companies are starting to get return on their initial investment in RPA, to support this, gauges should be fixated on measuring the total value RPA (Figure 5). As the number of automated processes increase, companies need to start considering RPA projects in a more organized fashion. Depending on existing organizations and where RPA was initially established, companies at the latest form a management model or a CoE to support automation projects across all business areas. Ideas need to start coming from business and involving them in the development is crucial firstly to manage expectations and secondly to ensure right actions for the robot. To accelerate employee

engagement companies can train their employees of RPA. In this stage CoE defines RPA long-term goals by creating an automation roadmap to help keep focus on the most profitable processes.

Scale is a stage where companies start to increase the overall usage of RPA within the company. Business employees at this stage are involved in all of the development stages from idea gathering to analyzing the benefits of the robot. The centralized CoE or management team works in co-operation with business and IT to efficiently conduct RPA projects. Company starts to create a routine for each development stage especially the process discovery and analysis to enable scalable usage. At this stage RPA becomes a central piece of process development enabling new services that were not possible earlier. Company considers RPA in their bigger process development projects to create streamlined processes. At this stage CoE evaluates the long-term goals created in the previous stage and makes necessary adjustments based on possible changes in the environment. As the automation portfolio grows companies need to constantly monitor the benefits that RPA brings and make possible changes to the metrics or the business logic if seen to provide more value.

Standardize is a stage where RPA has achieved a stable position in organizations culture and process development. In this stage business employees and RPA bots synergize from one another and create new insights for business. RPA is enabling company's strategic goals and it also acts as the core product for intelligent solutions. Cognitive solutions like AI and ML can together with RPA process unstructured data and make advanced decisions based on data. During this stage company's maturity grows from being centralized under CoE to companywide understanding and involvement in RPA development. This can also be referred as democratization RPA where the knowledge level of RPA within the company produces profitable ideas for RPA and even small development with the use of citizen developers. RPA is seen as an enabler to achieve strategic goals.

5.4 Growing capabilities in RPA

Scaling the overall usage of RPA can happen in two ways; scaling the number of processes utilizing RPA or scaling the automation level within a process. The first scenario focuses on

finding the bottlenecks of processes with high volume repetitive tasks that take up a lot of time. Automating these parts of the process can increase the through time of the process leaving employees focusing on more valuable tasks. The second scenario takes more analytical approach since when a company wants to scale the automation level within a process it has to differentiate the in and out of scope activities for a robot. This is a great opportunity for companies to reevaluate and develop processes before automation.

Focusing on just the problems and bottlenecks of the process can leave companies with several short-term solutions, which isn't a bad thing but in order to scale more sustainable solutions must be found. To make RPA solutions more sustainable companies can evaluate their end-to-end processes and identify what actions in the process would bring more value to the customer. If some of the actions require precision, speed or large volume handling, RPA might be your solution. As mentioned earlier RPA usually accelerates the through time of certain activities, but that doesn't necessarily decrease the through time of end-to-end process. If a process is built inefficiently RPA usually only moves the bottleneck to the next stage of the process. In an efficient process RPA enables employees to focus on more valuable tasks.

After process leaning the next challenge for companies is RPA project prioritization. Processes that have quantitative metrics (FTE, processed orders or data quality) have clear prioritization. In some projects the benefits are harder to measure for example if a robot does data gathering that hasn't been done before or how much new orders has RPA enabled due to faster processing. Companies need to evaluate all the benefits that RPA could bring starting from tangible benefits and not forgetting about intangible benefits. In most RPA business calculations, the intangible benefits are forgotten which could potentially lead to even bigger cost savings. Table 1 provides ideas and aspects to consider when evaluating the benefits of an RPA case. Examples of intangible benefits could be improved information flow, enhanced data quality or avoided errors. In the same chapter the WSJF-model (Formula 1) is presented, which can also be used to prioritize RPA projects.

As companies increase the amount of RPA bots in their processes, they will need a management model or an organization to support the development. One company articulated that they lacked this type of management model in their organization which created inefficiencies in their RPA

development process. Other companies didn't see this as an issue to scale but highlighted the importance of having a centralized development team. In order for RPA to fully work it needs support from several organizations including developers, business and IT. Ensuring smooth cooperation will remove possible roadblocks and keep track of the quality. Depending on the case companies should consider forming a centralized development team to support business in implementations and manage maintenance like Deutsche Telekom did in their RPA journey. (Figure 8). DT's model scalable development and suggest how change management can be handled.

One of the problems mentioned in the interviews was that the cost benefits of RPA cases didn't scale solely of hiring new developers. Companies can solve this problem by making their resources flexible with the use of external developers. Depending on the case this option will usually increase the unit price for RPA projects, but scale the overall usage. Another option is to utilize existing resources with the use of citizen developers. Citizen developers are business employees that are given licenses to develop RPA bots for their personal / teams usage. With citizen developers the outcomes of RPA cases will increase without the investing in new resources. The figure 14 below illustrates the development cases best for each party. RPA cases that require high effort and also have a high impact on the business should be allocated to the centralized development team. These cases are usually more complex and require certain level of expertise to be able to build a robust solution. The best cases for citizen developers are the low effort low impact-processes. These processes would not be prioritized normally in the centralized development, but citizen developers can develop them to scale up the overall usage of RPA. The processes that are low impact high effort should generally be at the bottom of the priority list. The opposite cases that are high impact low effort can be allocated to either depending on the current workload to maximize the value created. Generally, the cases that the centralized development team don't have time to develop and are not too complex should be allocated to citizen developers.

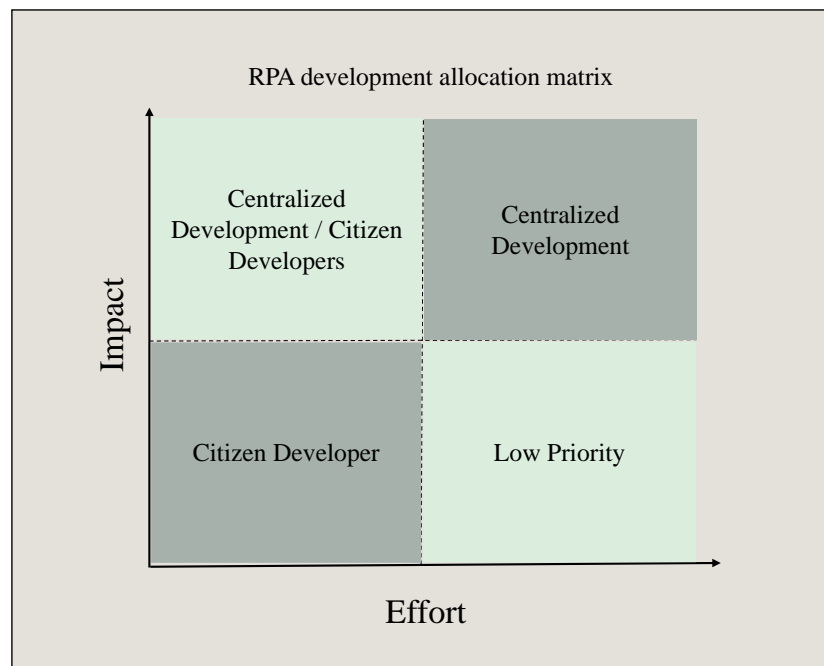


Figure 14. RPA development allocation matrix

Citizen developers will also speed up the scaling process since they will bring the development down to the operative level which can be more suiting for some employees to accept the technology. At the same time these citizen developers can promote RPA to their colleagues, identify more potential cases with a better understanding of the technology and act as a first line support for other employees using RPA robots.

Although citizen developers introduce a possibility for companies to scale their cost benefits it should be approached with caution. Before citizen developers can bring value to the company they need to be trained, a license needs to be payed and employees need to sacrifice other duties for learning RPA. All these costs should be considered when evaluating the possibility of using citizen developers. If a company decides to utilize citizen developers a governance model is needed to ensure quality and meet the company security terms. It also should be evaluated how many cases at minimum be automated to cover the license and other costs.

RPA maturity highly affects the business value created to the company. Growing the maturity level enables companies to effectively conduct RPA projects to even more complex processes.

The literature review and the interviews confirmed that companies are facing varying challenges in the journey to organization wide RPA usage. The model presented in figure 15 below aims to highlight the challenges faced between each stage and best practices to overcome those challenges. Having recognized these challenges companies can anticipate them and change their behavior in order to avoid or prepare for them.

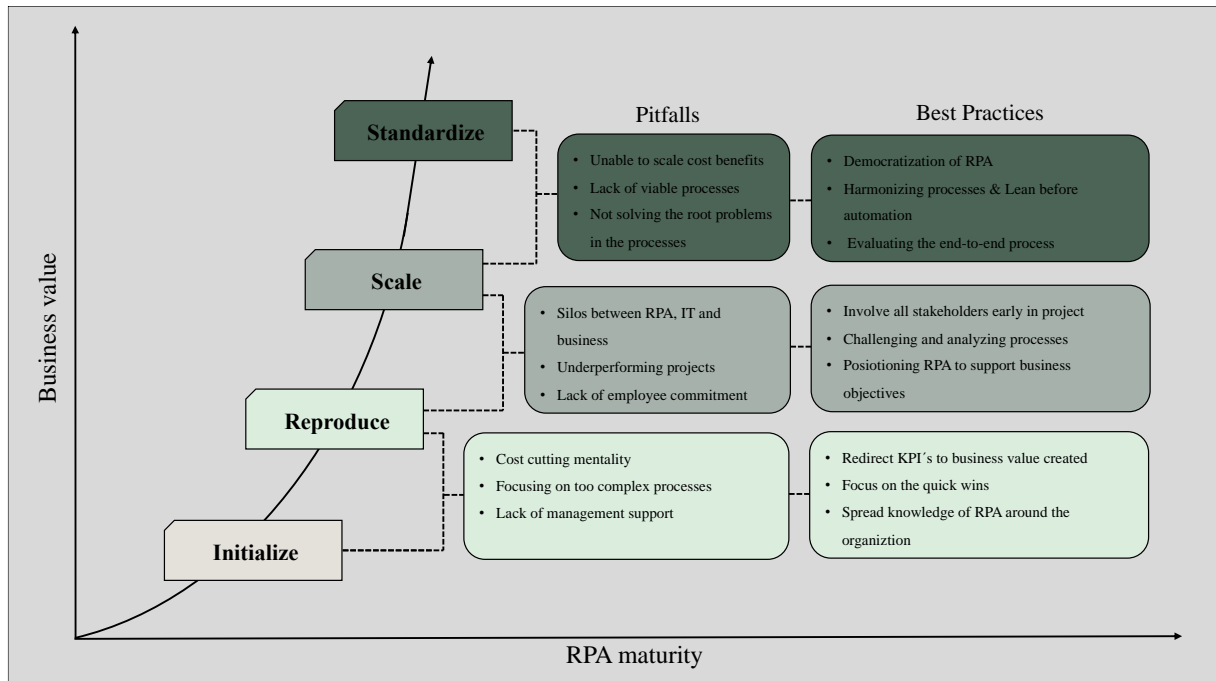


Figure 15. RPA maturity growth graph

After initializing RPA companies grow their capabilities to reproduce the successes made in the first stage. This transition aims to create a solid foundation for RPA by educating employees of the technology. The first projects might have focused solely on cutting costs which RPA can certainly do, but it does not create a sustainable foundation for it. Redirecting the KPI's to measure the value that RPA creates for the business will increase the ROI when all benefits are considered. This also supports the continuity of RPA when it has objective numbers to back it up. New investments are more easily justified. This isn't the stage to build the most advanced solutions but to focus on the basics which usually deliver the biggest ROI.

The second transition focuses on increasing the overall usage of RPA. As the number of automated processes grow and several automations projects can run simultaneously it's important that the development process is mature. This means to include all the stakeholders

early in the project to ensure smooth development and removal on possible roadblocks. At this stage companies have automated the “low hanging fruits” and processes grow complexity as the maturity grows. To ensure that projects still deliver value to the company they must be challenged and analyzed before automation. This work introduced a method to improve process efficiency by leaning them before automation (Figure 3). Business employees must at this point be committed to using RPA and finding potential use cases for it. Companies can engage employees to RPA by integrating it as a part of process development. This way the goals of the organization might motivate them to using RPA or at least seeing it as an option to develop processes.

The final transition is when RPA becomes recognized as an enabler for organizations to reach their strategic goals. At this stage companies have RPA in all of their relevant business areas and business involvement has increased due the democratization of RPA. Utilizing regular business users to conduct small automations helps companies to scale the cost benefits of RPA. Another way to scale up the cost benefits and find more viable cases for RPA by harmonizing and centralizing processes. RPA can act as the motivator to conducts bigger process development projects when the value can be demonstrated. Companies can also look into service centers which is an optimal area for RPA utilization. To make RPA sustainable within the company end-to-end processes must be evaluated and how could RPA fit in that equation.

The challenges described in the model don't necessarily appear in the order they are put in. The goal of the model is to raise knowledge of RPA and what type of challenges companies have faced during their maturity growths. With this model companies can avoid making the same mistakes that other have made and learn from them.

5.5 Case study and interview data comparison

The interviews revealed several challenges when it comes to scaling RPA. In order to analyze these problems and present somewhat valid suggestions to overcome them this thesis compares the challenges identified from the interviews with the challenges summarized in the case studies. In the table 4 below identified issues and their support from the case studies are presented.

Table 4. Interview and case study data comparison

Findings in the interviews of challenges scaling RPA	Support from case studies
Complex business processes	No
Combining business with technology	Yes
Not finding profitable processes for RPA	No
Employee engagement	No
Organizing around RPA	Yes
Increase of systems automated decrease the resources used to scale	No
Scaling solely on hiring new developers doesn't scale the cost-benefits	No
Inadequate process documentation and maturity	Yes
Unstructured data	No

Out of the challenges identified in the interviews majority of them were not supported by the case studies (67%). The lack of support can be explained by the time frame of these studies and how the knowledge and technology of RPA have improved over time. Companies in these case studies started their first RPA projects as early as 2014 when the technology was not as widely known as it is today. One of the factors that the case study companies highlighted were change management to prevent resistance from employees. Today the nature of RPA is understood more deeply and recognized as efficiency tool rather than a job eliminator. Couple companies pointed out that their employees weren't committing to RPA projects which slowed scaling. This can be a result of not handling change management when RPA was introduced. The lack of commitment can be explained that employees don't either see RPA as a viable tool or they don't really know where to use it. Promoting RPA cases early on is important for companies not only for the acceptance of the technology, but so that employees would recognize the benefits of it

The most mentioned problems in the interviews were around processes being too complex and not centralized. The case studies didn't recognize this issue at all which can be explained that two of the case study companies were BPO companies who specialize in process streamlining,

standardizing and centralization. Both data sets supported the claim that process documentation and maturity effect heavily on the deployment time. Companies in both explained that they even left out some processes because of the lack of process knowledge and documentation.

Couple of emerging concerns that were identified in the interviews related to number of systems automated and unstructured data. These problems came from companies that were in the scaling maturity stage as they began to interfere with more complex processes and data. One of the interviewees taught that “RPA’s use cases will exponentially grow when companies can reliably formalize unstructured data”. RPA can be coupled up with technologies like OCR to support unstructured data validation, but it has it’s limitations. In most cases formalizing the process to support standard data formats and educating data inputters can lead to better results.

The deviation of the challenges show that RPA is in desperate need of benchmarking and standardizing. Interviews revealed that when companies are starting with RPA, they usually consult other companies even competitors of their RPA journey. The most commonly asked question was “where do you find the best processes”. Companies definitely recognize the type of processes that are fit to RPA but fail to find them in their own processes. With industry standards and benchmarks companies could compare their results and get insights from best practices.

6 CONCLUSIONS AND DISCUSSION

RPA has enjoyed the hype of some organizations describing the technology to revolutionize the way we work. The truth of half a decade of RPA is that enterprises have mostly succeeded in moving data between systems faster with less manual work rather than transforming processes and creating new areas of value. RPA does not have the capabilities of transforming business processes on its own, but it has sparked ideas to many process owners to evaluate and transform their processes before automation. This ideology of constantly evaluating processes through the possibilities of new technologies is not only important for RPA but for a wider digital transformation.

RPA has somewhat failed to deliver on its incredibly ambitious promises of being the cheap and easily deployable solution for reinventing business processes. As discussed above RPA is not transforming processes it's enabling the process owners to create innovative solutions to their processes. Many companies have recognized this aspect and started to evaluate their processes before automation. As companies began to scale RPA, they phased a new problem that had nothing to do with RPA; lack of process knowledge. Transforming processes is never easy and with broader processes it might take years, but in the absence of detailed process information it's almost impossible. In order to scale RPA, companies need to look at their end-to-end processes, understand the actions being done, evaluate how could RPA benefit this process and most importantly document everything along the way. The greater part of the work of automating processes goes before the actual development and a big accelerator to this is detailed and up to date process information.

The hype that RPA created when it first came out was remarkable. Even though the technology behind it wasn't groundbreaking the ideology that anyone could start developing their own robots and its "lightness" was what made RPA so popular. RPA quickly became a benchmark in the digitalization race leaving executives demanding to have robots in production. This pressure was what led to many failed RPA projects because in the rush companies forgot the nature of RPA, it's an enabler not a solution. Through trial and error companies have now matured to a point where RPA is seen as an efficiency tool and the next step is to scale the utilization of this tool to all relevant business areas.

6.1 Answering the research questions

This thesis aimed to study the RPA usage in Finnish companies to expose the challenges and successes that RPA brought to these companies. Currently companies have matured to a stage where the majority of companies have passed the initial stage and the next step is to scale the overall usage of RPA. This transition has caused several companies problems in terms that they haven't been able to scale the technology or the scaling hasn't happened at the predicted pace. This thesis interviewed 12 companies to find out what is slowing down the scaling of RPA and what can be done differently to accelerate the pace. To support this objective this thesis used three research questions which are answered below.

Q1: How are companies utilizing RPA and what are the common investments associated with it?

Attitudes, utilization and the technology behind RPA have all changed in the past couple of years. Most people don't see RPA as a job eliminator anymore, more the opposite as operative employees are becoming more and more involved in RPA and process development projects. Companies have also changed the way RPA is utilized. RPA is now utilized in actions that wasn't worth or possible doing before RPA, thus creating new areas of value. The RPA technology itself has also developed to support more intelligent solutions like ML and AI. RPA vendors are also offering products to automate the whole development process from process discovery to results analysis.

RPA has seen many new innovative use cases, but the objectives behind these use cases have stayed similar over the years. Companies still see RPA as a tool to increase productivity and control costs. Other objectives include the pressure reduction of hiring new employees, repair the inefficiencies between information systems and processes and revive old legacy systems. Because of objectives like legacy system revivals RPA has been described as a "bandage" solution. RPA can certainly provide assist to existing IT-ecosystem without changing the underlying systems, but to only utilize RPA in these type of scenarios doesn't create a sustainable foundation for it.

RPA changed the process development in some companies that described how RPA had lowered the bar of solving technical problems. This meant bringing the process development to the individual level which brought many new ideas to the table. Couple more advanced companies described to have taken this to a new level where they harnessed the potential of their employees to develop small RPA projects. This was also referred as utilizing citizen developers or automations hubs.

As the study results showed majority of companies are now looking to scale RPA across all business areas. Many companies articulated that they were looking for bigger entities for RPA in order to scale effectively. One popular entity where RPA saw massive benefits was in service centers. These service centers take processes from a specific business area streamline and centralize them in order to gain value from economies of scale. Several companies in the interviews said that most of their RPA development was allocated to these centers. As companies gained good experiences from these centers, they began to spread RPA to other business areas with the best practices they had learned.

At some point in RPA maturity graph companies have automated the “low hanging fruits” and as they climb further processes get more complicated. From this point companies explained that they either looked for better processes or mixed RPA with more intelligent solutions like ML and AI. As these technologies are the logical next step companies need to acquire certain level of maturity in them before combining them with RPA, which is another thesis subject.

At least in the beginning RPA was marketed as the cheap, easy, and quick solution, but as one of the interviewees summed up “I don’t think it’s any of those things”, a reality check was in place. Most of the RPA solutions in the market have a business models around licenses and these licenses can cost up-to many thousands of euros just to get started. As the utilization scales the unit price drops, but the still initial investment is still too high especially for SMEs. This doesn’t even include the development costs, infrastructure and personnel. RPA can be an easy solution in the context that doing the same thing with other options like system changes or integrations turn out to be hard. In the other contexts RPA requires comprehensive process knowledge, programming skills, continuous development attitude and attention to detail. RPA

definitely can be a quick solution compared to other more traditional IT-projects like system changes which usually takes years. An average RPA project from idea to deployment usually takes 6-8 weeks to complete. The development time doesn't decrease massively when RPA maturity grows. It's more depended on the process knowledge of which is absent will increase the deployment time significantly.

Majority of the companies went with top down strategy when they were starting with RPA. This meant having higher initial investments on employees, licenses, trainings and development. These companies had a clear strategy of the next steps and how to scale RPA. Some companies had more of a conservative approach to RPA and they used a bottom up strategy where employees were "trying out" the technology and finding use cases for it. The trend that arose from the interviews is that almost every company had interests in growing internal capabilities in RPA to provide better support for business and to cut down on the development costs.

Q2: Why is it challenging to scale robotic process automation?

It probably took some companies by surprise of how challenging scaling RPA can be. Their initial RPA projects had delivered well above expected results and new cases were waiting to be automated. As companies moved forward with RPA, they faced several challenges that slowed down the scaling process. Complex business processes, silos between organizations, lack of employee engagement, scaling of cost benefits, lack of process knowledge and altering information systems were all problems that companies had faced in the recent years. Only the last problem can be categorized as a problem of the technology. Rest are problems that companies already either had or they were not considered when starting with RPA. Scaling RPA is mainly change management in the organization and knowing of the problems that are ahead helps them to alter their behavior to avoid or prepare for these problems.

Majority of the companies explained that they were constantly looking for better cases for RPA that could thrive major effectiveness. As companies had matured to the point where the easy cases had already been automated, they moved towards more complex processes and started to look for value there. This caused stiffness in some companies as RPA by itself had reached its

maximum technological capabilities. Some processes required actions that could not be performed with RPA or it required more advanced decision making. Another factor that affected the finding of these cases were decentralized processes. Especially international companies explained that their business processes were not harmonized between locations and thus reducing the volume of each case. Complex business problems were also a factor in the business case calculations that companies did to measure the value and prioritize different projects. Some companies explained that it was hard to measure some of the benefits that an RPA-project could bring. For example, valuing the increased sales that RPA has created or valuing something new that RPA does. Not finding valid metrics for the intangible benefits might have caused some companies to not see the real value of some RPA projects. Some companies also described that they already had a high automation rate which meant fewer potential cases for RPA. Also realizing the benefits that RPA brings, decreased manual work for example, measuring what employees do with their freed-up time was also a challenge for some companies.

RPA is a technology that requires several organizations within a company to work together in order to get the maximum value. People in these organizations have different backgrounds and skill sets. It is important that when a company starts to automate their processes with RPA that everyone would have a common understanding of what's actually being done. Some interviewed companies explained that this was a moment of inertia since they had to explain the possibilities and limitations of RPA for the business employees to ensure that they knew what it would be capable of. On the other hand, the project organization had to understand the business process that was being automated. This also caused slowness since the processes weren't documented properly and knowledge of the process was not at a level for RPA. The project organization had together with business create proper documentation and gain more knowledge of the process which usually took more time than the development itself.

At its core RPA is a tool to efficiently conduct business processes that are repetitive and have high volumes. Its nature is to work as a digital worker alongside human employees. Due to these characteristics RPA should be positioned in the business since they are responsible of deploying the bots and their benefits. Some companies explained that this lack of commitment from the business side made it difficult to scale operations. Humans solve problems with the knowledge that they have, and these organizations had had training days and seminars about

the technology, but employees still weren't committed to the cause. These organizations explained that it is pointless trying to force RPA since the actual benefits depend highly of how people work together with the bots.

When companies reach a point where they have certain amount of resources for developing the robots and they wish to scale RPA across all business areas they face a problem of not scaling the cost benefits of hiring more developers. At some point companies will reach a maximum marginal benefit of hiring new developers and then the scaling only happens at linear pace. Companies that were further down the maturity lane explained that they had multiple good cases in the backlog, but the size of the development team meant that only the best cases could be done, and the smaller ones would be ignored.

One of the most common problems with RPA is its dependency of information system UIs. Even the smallest of changes can break the automation making RPA constantly needing maintenance. This characteristic limits RPA of automating certain processes that are business critical since RPA is more bound to errors than integrations for example. Similar problem arose when companies began to scale RPA the number of information systems automated usually grew also. This created slowness in terms that resources normally used to scale were used for maintenance of existing bots due to multiple changes in the information systems. As with many technologies RPA isn't totally reliable when it's using unstructured data. RPA has seen some success with technologies like OCR, but not covering all the cases.

Q3: How to increase organization's capabilities in RPA to get the most out of it?

Although many challenges have rose in the utilization of RPA companies still see the potential and are willing to work to get past these challenges. Most of the companies where at a stage where they started to scale RPA across all meaningful business areas. To enable this scaling companies need to find enough potential cases that makes the scaling of RPA financially justified. In the findings below are suggestions to finding better use cases, making the deployment process more efficient, setting proper metrics for RPA and democratizing RPA in the organization.

The first step into utilizing RPA in more business areas is to find profitable use cases. Companies described several strategies of finding more use cases that included trainings, seminars, workshops, brainstorming, process mining, process discovery and external consultancy. These techniques focus on finding processes that are viable for RPA as they are. Companies were able to find many use cases with these techniques, but stumbled on a problem that processes turned out to be more complex or included more exceptions than originally expected. To avoid this problem companies started to “challenge” these processes before automation. This meant questioning the actions in the process and possibly suggesting alternative workflows. This work presented a lean first...then automate model (Figure 3) which follows the ideology of developing processes before automating them. One could argue that leaning processes before RPA takes the agility out of it, but as companies increase the automation level it’s good to remove the waste before doing so. RPA can also act as a motivator for developing processes and that’s why it should be included in the process development as one option to increase the effectiveness. Including RPA in the process development might also have positive impacts on employee engagement since RPA is now tied to the strategic objectives.

As companies scale RPA they will have to get innovative in terms where RPA can be utilized. Automating the obvious cases like order handling, data transfers and invoice enrichments should be the priority, but utilizing RPA in something that hasn’t been done before creates new areas of value. For example, using RPA to form a report that gets data from multiple systems and databases. Data validation is also a good use case example that would be too numbing to be done by hand.

As processes grow in complexity the measuring of the benefits becomes ever harder. RPAs most common benefits are the reduced time spent on routine, increased handlings or filling the gaps between information systems. All these can be measured and compared with alternatives to estimate the value that RPA could bring to the process. RPA can also create intangible benefits that are harder to measure and due to this reason left out from the business case calculations. In order to fully capture the value that RPA could bring to the process this thesis introduced two methods of measuring the benefits of RPA first one being in the table 1 suggesting different criteria to measure. Another method is introducing in the formula 1 where

WSJF score is calculated. Both of these methods include actions and their KPI's to effectively measure the value of an RPA project.

RPA is a business centric tool and utilizing the potential of employees will scale the usage and cost benefits of RPA. This can also be referred as the democratization of RPA where employees engage in RPA projects and some of them even develop their own bots. Increasing the knowledge level of RPA within the organization creates a lot of benefits and solves couple of problems. Firstly, employees are now more likely to find potential use cases for RPA as their knowledge grows. Secondly, the deployment times will probably decrease as employees already know what level of process knowledge and documentation RPA needs and they can individually conduct them. Lastly the automating potential of employees can be harnessed with the use of citizen developers that are given licenses to develop their own robots. This approach solves the problem of scaling the cost benefits since citizen developers will conduct RPA projects that wouldn't be prioritized thus increasing the overall usage while not investing in new resources.

The interviewed companies were in different RPA maturity stages thus facing different type of challenges. This thesis categorized these maturity stages to four initialize, reproduce, scale and standardize to comprehensively present the problems in each stage and provide best practices to overcome these challenges. With these models presented in the figures 13 and 15 companies can identify the current stage they are in and make justifications on their behavior based on the next stages problems and best practices.

6.2 Discussion and further research

Due to the challenges that companies are having scaling RPA this thesis aimed to identify these problems and create a model for growing capabilities to avoid recognized challenges. As the results show companies were struggling with different problems when it came to utilization and scaling of RPA. The lack of industry standards and benchmarks made companies hesitant on their choices and they were interested how other companies were utilizing RPA. By providing data of the current market situation and categorizing companies to a maturity stage

will serve informational material for companies moving forward with RPA and for companies starting their RPA journey.

Digitalization reveals the inefficiencies that companies have on sitting on legacy systems and processes from the last century. RPA has been one of the first technologies to reveal the underlying challenges that companies are having. RPA requires in-depth process knowledge and process documentation, which most companies lack in their day to day processes. Companies now have the opportunity to make a more fundamental change with the help of accelerating technologies like RPA.

One of the problems of scaling can be summaries as not finding enough profitable use cases for RPA. This thesis has provided methods and suggestions on how to find, develop and prioritize processes. Although most companies definitely have a lot of potential for RPA it cannot be generalized to all. RPA requires high volume streamlined processes in order to provide value. Some companies might not have streamlined processes and others business model doesn't create enough volume work. Scaling RPA means recognizing future potential to justify investments and without this potential company needs to make fundamental changes before scaling or focus on other options.

The market for RPA has changed rapidly over the past five years and will continue to evolve as companies gain more experience and technologies mature. The case studies provided insights on how companies were utilizing RPA half a decade ago and the answers vary compared to the current problem's companies are facing. We are already seeing huge leaps in technology as AI is helping to find suitable processes for RPA, machine learning is enabling RPA to cover more complex processes and robots are coming ever so more autonomous as the market grows capabilities. AI and ML have followed the same hype cycle as RPA as of now being described to change the working environment permanently. Might be true, but critically viewing new technologies and seeing past the hype will lead to realistic expectations of what's to come.

This thesis aimed to add knowledge on the narrowly researched area and to provide additional data to existing researches by providing a new angle to research RPA usage. The data comparison between past case study and present interviews showed how the market has evolved

in the past years. With the knowledge gained through this research companies can identify the problems associated with RPA and look for examples of how to avoid them by the companies that already have struggled with the same issues.

This thesis serves as a good foundation for future research. This study focused on the challenge's companies are having currently and conducting a similar research a couple years from now could provide great insight given how fast the market and technology is developing. This thesis also touched the subject of combining RPA with other emerging technologies like AI and ML. Conducting more in-depth research about the subject and how RPA could accelerate cognitive technology implementation.

The limitations of this work are somewhat to the Finnish market of RPA. Although the technology usage is pretty universal when looking at the past research, but the best application of this thesis is to the Finish market. Second limitation is the relatively small number of interviews. To gain a more comprehensive view of the current market situation one has to conduct more interviews. The fact that research did not scope out certain industries can act as a limitation since the methods are built to a general audience excluding any specific needs of a specific industry.

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APPENDICES

Appendix A1: Cover letter for Interviews.

Hey x,

I approach you for the opportunity to conduct an interview regarding my master's thesis. I'm doing my thesis for a Nordic technology company Knowit Oy. My thesis researches the challenges of scaling robotic process automation in companies operating in Finland.

The main purpose of the interviews is to map the extent of RPA utilization, identify the possible challenges of scaling RPA and discuss how to increase capabilities in RPA to achieve better results.

Would you have time for an interview of about 30 minutes to an hour on the topic? The interviews will be conducted anonymously, and the results will be handled confidentially for academic purposes. Your contribution to the work will be crucial, since it's a narrowly researched area. The results of the thesis can be presented in person or sent by email later in the spring.

Appendix A2: Interview questions.***Common:***

1. Briefly describe your role and responsibilities in the company?
2. What experience do you have in robotic process automation?
3. How did your company end up using RPA?
4. What business area utilizes RPA the most?

Related to the first research question (RPA utilization)

5. How did first RPA projects get started?
 - a. Specify: What investments did it require?
6. What were the main objectives in the beginning?
 - a. Specify: Did you aim for a quick win or did you see long term potential in RPA?
7. Did your company start developing RPA in-house or did you rely on a partner?
 - a. Specify: How did you come to your solution?
8. How did your company find the first processes to be automated with RPA?

Related to the second research question (Challenges of scaling)

9. After the first RPA projects, what were the next steps?
 - a. Specify: Did RPA redeem the expectations or did some other technology turn out to be better for the use case?
10. How much automation potential do you see in your company?

11. How or did the objectives for RPA change after the first projects?
 - a. Specify: Where these objectives met? If not, what were the biggest challenges?

12. What do you think slows down the scalability of RPA the most?
 - a. Complex business processes
 - b. Combining business with technology
 - c. Finding profitable processes
 - d. Organizing around RPA
 - e. Limited management support
 - f. Other, what?

Related to the third research question (Growing capabilities)

13. Related to the previous question, are any of the problems mentioned currently an issue?
 - a. If yes, how they have been resolved?

14. How has your company organized around RPA?

15. How does a process end up being automated currently compared to the first RPA projects?

16. What has been the clearest change in your company that has taken RPA utilization to the next level?

Appendix A3: Interviewed companies, roles and dates

Company	Interviewee role	Date
Company A	RPA specialist	20.02.2020
Company B	RPA Manager	20.02.2020
Company C	RPA Manager	21.02.2020
Company D	CIO	21.02.2020
Company E	RPA Manager	03.03.2020
Company F	RPA Lead Developer	05.03.2020
Company G	CIO	12.03.2020
Company H	CIO	12.03.2020
Company I	RPA Manager	16.03.2020
Company J	RPA Manager	18.03.2020
Company K	RPA Manager	20.03.2020
Company L	RPA Manager	02.04.2020