

Analysis of Robotic Process Automation adaptation in the purchasing process

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Abstract <p>Robotic process automation (RPA) has become a buzzword since 2000s and obtained more and more attention from various industries and services. However, the widespread of the term is contrast to the amount of research or studies about the subject. Moreover, when it comes to RPA adaptation in purchasing process, case studies or proven methods are still limited. Purchasing process has grown overtime and become a strategic part of any business organizations. Because of its significant contribution to company's turnover and asset, purchasing function is on the run of utilizing its processes with help of advanced technology. RPA, among other ground-breaking technology, is a potential subject that can leverage purchasing function, and business operation. The aim of this study is to uncover the challenges in adopting RPA solutions to purchasing process, identify suitable purchasing process, and the approach to start RPA project plan.</p> <p>The qualitative method was applied to conduct this research. A comparison between RPA and traditional automation solutions were constructed. The comparison provided supports for the flexibility of RPA in organizational IT systems. Available research and case studies were used to build theoretical background. The results from the interviews served as sources for practical analysis which provided further support for the theoretical background. The challenges that prevent organizations from adopting RPA to purchasing process are the maturity in process, the people, and the resources. Potential candidate for RPA solutions is operational purchasing process. The study suggests using the process mining method to help firms overcome the challenges in adopting RPA.</p> <p>The method to adopt RPA was given and applied to organizations that require more content on the subject. For organizations that have already adopted RPA, this research stands as a source for recommendation of method to evaluate and monitor RPA performance more efficiently.</p>		
Keywords: purchasing process, purchase-to-pay, RPA, process mining, ITPA, process maturity, process analysis.		
Miscellaneous		

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Abbreviation

AI	Artificial Intelligence
BPM	Business Process Management
BPMS	Business Process Management System
BPO	Business Process Outsourcing
COGS	Cost Of Goods Sold
EAI	Enterprise Application Integration
EDI	Electronic Data Interchange
IEEE	Institute of Electrical and Electronics Engineers
ITPA	Information Technology Process Automation
FTE	Full-time equivalent
ROI	Return On Investment
RONA	Return On Net Assets
RPA	Robotic Process Automation

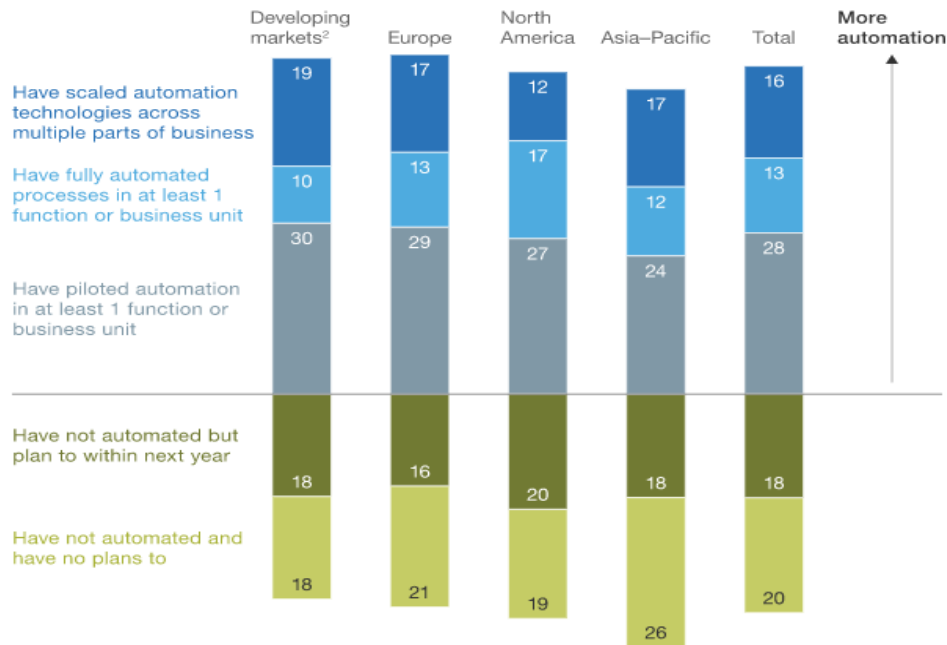
1 Introduction

1.1 Preface

Automation or Robotic Process Automations (RPA) term has been a buzzword for over decades and grown to possess the power of changing the definition of manual work. Its influence has been predicted to become a leverage for every industry who always set process optimization along with systematic efficiency as their goal over the course of time. However, the adaptation of any new technological advance, especially RPA solution, to organizational operation presents conditions for business owners to think of their ability to comply to new change. Any technology adoption for internal practice is to trade in reliability and learning process from the human workforce (Butler& Sellbom, 2002). Employees show concern over the reliability of new technology whether its rate of interaction correspondence is relevant to their expectation. Moreover, the fact that how the technology is quickly learnt and used by employees is an aspect to consider. According to Atkin and Chaudhry's observation on firm's practice, there is not only rare evidence showing that new technology being used directly but also rarer 'direct measures of the costs and benefits of adoption (Butler & Sellbom, 2002). Human workforce opinion is not the only condition ensured the successful of a technology takeover. The cost of initial investment, the suitability and maturity of current organizational processes are preliminary to the transition from existing IT system to new IT system in company's operation (Lacity et al, 2015; Virkkunen, 2019). It is undeniable that these factors stand as barriers that affect organization's decision to adopt RPA solution.

According to McKinsey & Company report, the growth rate of automation is expected to be 72% in 2019. The percentage of the group of companies whose processes have been partially or fully automated in one business unit or across multiple parts is presented as 57% in global scale (figure 1). From the statistic, developing markets and Europe market have the highest percentage of having automation pilot projects and scaling automation technologies in organization. The opportunity for automatic processes, specifically RPA solution, is high in North America, developing markets, and Asia-Pacific. In the other hand, the data also shows more than 20% of surveyed companies do not know about automation solutions and do not plan to automate their business operation. This data is served as a summary of the current situation of automation demand now and in the near future. Since automatic processes will

become crucial for any business to leverage daily operation and gain more advantages, it is essential that organizations are aware of the challenges and factors that expose to them and find suitable solution to leverage the current processes into more standardized and efficient ones.



¹Respondents who answered "don't know" are not shown. Total n = 1,303; in developing markets, n = 373; in Europe, n = 479; in North America, n = 281; and in Asia-Pacific, n = 170.

²Includes respondents in China, India, Latin America, Middle East, and North Africa.

Figure 1. Steps organizations have taken to automate business processes (McKinsey&Company, 2018)

To adopt RPA solution to the system is yet to carry further investigation from the inside-out of any organizations. "It is not only important to recognize the willingness of the industry to innovate, but also its awareness and appreciation of the barriers to be overcome" (Mahbub, 2008). Being a big investment that changes the dynamic of work and collaboration between human workforce and technology, RPA possesses a systematic approach from the top to the bottom. It is known to improve process and productivity through mimicking human work by automating routine tasks. Human position is now responsible for productivity in logicity or thinking (Vainio, 2019) after receiving the desired results from the robot. The benefits are proved to be significant in compliance, quality/ accuracy, productivity, and cost reduction (Wright et al, 2018). Regardless of notable results, the variable barriers to overcome whenever adopting automation and robotics are economic and cost, structure and organization of the construction industry, construction product and work processes, technology, culture, and human factor.

1.2 Objectives

Implementation of RPA has been seen popular among many fields of industries and services. However, there has not been much research done for the purchasing process adaptation with RPA. Purchasing process is not an exemption from facing the dilemma of RPA adaptation. The pressure to pursue cost effectiveness and efficiency in managing required external resources has brought the necessity for applying automation in purchasing process. However, among critics, the postpone for RPA adaptation lies in organization's process fragmentation and IT readiness (Wright et al, 2018). Following this matter, the author took the concern with RPA adaptation in purchasing process as an investigated subject. "The traditional routine-based procurement activities such as purchase order processing and market analysis are increasingly being automated or outsourced" (Muurinen, 2019). The author was intrigued by the impact of RPA to purchasing process because strategic purchasing can affect positively on profitability of a company and reputation, image, agility, and strategic positioning (Vainio, 2019). Moreover, the lack of relevant studies on organization's obstacles to automate RPA is the purpose for the author to conduct the research.

The target of this research is to find out the factors that influence company's decision to adopt RPA solution in purchasing process and to deliver solutions or improvements for further usage. To deliver the reliability and validity to the matter, the author decided to base the thesis research on these questions below.

- **What kind of purchasing process is suitable for RPA adaptation?**

A definition for RPA is described to give the background of technology usage, benefits, requirements. Elaboration on success cases in RPA is given. The most crucial aspect conveying this part is to verify the specific process which is suitable for RPA.

- **What are the obstacles for company to integrate RPA in its purchasing process?**

This question is targeted at the operational environment of interviewees from different companies. Certain factors pose as obstacles or challenges that effect organization's decision to practice RPA. These factors can prevent company from successfully integrating RPA solutions in its purchasing process. To obtain the result, the author was to arrange interviews and questionnaires, case studies to deliver the analysis of barriers/ difficulties that companies experience.

- **How can company adapt RPA in their purchasing process successfully?**

The final question is to discover an approach or solution that can resolve the challenge that each company faces. The solution has been adopted successfully by Vodafone company and

shown prospective to be used in the future. The solution aims at analyzing and suggesting suitable processes that are suitable for RPA implementation as the process of finding the right candidate for RPA will affect the success of whole RPA project. Due to the small size of investigated subjects, the solutions are limited to only specific kinds of organizations. The solution is not a generalization to every organization in any industries. However, this resource can be used later for further research on the matter.

1.3 Scope and limitation

The author chose to narrow down the subject to RPA-suited purchasing process where the obstacles occur due to characteristics of each company. The goal of the thesis research is to find the suitable purchasing process that can be improved using RPA implementation and the method to start RPA journey. Theoretical definition of a complete purchasing process is the base for developing argument to select suitable process for RPA. Regarding RPA, the technical configuration and code system is irrelevant to the study of this research whereas functional compatibility, competency, and quality support the structure of the analysis. The subject was studied within the scope of purchasing process operated in organizations in Finland only. Diversity in results is predicted to acquire generalization in the finding of barriers. It is essential to establish the limitation for the thesis research area. These criteria are shown below.

- Accountability of the status report

The immediacy of investigated subject increases the validity and reliability of the study due to the accuracy in relevance and clarity (Kananen, 2011). According to the theoretical finding and empirical finding, the author is to propose a method to help organizations approach their issues.

- Concentration to the analysis

The objective of the research is to find out the root cause of the barriers to firms on automation adaptation. The imperative to formulate comprehensive analytic method and descriptive report is therefore the prerequisite for a coherent and cohesive research. It is crucial that the output from the analysis be acknowledged as considerable prompt solutions, not as improvement to firm's technology problem.

- The interviewees are from Finnish companies

This research acts as an analysis-solution review aimed at specific type of companies from different industries in Finland. The scope of the study remains small and hence cannot speak

for other industries or apply to the same industry. The growth in automation demand in Finland has opened more channels for organizations to reach out to new solutions and advance their business operation. The variation among firms who accept RPA or waver between RPA and other technology solutions has been viewed as different sources of reasoning, organizational culture, and business operative structure. Nonetheless, due to the time limitation for thesis research and numbers of interviewed firms, the results are to cover only definite issues and generalization.

2 Theoretical findings

2.1 Robotic Process Automation

RPA has been widely recognized for its significant transformation in business operations. In this section, the concept of RPA is uncovered and explained. To unravel and explain the reason for the popularity of RPA solutions, the author focuses on the benefits that RPA implementation will influence organization's business operation, finance, and human workforce. Accordingly, a step-by-step framework to adopt RPA is presented as a project plan. Like any other available IT solutions, RPA requires specific conditions to work to its full potential. Therefore, consideration over situations to adopt RPA along with recipes for failures is considered.

2.1.1 The concept of RPA

Process automation has existed more than two centuries, since the need of human replacement for labor-intensive tasks in the textile industry emerged (Theyssens, 2017; Lowes et al, 2017). Therefore, the achievement of replacing manual work in the textile industry has widely spread the growth for automating processes across manufacturing and other industries and encouraged developments to lower the cost of automation (Lowes et el, 2017).

RPA has seen the rise in popularity since the beginning of 2000s. In 2018, this enterprise software market size in global scale reached \$846 million USD, which was equivalent to 63.1% growth to previous year according to Gartner (Wilson, 2020; Casey, 2019). However, the term's origin dates to 1920s when it was used as workflow automation during the industrial era and emergence of manufacturing (Ostdick, 2016). In fact, in prior to such knowledge of RPA development up till today, owing to the predecessors of RPA, which were screen scraping software, workflow automation and AI, RPA has thrived as an innovative emerging tool

for offshoring as of today's (Ostdick, 2016). The question here is what RPA is and its potential aspects that could change the dynamic of human workforce. Various definitions were given below to describe RPA.

- It is a software that repeat human interaction with applications in a computer and perform rule-based tasks. (Tripathi, 2018; pg. 10)
- RPA is not a physical robot that wanders around offices to replace human workers. However, RPA refers to the software that is programmed to handle the work previously done by people, such as transferring data from multiple input sources like email and spreadsheets to systems of record like ERP and CRM systems. (Lacity et al, 2015)
- RPA is a preconfigured software application that is derived from business rules and predefined activity choreography to execute a combination of processes, activities, transactions, and tasks in one or more unrelated software systems to deliver a result or service with human exception management. (IEEE Corporate Advisory Group 2017)

THE shared point from above definitions was the need for automation stemming from the replacement in repetitive processes which was previously performed by human. Therefore, RPA is created in the context of a technology approach that levers business process to achieve the efficiency, scalability, auditability, security and compliance at lower cost than other traditional process automation (Hofmann et al, 2018). It forms the digital workforce that performs knowledge-related and back office work such as transferring data from multiple input sources like email and spreadsheets to systems of record like Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) systems that has been done by human workers (Lacity et al 2015; Geyer-Klingeberg et al 2018). Like its human co-worker, the robot is granted access permission by having a logon ID and passwords to perform tasks after being introduced to a process workflow (Lacity et al 2015; Geyer-Klingeberg et al 2018). It works on the user interface of other computer system that has already existed and does not change anything in the core system (Lacity et al 2015; Aalst et al 2018). Therefore, a fully automated process is prone to analyze the factors of technological process reframing and workforce elements (Moffitt et al, 2018). Specifically, these two factors stand as the foundation elements towards RPA adaptation in general level. However, this subject will be discussed in the latter part of the study.

2.1.2 Benefits of RPA

An emerging technology like RPA can impact organization through business operation, financial outcome, and workforce dynamic (figure 2).

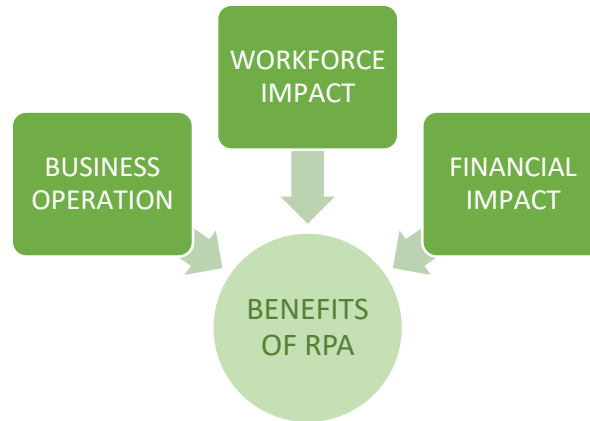


Figure 2. Impact of RPA (Alberth et al, 2017; Slaby et al, 2012)

Business operation impact

RPA gives builders process insights to identify business bottlenecks which are rooms for optimization effort. To learn from human daily performance, RPA requires developers to simulate and record live process to automate and perform accordingly. This function is beneficial to developers as the record is useful for performance analysis, auditing, and reporting to develop process more efficiently. Moreover, RPA is a lightweight approach to run on already exist IT legacy systems. It delivers presentation-layer integration approach to avoid the complexity, expense, long-time to market, and potential brittleness of data-layer integration. The deployment of RPA requires business units give tactical requirements to the RPA developers as the business units know what a concrete business process is. The business units are less dependent on the existing complicated system and IT as they specify the characteristics of their robot workers (Slaby et al, 2012). Another aspect which is considered as challenge to improve is the front office and back-office operation. However, Lacity et al (2016) states that Telefonica O2's software robots processed between 400,000 and 5000,000 transactions each month after automating back-office processes. Since 2010, the automatic back-office operation has taken up to 35% of the total volume. For front office service, the response time to customer-facing processes (e.g phone activation) has been improved to just minute, comparing to that of before automation which took days to proceed.

Financial impact

It is no doubt that any initial investment on technology is a concern to firms when the cost and benefits are on the table. As a matter of fact, RPA brings to the table a lever to make the cost structure more competent.

Firstly, RPA software and services require small upfront investments costs and license fees, which are calculated reliably, and serve as a tactical interim cost cutting solution when the strategic technical solution bares higher cost. It is cost-effective technology solution since ROI is measured between 30 and as much as 200 percent in the first year (Lhuer, 2017). Furthermore, an instant cost reduction in moving services from offshore to onshore means that the number of reduced offshore FTEs results in extra savings to protect onshore FTEs and hire new ones (Slaby, 2012; Alberth et al, 2017). According to the HfS report, a major mobile telecom services provider was able to save \$1.25M from the initial annual cost of \$1.35M spending on 45 offshore FTEs by adopting 10 robotic FTEs at an annual cost of \$100,000 to handle back office processes. The firm was able to use the resulting saving to invest in 12 FTEs onshore to do higher-value work (Slaby et al, 2012). The issue of FTE overhand cost is solved when firms start to deploy RPA practice to their business operation. Since firms are influenced by the market demand, they are tied with either too many salary costs or too few turnover and income/ market share. RPA is scalable as it can jump in whichever position lacks in personnel demand to adjust the workforce. Having a 24x7 robot employees can even lower the cost of client acquisition and improve client retention as the robot are just-in-time scalable to handle short service level agreements for new offers to clients or new client experiences (Alberth et al,2017).

Workforce impact

Failure and errors are unavoidable during any business process. Yet with RPA, the failures and errors are anticipated and programed to not repeat after the rules of the function are completed. Thus, human errors are eliminated; compliance and auditability are improved since the output of each task is traceable to guarantee the quality. Since repetitive tasks are in the domain of robot workers, employees can focus on creative, strategic, and managerial tasks. The new definition of labor work is shifting from high-volume dull routine manual work to value-added productive creative work (Engelhardt et al, 2018). Employees are more committed to the process and documentation compliance; hence they are more satisfied with their jobs. In the other hand, companies can avoid expanding their headcounts due to the human resource reconstructed (Lacity et al, 2016).

RPA benefits

In summary, RPA has unlocked potentials that bring many benefits to firms, such as cost reductions, efficiency and quality improvement, faster output, and the ability to integrate with legacy systems. Some argue that the benefits of RPA share similarity to core platform transformation programs. However, RPA can perform tasks much faster with lower risk, and only at a proportion of the cost compared to that of ITPAs. RPA applications are not constrained in any specific industries since they can handle multiple processes simultaneously from enterprise servers (Rutaganda et al, 2017). The figure 3 illustrates the results that RPA can accomplish from various industries.

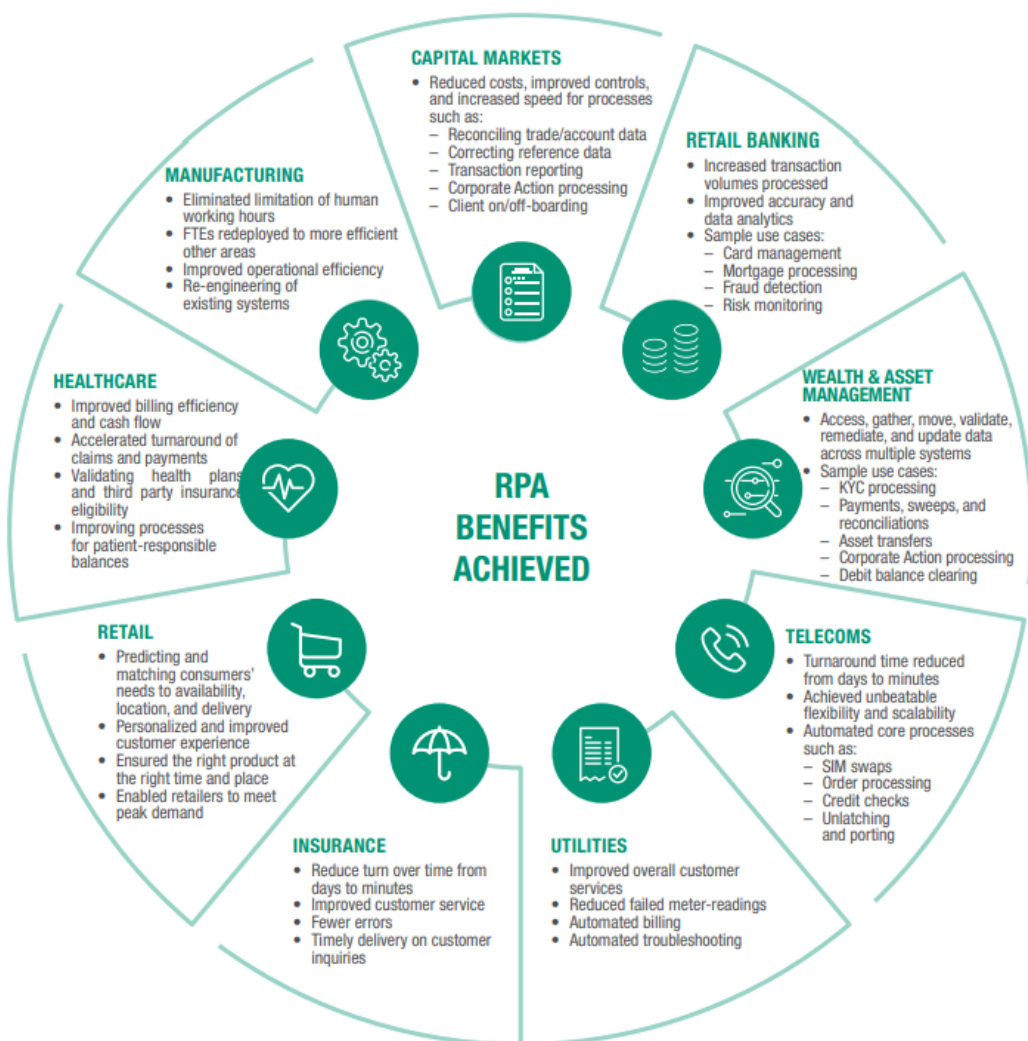


Figure 3. RPA benefits achieved (Rutaganda et al, 2017)

2.1.3 How to adopt RPA?

RPA is suitable for business processes which are bottlenecks, and which meet difficulties to scale up to improve income sources. These situations should be considered to adopt RPA (Alberth et al, 2017):

- Demand in FTE productivity while maintain accuracy
- Low ROI on EAI
- Increase return on BPO initiatives by automating lower-level tasks rather than using lower-cost human FTE
- Demand in new online or mobile front-end desired for legacy back-end architecture

Specifically, RPA implementation requires the following attributes in the processes or sub-processes: (Lacity et al, 2015; Alberth et al, 2017; Geyer-Klingeberg et al 2018):

- Unambiguous rules
- Limited exception handling
- Stable operation environment
- Known costs
- Multi-system data entry/reconciliation
- High and predictable volume of data processing

To imitate human performance respectively, robots request precise instructions from unambiguous rules. Robots cannot perform tasks where there are too many exceptions in task handling, such as analysis, judgment, perceptual or interpretative skills. When the process has predictable volumes, robots can process high volume of data smoothly. Moreover, robots work ideally in stable environment. Should there be changes in the interfaces like new menu items or new options added, robots must be reconfigured to adopt to the change. Process that needs human to access multiple system (called swivel chair process) drives an urge for automating since robots are quicker at accessing various system. Data entry and validation, file and data manipulation, formatting are multitasking and time-consuming, if are not automated. Another factor to consider RPA adaptation is understanding the costs of manual process. The cost of manual process is measured by following formula (Lacity et al, 2015):

$$\frac{\text{standard unit of time}}{\text{average handling time}} \times \text{the resource costs}$$

[Both standard unit of time and average handling time are based on the time that a human takes to complete the process. The resource costs are salary, wages, overhead, etc.]

Before starting an RPA implementation project, firms are required to consider cost structure, which involves costs for internal resources (e.g adjust policies, make decision, technical implementation in the data center), consultancy (e.g feasibility study, process preparation), robot provider, service provider, human resources costs, license cost, new workforce cost (training cost, recruiting cost) (Alberth et al, 2017).

The process for RPA implementation has at least three phases (figure 4), which are the proof of concept, the pilot, and the leverage phase to other use cases within the company (Alberth et al, 2017). Many suggestions to develop RPA implementation framework are not standardized since RPA is still a new technology, all of them bare resemblances to the same pattern and have some definite components. A tailor-made process like RPA yet requires these three major phases:

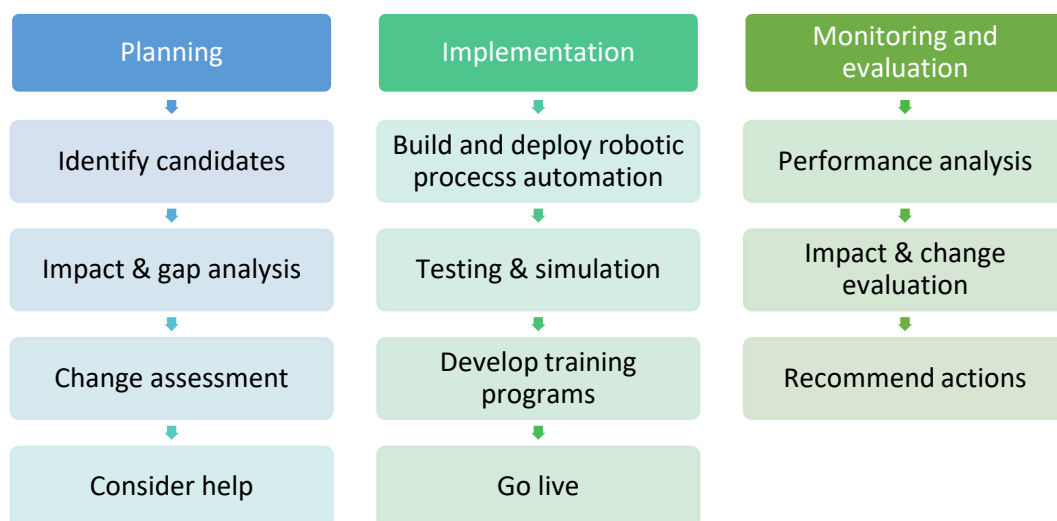


Figure 4. RPA implementation phases (Theyssens, 2017)

An RPA project cannot start without a concrete **plan of actions**, objectives, and assessment. Before any new change to the system occurs, it is crucial to identify and analyze which process is a promising candidate for RPA. Evaluate the right candidates is necessary for the success of the total procedure. A bottom-up approach, which means managers and employees who are the closest to the operational process flows are to recognize right processes to be automated, will guarantee the essential level for RPA adaptation. As firms starts to identify candidates, they will also assess the pros and cons to rank the candidates based on their value adding potential. This is an importing step since firms can make decision about which

processes are to be automated, when they will be automated, what budget they will cost. Once the suitable candidates are selected, the gap analysis is prepared to evaluate firm's current status and change assessment. The analysis is needed for the vision, the long-term action plan to fill in the gap of the current situation. Change assessment is beneficial for long-term goals as it expects the changes that firms will make to reach the goals before the implementation is in action and the problems that firms will face. It is crucial that firms consider using consultants or RPA vendors if they lack in-house excellence (Theyskens, 2017)

Firms can start **the implementation** after the plan is well-prepared. The software robots are trained algorithms that can mimick the behavior of humans to interact with the user interfaces (Theyskens, 2017). The robots receive the rules and instruction to mimic human work, but they cannot learn from themselves or create human reasoning. Therefore, repetitive, rule-based and consistent tasks are well-suited for them. Another aspect when firms deploy robots is to train the human workforce to use and understand the potential brought by their robot co-workers. The training will equip employees and other stakeholders with effective interaction and harmonious human-robot cooperation when they are ready to be launched. (Theyskens, 2017)

The final phase is to **monitor and evaluate** RPA performances. The output of this phase is to measure and analyze the effectiveness of RPA solution to compare and evaluate the on-going level of performance with the initial goals. From the evaluation result, firms will determine whether the goals are achieved, or some modifications are added to improve RPA solutions. Firms are to perform this final phase on regular basis to guarantee that the RPA solution is maintained and consistent. (Theyskens, 2017)

2.1.4 Challenges to adopt RPA

The framework for adopting RPA works best when firms clearly know the issues which they want to improve and have strategic vision for financial, operation, and business KPIs when deploying RPA programs. Most of the challenges or failures to adopt RPA fall to the fundamental level, misconception of what RPA does and how RPA works. The definition of RPA is exaggerated to become another technology-led IT initiative whereas it should be considered as as-is process, which means to find the gaps among process – technology – workforce and then to agree the to-be state of these processes. The focal point of RPA application does not target immature, unstable or broken processes or integrate with legacy systems which are to be de-commissioned in the immediate future. RPA does not aim at human workforce replacement since it delivers accurate, fast, agile, and quality output for human managerial

tasks. In short, to avoid pitfalls in adopting new innovative technology, firms should be conscious of the tool and should establish thorough communication channel from process change owners and key decision makers in business functions (Rutaganda et al, 2017). Most critical factors, which challenge organizations to successfully adopt RPA application, are shown below in figure 5 (Rutaganda et al, 2017; Virkkunen, 2019).



Figure 5. Challenges to adopt RPA

Leadership: Incorrect RPA leadership at the top level

The objectives of RPA should be derived from business intention to optimize its process rather than from IT. It is crucial that IT work with business operation as a strong ally and partner. The owners of business functions own process know-how and detail documents of the process framework. They are more proactive to measure human capital redeployment or downsizing and to define KPIs of selected RPA use cases. (Rutaganda et al, 2017)

Vision: No long-term RPA vision or roadmap

Because of the lack of RPA experience, organizations might not be alert of the necessity of making strategic decisions around RPA. They will lack of the conviction and vision to set up a long-term direction if there is no setup of an RPA center of excellence and a strong governance structure. In other hand, it is important that organizations convince HR and the heads

of business to stay on board and give a clear mandate about how organizational structure will be rearranged. (Rutaganda et al, 2017)

Execution: Selecting incorrect RPA use cases and lack of clear business case, KPIs, or success criteria

It is important to develop RPA initiative with a clear scope of implementation and detailed indicators to measure the success of the project. RPA cannot deliver the goals if RPA proof of concept is loosely defined and the unawareness of strategic RPA sponsorship and funding without tangible benefits like cost saving and FTE reduction. (Rutaganda et al, 2017)

Project approach: Dated project delivery approach for RPA

An RPA implementation project usually takes 2-4 weeks from inception to production. To keep the advantage of RPA which is rapid development and deployment into production, the procedure of developing RPA into organization's system should adopt agile and lean delivery methodologies. It is a typical issue that organization tries to impose heavy IT project delivery methodologies on RPA projects. This approach will give organization nothing but unnecessary time consuming, low-value documentation, management packs and management information reports being produced. (Rutaganda et al, 2017)

Environment: Trying to deliver RPA benefits on shifting sands

RPA is not a suitable tool that company can exploit its benefit in an unstable environment where the people structure, business processes, and underlying tools and technologies are altered from time to time. RPA use cases are based on low velocity of business change and infrequent underlying system change. For examples, RPA cannot automate the swivel chair problem of legacy applications when there is a conflict of interest between IT portfolio rationalization program under strict NDA and those legacy applications. (Rutaganda et al, 2017)

Financial ability: Lacking budget to begin with

According to an ISG report, business leaders are hesitated to expand their use of RPA because of having a restricted budget. However, a robot-as-a-service model can be the solution that firm can opt for since the service model is the latest iteration of the software-as-a-service model. Firm makes its payment based on its need of scaling or down with cost-effectivity. Firm can exploit the benefits of RPA while having all essential tools to start implementing digital workers. (Virkkunen, 2019)

Human acceptance: Getting staff on board with automation initiatives

One of the most prominent barriers to adopt RPA is organizational resistance to change (Virkkunen, 2019; Viale & Zouari, 2020). Firms are reluctant to RPA implementation is the pressure of having to share appropriate information with partners. Moreover, replacing RPA in manual work causes a fear in workers of losing their jobs and of changing their tasks and roles (Viale & Zouari, 2020). Therefore, organizations need to prepare, oversee the difficulties, and let all organizational levels and decision-makers involve in the process.

In brief, RPA implementation is an emerging technology that allows organizations to create business leverage to their daily operational activities. RPA assists human workers in executing routine, manual tasks so that human workers can focus on higher degree of managerial tasks. However, RPA is not suitable for complex processes in which the robots are to make decisions for human workers and for unstable, immature, broken processes in which the recurring continuous flow cannot be developed and automated.

2.1.5 Process mining method supports RPA implementation

There have been some methods developed to analyze and evaluate the possibility to implement RPA solutions in suitable operation process. Process mining is one of the methods that help companies to have an end-to-end view to their processes, identify the right candidate, quantify the economics of value of corresponding initiatives, and eliminate costly and subjective manual process evaluation (Wanner et al, 2019). The giant telecommunication Vodafone has successfully utilized the use of process mining technique and RPA solution to leverage its operational purchasing costs, obtain faster time-to-market and reserve more time for value-adding activities. Process mining is a technique that uses data-driven process analysis from transaction logs from IT system to reconstruct the flow of business processes. It assists business operation in finding solution strategies and selecting maneuvers for implementation strategies.

In the research, the Celonis Process Mining software was used to evaluate RPA application to the Purchase-To-Pay Process. A demo data set was extracted from SAP ERP system to run the software. Process mining approach to RPA implementation also has three phases: assessing RPA potential, developing RPA application, and safeguarding RPA benefits (Geyer-Klingeberg et al, 2018).

- Assessing RPA potential

Companies will find themselves surround with various processes that are potential candidates for RPA implementation. However, the decisions that lead to process selection should be based on process analysis. With the help of process mining, companies can see a big pic-

ture of a thorough process flow and the measures of automation rates taken by the software. Hence, companies can make decisions based on the whole process view and the data analyzed. The research presents the analysis to compare two same processes of different subsidiaries. The process mining program will run the data set and show users standard event log data (case ID, activity, and timestamp) and the user type executing the process activities. In the event log, the data from SAP system marked manual users and robots respectively as dialog users and system users. The visualization from process mining program provides users quick and easy understanding of the maturity of operational processes and show the largest automation opportunities when automation rates become transparent. The automation rate can be calculated based on the following formula:

$$\frac{\text{system user case number}}{\text{total number of cases}}$$

The process mining application shows the automation rate as a performance indicator added to the process explorer and the number of cases of the activity. The comparison of the two processes is shown below.

Identify processes that have maturity for automation

Process Mining for RPA

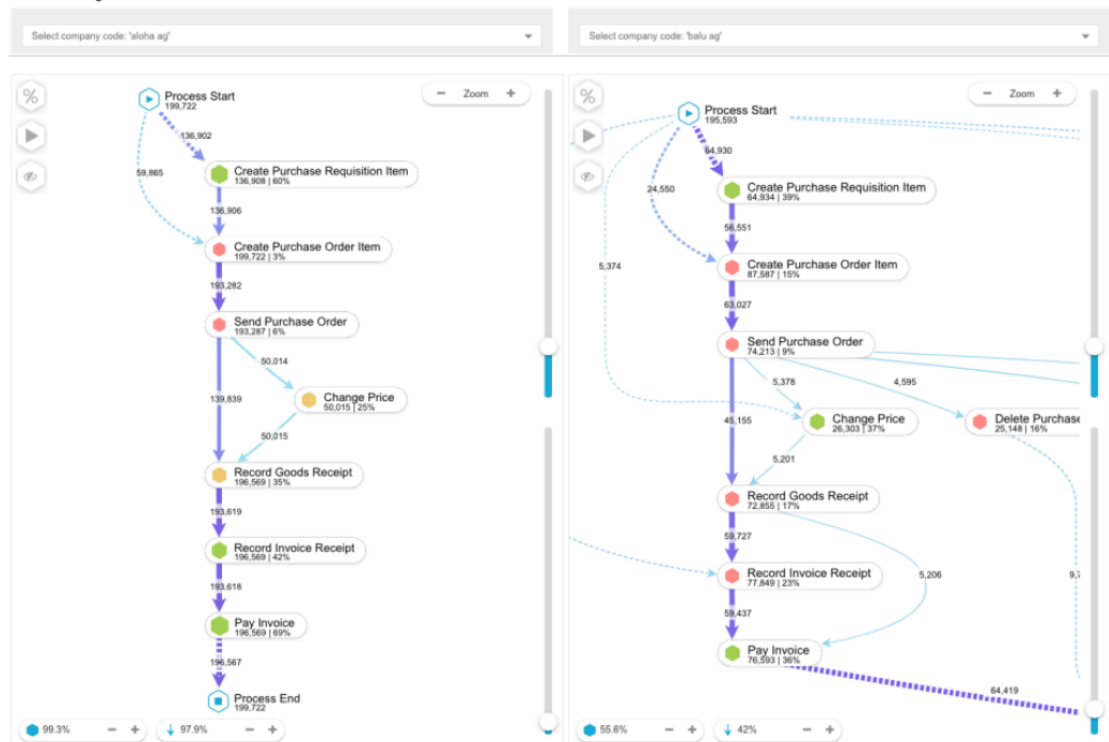


Figure 6. Benchmarking between standardized (left-picture) and non-standardized (right picture) process flows (Geyer-Klingenberg et al, 2018).

The results are given in the bottom line of the figure. The automation rate for standardized and non-standardized process is, respectively, 99.3% and 55.6%. Figure 6 shows that right process flow has more variants in than the left process flow which is quite linear and have a low number of deviations. The automation rate indicates that if the right process flow wants to increase the automation rate by applying RPA implementation, the investment and effort to train robots will result in large sum so that the robots can run through deviants in the process. Therefore, the conclusion is that the maturity and the readiness for RPA application in left process flow is higher. Moreover, process mining can improve the speed of implementation project by organizing processes before an RPA initiative. This will result in decreasing time and cost of the training for robots. The insights for root cause of driving complexity in non-standardized process will be analyzed by process mining program so that organizations can standardize the process prior to adopt RPA solutions. An example of process analysis is shown in figure below. From the bottom right table in Figure 7, the automation rates for each material process group indicate the difference in level of automation adaptation. However, the low level of automation rates can receive faster benefit of RPA than the high level of automation rates. Thus, the analysis can influence business performance by indicating the necessity of automation in changing throughput time and other performance indicator.

Evaluate current automation rates

Process Mining for RPA

Number of PO Items: **395k** Net Order Value: **8.38B \$** Automation: **29%**

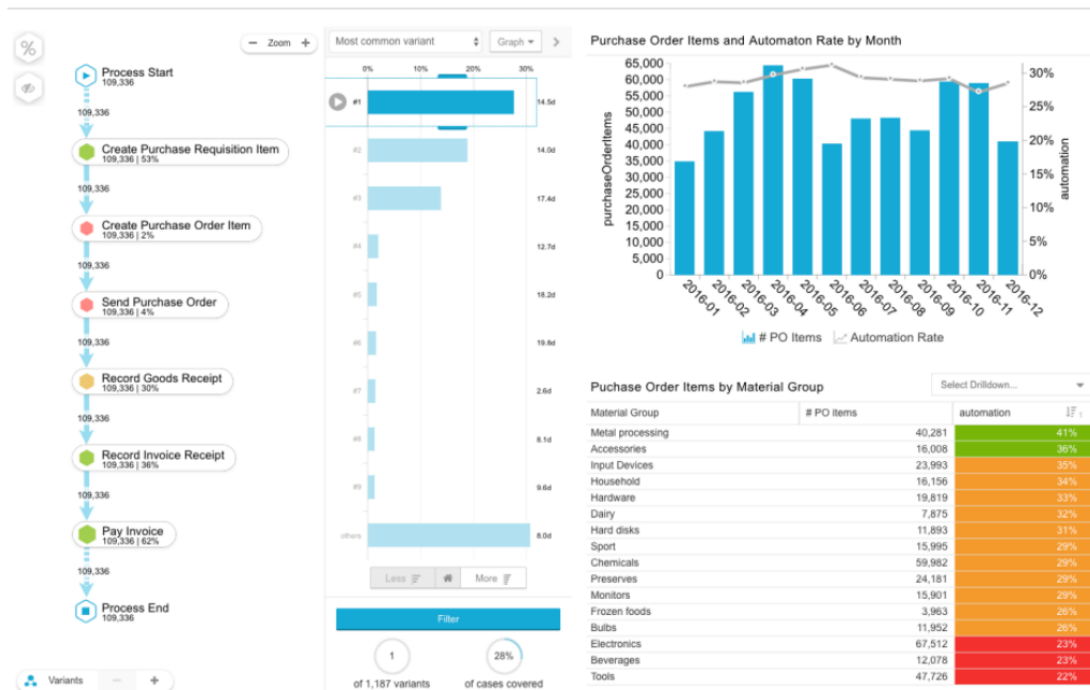


Figure 7. An analysis for RPA potential candidates (Geyer-Klingenberg et al, 2018).

- Developing RPA application

When the right candidate is selected, companies can start training robots by recording manual processes steps in the front end, in this case the SAP ERP interface for Purchase-To-Pay. After the training, robots are deployed in pilot project. At this point, process mining can act as a supervisor to compare performance of each robots with non-automated performance. This analysis from process mining program will help organizations to choose the best performing cases and the best execution automatic pattern. In figure 8, users can see important performance indicator of different robots and the human-robot interaction from “Cases come” from and “Cases go to”. Records of robots’ activities are shown in the bottom table to compare at ease.

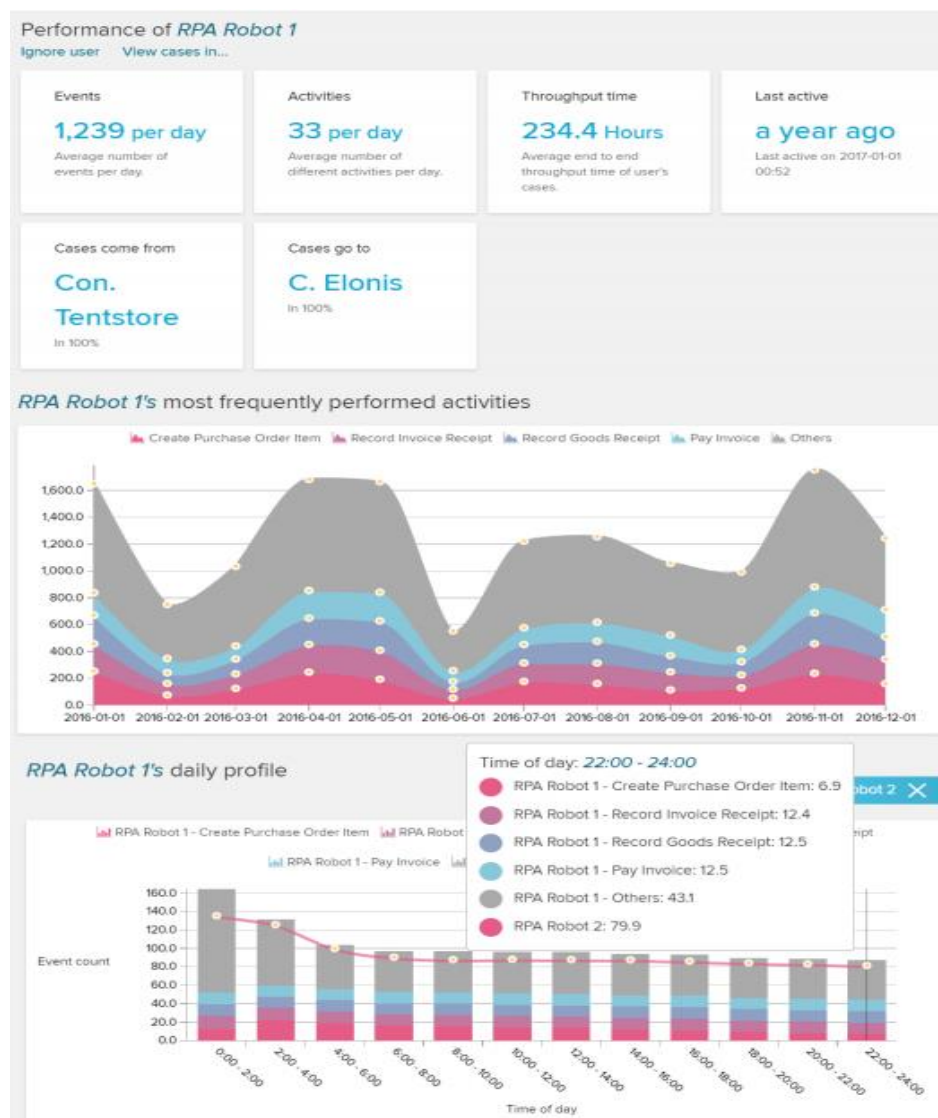


Figure 8. Comparison of performances of different robots (Geyer-Klingeberg et al, 2018).

- Safeguarding RPA benefits

When the performance of robots is proved to be a fit to business operation, robots are deployed in daily organizational activities. It is crucial that users maintain and increase robot capabilities. The process mining software helps users to monitor performance of robots and configure parameters of robots to keep their performance at peak.

2.2 Purchasing process

In this section, the theoretical background of purchasing process is discussed. The generic purchasing model, adopted from Van Weele (2009), is presented to illustrate purchasing activities and meaning of each stage. Purchasing process was initially comprehended as clerical activities. However, through globalization and market trade, purchasing function has evolved overtime to become more of a strategic position in organizations. The importance of the process is illustrated and backed up with DuPont analysis. To meet the shift in demands, purchasing process is on its way to adopt more advanced technology. From time to time, purchasing activities have been optimized with the use of enterprise resource planning (ERP), and now RPA. A comparison between information technology process automation (ITPA) and RPA is examined to support the fact that the combination of both IT integrated solutions will leverage business operation to more strategic level.

Purchasing process is a purposeful, goal-oriented course of activities dedicated to the process of buying based upon materials or merchandises that are fitness for use in organization's primary activities. In specific, it aims to manage firm's external resources so that "the supply of all goods, services, capabilities and knowledge which are necessary for running, maintaining and managing the company's primary and support activities is secured at the most favorable conditions" (Van Weele, 2009, pg. 8). Purchasing process is a continuous and recurring course of activities which varies from company to company, depending on company's focus area and final products. Yet, complete purchasing processes share a process model which is illustrated below (figure 9).

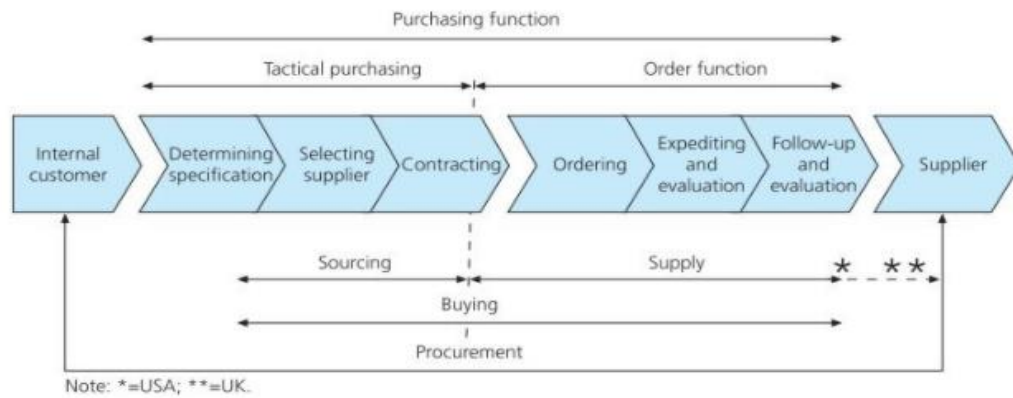


Figure 9. Purchasing process model and some related concepts (Van Weele, 2009, pg. 9)

Determining specification

The process starts when there is a demand from internal customer within organization, which can be manufacturing line, office supply. Specific detail of purchasing required quality and quantities, functional and technical requirements is mandatory so that purchasing entities recognize the requirements, objectives for buying specifications.

Selecting supplier

When the purchasing request is established, then comes the supplier selection. Firstly, the buyers will establish prequalification requirements that are based on the research in previous step. An RFI is sent to a list of potential suppliers (initial bidders' list) to provide buyers information of prior projects and previous experience from the suppliers. The buyers then choose suitable suppliers to send RFQ to. The suppliers will submit a detailed bid that fulfil requirements from the RFQ. The buyer will take into consideration not only the bids but also the performance level to reach wanted speed and quality (Sollish et al, 2012, pg. 70). It is crucial that buyers determine contracting method at this point to plan how buying process will be handled. Suppliers who meet all the demands from the purchasing department will be selected to join the contract negotiation.

Contracting

At this point, the buyers will conduct negotiations with the supplier to reach an agreement and sign the legal contract. The buyers and suppliers will negotiate upon these aspects: prices and terms of delivery, terms of payments, penalty clauses and warranty conditions, and other arrangements.

Ordering

The order is placed after the contract is validated. Both suppliers and buyers establish order routines and placing order means. Different means of ordering, manual, or electronic order initiation, occur following the terms in the contract. Currently, it is usually the case that purchasing order is sent electronically through a purchase order requisition or materials requisition (Van Weele, 2009, pg. 42). Then, the suppliers will send a confirmation for each purchase order received. These operational stages, called purchase-to-pay process, requires purchasing function to perform at highest level since they involve a lot of transactional activities such as order placing, invoicing, claim processing (Van Weele, 2014, pg. 48). These activities are repetitive or recurring, promising candidate to automate. According to a McKinsey's issue on digitizing purchase-to-pay (Jain & Woodcock, 2017), several emerging technologies can automate fully or largely 60% of these activities in purchase-to-pay process. For example, 88% of tasks can be automated in placing and receiving orders, and 93% in payment processing.

Expediting and evaluation

The purpose of this phase is to follow-up on purchase order to guarantee the supplier's order fulfilment align with his purchase order confirmation. Van Weele (2009, pg. 42) states that expediting needs buyers' attention based on overdue list. The buyers can expedite their suppliers in three ways: exception expediting, routine status expediting, and advanced status expediting. Exception expediting occurs after-the-fact that the internal customer informs purchasing department about the late delivery. The passive-in-response can cause disruption in internal customer's operation, therefore, a preventive approach – routine status check, is inclined to check the suppliers before delivery date to avoid surprised scenarios. Another method to engage suppliers to their agreements is advanced status expediting. This method is essential for critical purchased parts of material planning, strictly qualified tolerant materials from unstable suppliers. The buyers are to schedule routine check at the progress of suppliers; the schedule is planned during the contract closure. Until purchased merchandise is put to use, the acceptance test, which is technical test to check the functional and technical requirements of the equipment, is organized at the supplier's site before shipment, at the user's site after the deliver, and at operation site when the equipment is used for the first time.

Follow-up and evaluation

This phase considers the long-term benefits of the organization as an input to produce assessment towards suppliers' performance, such as quality, delivery record, competitiveness,

and innovativeness. A thorough, up-to-date record of each supplier is imperative to add value to subsequent purchasing cycle and to future projects or contracts. The performance report will be sent to both buyers' management and suppliers' to reinforce the commitment and the reliability in the agreement. When the purchasing department learns how to work with their suppliers, their suppliers base will be reduced subsequently so that they can concentrated on business partnership with the best suppliers.

2.2.1 The importance of purchasing process to company

Purchasing function was first acknowledged as a clerical buying activity, which was considered passive rather than proactive. Kraljic changes the view of purchasing function by declaring purchasing must become supply management. In his publication, he calls purchasing function as a strategic role and regards the profession as operational professionalism. Until this day, the recognition of purchasing ability has created and developed tremendous competitive leverages to business organization: make-or-buy decision, strategic sourcing, supplier relationship management, customer-centric. The development of purchasing function in business operation has proved its critical contribution to the profit of organization. (Glavee-Goo, 2016)

The cost structure of any business entities is the evidence for the weight of purchasing value compared to other operational activities. Van Weele (2009, pg.12) states that: "The largest part of the COGS or sales revenues appears to be taken up by purchased materials and services." In figure 10, the average percentage for purchased products weigh approximately 50% and more in most of the industries (except in pharma industry). In fact, if the company can improve its buying process, it can increase company's RONA significantly, according to figure 7.

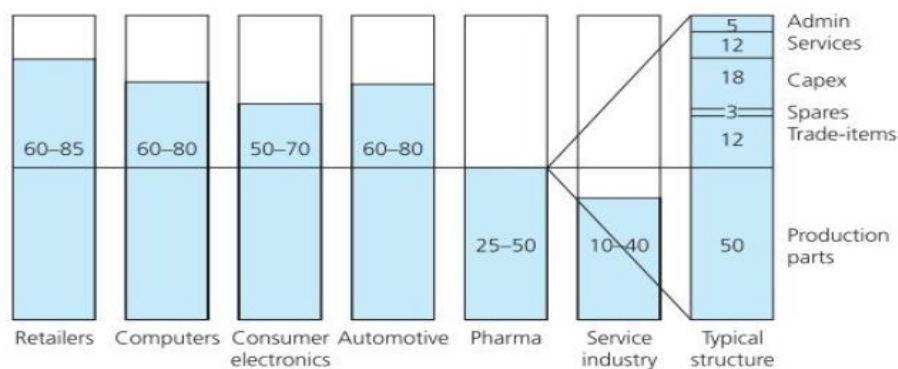


Figure 10. Proportion of purchased goods and services to COGS (Van Weele, 2009, pg. 13)

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

Figure 11. Contribution of purchase costs on profit (Muurinen, 2019)

From figure 11, it can be concluded that the more the purchase costs are reduced, the more the net profit are increased. To calculate financial diagnostic efficiently, DuPont analysis is used to indicate business ROI based on sales margin and capital turnover ratio. From the result of DuPont analysis, solutions to improve company's RONA can be executed in three ways. (Van Weele, 2009).

- Reduce all direct material costs: the target of this method is company's sales margin. To reduce the direct material costs, company can apply such measure as supplier base reduction, product standardization, competitive tendering application, and new substitute materials.
- Reduce net working capital employment: the target of this method is company's turnover ratio. Company can practice longer payment terms, JIT agreements with suppliers to reduce inventories of base materials, supplier quality improvement, and leasing equipment.
- Improve company's revenue: the target of this method is company's process improvement and new product development with challenging suppliers. This method involves supplier technical expert in early involvement in product development process together with procurement managers to promote product innovation.

The practice of successful purchasing function results directly in company's revenue and influences profoundly on company's returns. As company gains higher capital turnover ratio, it has the possibility to increase savings on direct material costs. (Van Weele, 2009). Consequently, effective buying process demands not only purchasing management tactics but also high-level quality of purchasing operational activity.

2.2.2 RPA adaptation in purchasing process

Suitable purchasing process for RPA adaptation

The advancement in technology has transformed purchasing and supply chain management to address more targets and create more impact of this function. Getting the access to the unavailability of data, establishing order to mass amount of data sets, having more accurate analysis to generate long-term vision, and gaining more efficient operation (Umbenhauer et al, 2017). As primary activities of purchasing process are exchanging contractual data and information among suppliers, purchase prices, discounts, raw materials characteristics, and delivery terms, multiple digital and automatic technology solutions are implemented to organization's system to support the workflow (Rejeb et al, 2018). These solutions are so advanced that their function can perform transactional automation to specific phases in the buying process (Rejeb et al, 2018). The author uses Van Weele's extended purchasing process model (2014) to demonstrate how technology advancement can be applied in the **purchase-to-pay** of buying process. The reasons will be given in the next paragraph. Based on this model, purchasing process can be separated to sub-processes: source-to-pay, purchase-to-pay (procure-to-pay), source-to-contract (figure 12).



Figure 12. Extended purchasing process (Van Weele, 2014, pg. 43; Muurinen, 2019)

The author focuses on specific characteristics, which are potentials for technology solutions, in the purchase-to-pay processes: high volume of manual transactions occurred and high demand of purchasing function focus during the operational stage (Van Weele, 2014). The overall process is responsible for purchase-requisition approval, purchase order generation, invoice receipt and processing, payment processing, and vendor management. A loss of 3 to 4 percent contributed by excessive transaction costs, inefficiency and noncompliance can be

avoided if organization chooses to automate end-to-end purchase-to-pay process. For example, with an annual spend of \$2 billion, organization can save \$70 million a year and add that amount straight to the bottom line (Jain & Woodcock, 2017).

Tradition information technology process automation (ITPA) versus RPA

The advancement in technology has led to wide application of automation solution in purchasing process. The traditional IT system, such as ERP or BPMS, holds critical linkage in keeping organization's operation in place, especially in operational purchasing process. Without the help from traditional ITPA, ordering, expediting, and follow-up would still be done manually. Repetitive tasks, such as order checking, sending, and confirming would expect firms to spend big budget on human resources which generates little added value on the turnover. The output of traditional ITPA solution is scalable, manageable, and predictive. The practice of tradition ITPA, however, are less flexible when compared with new emerging technology like RPA (Lowes et al, 2017; Theyssens, 2017). In this paper, the difference between traditional IT automation system and RPA application is examined.

ITPA and RPA are both technology advancements that help organization's daily operation to improve efficiency and boost productivity (Theyssens, 2017). They possess different characteristics that serves different purposes and objectives in the organizations. However, they can be leveraged together to build a highly-efficient, cost-effective, and productive work environment (Lacity et al, 2015; Theyssens, 2017). In extent, traditional ITPAs, such as ERP and other business applications, have a patchwork of less-than-optimal operation in communication between business processes and applications and do not ease the workload of producing meaningful insights. This weakness will bring the increase of costs, high cycle times, inconsistent quality, and impaired agility (Lowes et al, 2017). The comparison between ITPA and RPA is illustrated in table 1. Therefore, the current situation with ITPA presents opportunities for the implementation of RPA.

Table 1. Comparison between RPA and ITPA (Lacity et al, 2015; Lowes et al, 2017; Theysen, 2017)

Criteria	RPA	ITPA
Area of focus	<ul style="list-style-type: none"> • Automate existing processes. • Used in every facet of the business. • For end-user. 	<ul style="list-style-type: none"> • Reengineer processes. • Used in certain process disciplines. • Behind-the-scenes automation.
Type	<ul style="list-style-type: none"> • Lightweight IT solution. 	<ul style="list-style-type: none"> • Heavyweight IT solution.
Technical outcome	<ul style="list-style-type: none"> • Use existing applications. 	<ul style="list-style-type: none"> • Create a new application.
Integration method	<ul style="list-style-type: none"> • Access the presentation layer of existing applications. • Work on top of current IT architecture. 	<ul style="list-style-type: none"> • Access business logic layer.
Developers	<ul style="list-style-type: none"> • Business operations. 	<ul style="list-style-type: none"> • Software developers.
User experience	<ul style="list-style-type: none"> • Simple user interfaces. • Customized to the needs of final users with indicators. • Operated by everyone with basic IT-understanding. 	<ul style="list-style-type: none"> • Unpolished user interfaces. • Have complicated design. • Require advanced IT-skills and even programming skills.
Process disruption	<ul style="list-style-type: none"> • Low level of process disruption. • Access end-user computer systems – via user interface with an established access control mechanism. • No change to existing IT architecture. 	<ul style="list-style-type: none"> • Medium to high level of disruption. • Transform or change less-than-optimal processes and systems. • Disrupt the current IT architecture.
Testing requirements	<ul style="list-style-type: none"> • Output verification. 	<ul style="list-style-type: none"> • System testing.

Common problems that company encounters with ITPA are the scalability of processes and technologies, and siloed applications (an application that only serves its own to solve problem and that does not interact with information system). It is difficult for the management of

business growth to link two disjointed organizations and to harmonize various sets of operations. To solve the current issues, company usually resolves by making investment in better integrated enterprise applications, or by developing processes with the aid of a BPMS, or by promoting shared services or outsourcing processes to a third party BPO provider. However, the limitations of each solutions come along with questions about the balance between the cost, which yields operating costs higher to maintain operation, and the value, which business achieves from implementing its product, process, and innovation at competitive spending. (Lowes et al, 2017). RPA, hence, gives solutions which can complements ITPA to address process efficiency and cost effectiveness to business operation (in figure 13).

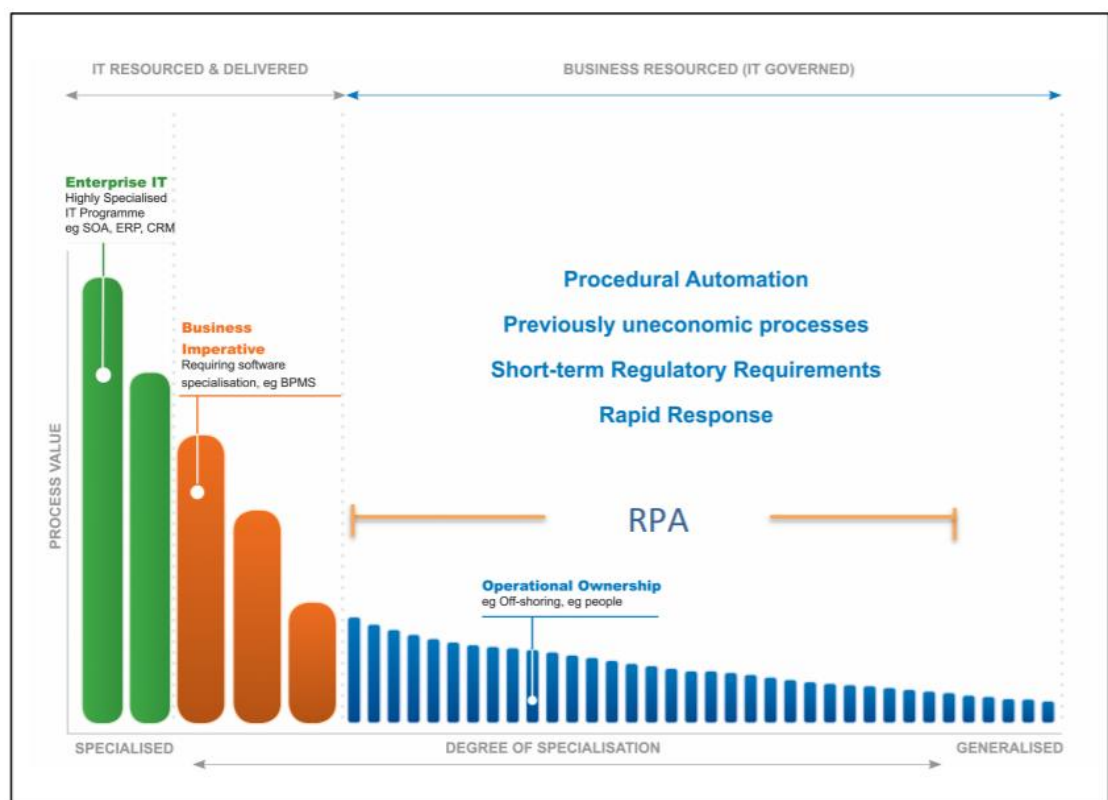


Figure 13. RPA complements ITPA (Lacity et al, 2015)

RPA is nowadays more common among procurement organizations. It shifts the focus of buyers from low value added and time-consuming tasks to complex operations, like internal customers and supplier management. Instead of wasting time and resources to handle repetitive tasks like invoice processing and supplier management, company can automate 45% of business activities to save \$2 trillion of global labor costs (Viale & Zouari, 2020). According to a KPMG report on opportunities for RPA in procurement (Borbe et al, 2018), RPA can handle these specific purchasing activities (figure 14).



Figure 14. RPA application in purchasing process (Borbe et al, 2018)

Based on a research on how companies perceive RPA contribution to the operational purchasing process, Viale & Zouari (2020) recognize significant changes inside organizations' performance. Because of the lack of technical and human resources, pre-automation processes are difficult to speed up and cause excessive long reception times (arrival time of letter via the post or delayed invoices). However, now, companies are more proactive to manage non-productive tasks since they can actively reduce the time and resource for important category purchasing and back-end management of invoices. Moreover, RPA does help buyers from making human errors when the robot is configured properly since it is tireless and fatigue-free. This improvement in the quality of the process helps organization to maintain the trust among key strategic suppliers by having high-level of operational efficiency (data accuracy and integrity, JIT information) and keep the peak of professional work by improving the perceived quality of service.

3 Methodology

3.1 Research methods

Regardless of many interpretations of research definition, P.M. Cook announced a comprehensive and functional definition that a research provides an honest exhaustive, intelligent searching for facts and their meanings or implications with reference to a given problem. The output is required to deliver authenticity, verification, and knowledge contribution to the studied field. It is emphasized that the characteristics of a research, such as problem-centered research, validated and verifiable finding, honest and exhaustive process, be adhered to. (Singh 2006, 3).

The production of an informative research results in inter-disciplinary approach (Singh 2006, 5). Research methodology is a way to systematically solve the research problem (Kothari, 1990). To choose the suitable methodology is to know research's aim, epistemological concerns, and norms of practice of other previous work in the topic area (Ahmed, Opoku & Akoa, 2016). The phenomenon of the studied subject is to be examined for the purpose of obtaining accurate understanding and methodology selection. For "it is the choice of paradigm that sets down the intent, motivation, and expectations for the research" (Mackenzie & Knipe, 2006, pg. 2). Qualitative, quantitative, and mixed methodology were considered for the conduct of the research.

According to Kananen (2011), to distinguish qualitative and quantitative methodology based on logic of text/ words and numbers. It is on the intricate level of knowing the phenomenon and data to be retrieved and extracted from. Specifically, if the phenomenon has not been clarified to theories or supported models, the need of establishing the study under qualitative methodology is essential. In other words, qualitative methodology focuses on the accurate capture of experiences and perceptions from investigated participants related to the phenomenon (Ahmed, Opoku & Aziz), which are not evaluated by way of quantification. Qualitative methodology is employed by observation, interviewing, ethnographic fieldwork, discourse analysis and textual analysis (Travers, 2001, pg. 2).

On the contrary, quantitative methodology is constructed upon the understanding of the phenomenon. In other words, quantitative research uses theories definition and the correlations between the factors/ variables of the phenomenon to quantify the studied subject. It requires systematic controlled, empirical way for a significant investigation of facts about natural phenomena (Ahmed, Opoku & Aziz). The method involves statistics and mathematics and the processing of numerical data (Basias & Pollalis, 2018).

A combination method of qualitative and quantitative is also believed to be a more flexible and complex research approach. The mixed method involves gathering both numeric information as well as text information so that the final database represents both quantitative and qualitative information (Mackenzie & Knipe, 2006, pg. 9).

Considering finding the potential purchasing process for RPA project and the technique that can embark the RPA implementation, qualitative methodology was reserved for this thesis research. As the research is meant to address the explanation for organizations' barriers to adopt RPA, the qualitative methodology has key advantages over quantitative methodology in flexibility in portraying phenomenon. Specifically, it allows flexibility in the approach of research detail development and participants. In contrast, quantitative research seeks for systematic empirical investigation of phenomena through specific, standardized, and closed questions. Moreover, following the general context where each method delivers, the strategy of qualitative method tends to investigate the depth of the research through interviews while quantitative method is destined to test hypotheses related to phenomena using questionnaire and advanced statistical tools. There is speculation over the willingness to share confidential figures or data from organizations. This fact imposes a major factor in data collection stage as each organization is binding to its policy of disclosing strategic data. Consequentially, numeric data for quantitative method is unattainable to quantify through standardized questionnaire and limited to measure through little database. Yet, text or spoken words through observation, interviewing, textual analysis is an accessible source for qualitative methodology to comprehend the nature and complexity of the study subject (Basias & Pollalis, 2018).

3.2 Research process

The research process is illustrated below (in figure 15) to present a brief overview of the steps carried throughout the thesis research.

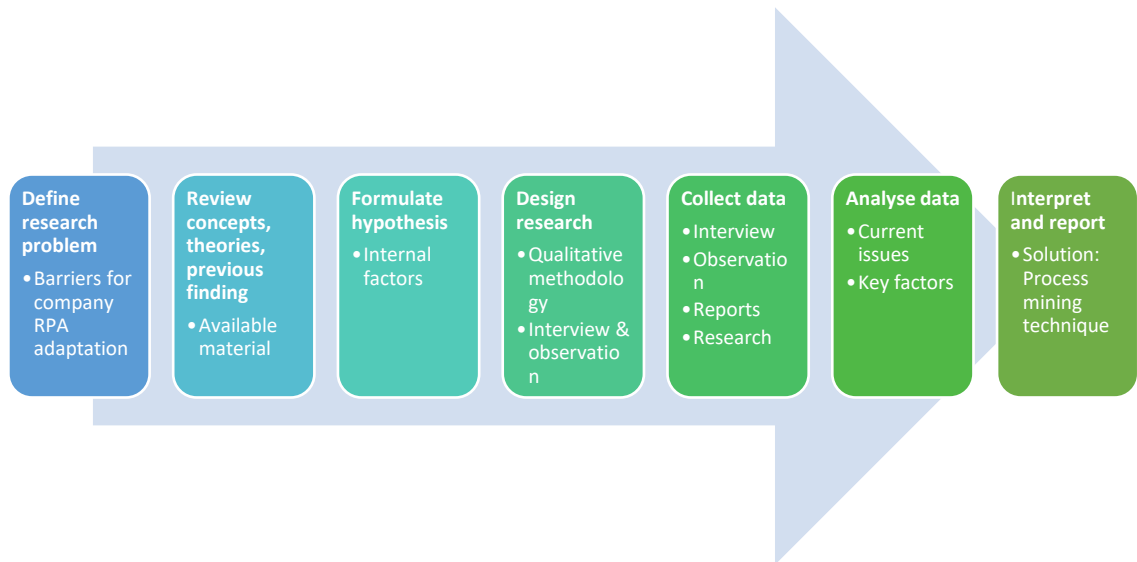


Figure 15. Process workflow (Kothari, 1990)

The research process workflow was inspired by Kothari's theoretical chart. The process includes a sequence of 7 logically connected steps. Before the thesis research was started, the studied subject was reviewed to establish criteria for evaluation and mandatory guidelines for the general outlines. Each step in the chart which has clear objectives and requirements is responsible for the essential material output for the next step. From step 4 to step 6, the mean of transforming raw data to conclusive informative report is carefully assessed to reach to the core of the research.

Define research problem

The scope of the research is to investigate the challenges or the factors that affect organization's RPA implementation. The theoretical review and empirical finding are to explore organization's difficulties. The result from the findings is analyzed to conclude the common factors that impact firm's decision. Then, the process mining method is chose as a suitable approach to the related matter.

Review concepts, theories, previous finding

The author is to use available sources from research papers to review related theories in these areas: RPA and its related challenges, purchasing process and the adaptation of RPA in purchasing process, and the process mining theory. The conclusion is made upon the availability of current resources and the relevance from the empirical findings.

Formulate hypothesis

Firstly, it is crucial to understand the definition of RPA and the adaptation procedure of RPA. Since any technology has its advantages and disadvantages in certain area, the scope of operation is clearly defined to avoid misconception over RPA and its capability. Secondly, when the foundation of RPA functions is established, the process of finding suitable purchasing process is reviewed. Moreover, the current IT integrated solutions used in purchasing process is considered in the compatibility with RPA implementation. The primary factor, the selection of the right process, is the fundamental issue that determines the success of RPA deployment. Therefore, the process mining method is chosen as the accountable tool for firms to embark their RPA journey.

Design research

- Selecting interviewees

The qualitative methodology is adopted to conduct the thesis research because of the flexibility in exhibiting the results. The author recognized that the study of RPA adaptation in purchasing process had been scarce. Therefore, the goal of this research paper is to understand the urgency and the barriers to adopt RPA. The author obtained information for the research paper from four firms, located in Finland, which showed interest in the impact of RPA in the organization as a whole and in purchasing process specifically. The size of each company varies from small and medium-sized enterprises (SME) to big corporations. The information of each firm is presented in the table 2 below. The author aims to collect information from face-to-face interviews that can help author to understand organizational situation and personnel's experiences. Another source of information that the author extracted data is from the company websites. This source helps the author to prepare background knowledge and current projects of selected firms.

Table 2. Information of selected firms

Company	Participant	Title	Industry	RPA adaptation	Duration
A	1	Head of Procurement	Machine and metal manufacture	No	45 minutes
B	1	RPA Team Manager	Cranes and lifting equipment manufacture	Yes	1 hour
C	1	Material Planner Officer	Automotive	No	45 minutes

- Interview preparation

The information of RPA implementation in organization's system is confidential as RPA adaptation is considered as a business lever and a strategic competency. Because of the limited sources that measure the RPA case studies in Finland, the author made the contact to various firms, from SMEs to big corporations, to arrange the interview. As the goal of the research is to analyze the barriers or challenges that effect organization's decision to adopt RPA in its purchasing process, the author decided to interview companies that have and have not implemented RPA to organization's system. It is crucial that different aspects of the studied subject be recognized and analyzed accordingly to help readers realize the immediacy of the research. Moreover, to demonstrate the flexibility in RPA adaptation environment, the author tried to contact different industries to record particular challenges or barriers that are distinctive to each field of operation. Hence, the studied subject can address the diversity in RPA solutions, which are valuable for the general outcome of the research.

Collect data

The content of the interview is centered around the automation in purchasing process and challenges to adopt RPA. It is crucial that the company's portfolio be studied carefully before the interview. Information from company websites were investigated; the data obtained helped the author in generating the baseline from which the questions were elaborated more closely. Each representative from the 4 companies received the questions list in advance and the duration of the interview. The representatives were interviewed separately, according to their suitable schedule. All the interviews were conducted online for one hour and the content were transcribed for the purpose of research analysis.

The layout of the meeting is structured from the general overview to in-depths perspectives of RPA implementation. The structure is described below

- Introduction
 - Description of interviewee's role and responsibility
 - Available technology in use at present
- Challenges to RPA adoption
 - Systems and processes
 - Human workforce acceptance
 - Resources

Analyze data

The interview results were transcribed following the question structure. The content was structured in two parts: company's current technology in use and challenges to adopt RPA

solution to analyze the relation between the theoretical finding and empirical finding. The finding of the result, however, matched three of the challenges to implement RPA solution, which was presented in subsection 2.1.4. Details on the interview results were then summarized and highlighted in the three key points: current IT system and process, financial ability, human acceptance. The scale of operation, the level of RPA adaptation is different among three companies. Therefore, the suitable solution was assessed by the ability to apply to various situation, and the competency for organization's operation to lever their performance with RPA implementation. Process mining method was then selected to address the issues that each company faces.

Interpret and report

The prerequisites for RPA solution to be successfully implemented concentrates on the condition of the process. Lacity et al (2015) stressed the importance of potential RPA candidate process that have unambiguous rules, limited exception handling, stable operation environment, high and predictable volume of data processing. The more standardized the process is, the more suitable the process is for RPA adaptation. Therefore, process maturity and process standardization are critical for the initiation of RPA project. Since process mining focuses on the analysis of process maturity and embraces standardization, it can deliver the benefits of building more critically structured processes and of suggesting the suitable process for RPA implementation. Process mining method in this thesis research was based on the research of Guyer-Klingeberge et al (2018) that applied the process mining technique to assess and monitor RPA implementation. The method is applicable to organizations that are in the planning phase of RPA implementation and that are continuously monitoring and evaluating RPA output. The concept process mining technique is to use statistic calculation to measure the automation rate of the process and standardize the process to elevate the outcome. The application of process mining method was employed in purchase-to-pay process since purchase-to-pay process meets the conditions for RPA implementation.

4 Empirical findings

4.1 Interview results

The interviews were scheduled according to the representatives' agenda. Two meetings were recorded and scripted after the interview, the other one was scripted live because of the error in the record function of the meeting platform.

Company A interview

Representative from company A has had 20 years of experience in purchasing management. He is Head of Procurement at company A, who oversees a group of buyer-unit productions. He manages daily orders, supplier contracts, supplier management, process development through interaction with two ERP systems: one old system and one new system.

“We did not even have an automatic ERP system 5 years ago. We used to receive email from suppliers and then enter orders manually to ERP system.”

New ERP system was introduced to the workplace environment one year ago. It is used to manage resource planning for indirect procurement process. On the other hand, the old ERP system has been used for direct purchasing process and production planning. This ERP system is linked with online web-based system at which customers and suppliers confirm the orders during the purchase order phase. Order confirmation comes automatically and does not need human input to perform tasks. However, employees still have to take responsibility for the rest of the process: checking and accepting proposal, sending purchasing order to customers and suppliers, checking and paying invoice, and production planning.

“Employees spend much time on proceeding purchase order and checking proposal because they have to understand the situation at the company and cross-check with the agree terms in the contract.”

The interviewee recognized the need to digitalize purchasing process. He admitted that the implementation of ERP systems provided such benefits and improved efficiency greatly. However, there is still room for more process development:

“It will be great to automate such tasks like sending RFQ, comparing offers, bidding, forecasting demand from customers, logistic follow-up.”

He showed his interest in RPA adaptation to company's IT system. He was fully aware of the benefits and challenges that RPA implementation may pose to organizational operation.

“Employees find it difficult to adapt to the change in new system. The previous ERP implementation project required a lot of training and took half-year training for all units to use smoothly.”

He concerned over not only employee’s acceptance, but also knowledge transition and financial investment aspects to adopt RPA to the current system. Since there had been no offer yet for the RPA implementation project, he did not anticipate the investment cost and the length of RPA project plan. RPA was certainly of his interest and of procurement department interest as there was a new established team to investigate about the subject. He aimed at applying RPA solutions to indirect procurement process so that the indirect procurement management would optimize current process and enhance workers’ compliance to process.

Company B interview

The representative from company B has been the Head of RPA team since 2017. His responsibility includes: supporting, coordinating, and managing RPA related activities in company; defining strategy to utilize RPA and mission to achieve with RPA; bring possibility to provide RPA service within each department. The company uses various traditional IT solutions.

“We use SAP as the main ERP, Seabells CRM, effective system for IT tickets, global system to maintain master data of customer and vendor, SAP cloud-based for HR.”

Idea of RPA implementation originated from Finance Department to harmonize processes after the improvement in ERP system. The manager wanted to cut down on manual tasks, hence, he considered RPA as a good technology to replace repetitive, high-volume and rule-based tasks.

“The initiatives come from the managers or function leaders who have been observing the time spent on manual tasks. However, people were skeptical when thinking about adopting RPA in first place.”

The motivation to adopt RPA to business operation came from company’s vision to leverage business by supporting workforce, increasing productivity and efficiency, speeding up process, and harmonizing people-process. It started the RPA journey at the beginning of 2017 for 6 months with limited budget.

“We first initiated the project by reviewing existing RPA provider and platform. We tried to find good partner to get started in RPA area and select the suitable technology for our organization. Then we built the talent pipeline for RPA project.”

Yet, going through 3 phases of RPA implementation -pilot automation, prove of concept and value process, company B has successfully gone live with RPA and established a framework

for RPA implementation. This framework is process targeted as it aims not to fully automate end-to-end process. Now, the majority of business units and function in company B have implemented RPA solutions. However, two departments that are R&D and legal functions have not adopted yet. Company B has had 250 processes fully automated and around 15-20 ongoing projects in different stages. The procedure for RPA adaptation is closely followed and complied. It is the incentives coming from internal business customers that pose significant demand for RPA in company B. The managers and team leaders take the proactive role in deciding which processes are critical for automation. Consequently, the project plan is executed following the framework listed below.

- Pre-analyze stage: define the business case to automate in broad level; estimate the technical possibility to automate.
- Detail process analysis: map out manual process in detail level.
- Process design stage: design manual process to RPA process; reorganize some steps for robot to carry out.
- Robot development: develop automation scripts.
- User acceptance testing: test automation to production.
- Project closure and maintenance: support if the system change.

To build up the current working framework at present, the presentative from company B faced difficulties along the implementation project. One of the hardest tasks that he was to go through was dealing with creating new customer with RPA and giving user right access to business system based on tickets that users create through portals. This task takes time as it is complicated process, and it requires his team to get data from one system to other system. He stated that company B had a complex compilation of systems, varied from legacy systems to new ones. Moreover, his team also found it challenging during the pre-analyze stage that the process knowledge within organization was not detailed enough and lack of process documentation. The users can easily get distracted with robot solutions if the flow of automated process is not organized properly.

“The RPA project took longer to finish in the beginning. It took time to improve project RPA project framework, schedule project, skills, and ability to plan more accurately. Some projects have vague starting points. Therefore, if the top management have higher prioritization and give clear guideline, the project will be sketched more detail.”

He emphasized the concern over people, process, and data when first introduced to the project. The difference between old and new system, human training, master data quality, and

data migration from old system to new system are the factors that call for his attention the most. However, the initial investment was not a factor that affect the decision of RPA adaptation. Since the cost for RPA package compensated after launching in first half year, he concluded that it was not costly to invest in RPA.

Purchasing function in company B has been automated in order-handling operation. The change in human workforce in the department was significant since many people got allocated. He stated that RPA was not the tool to automate every process. The decision of using RPA as a tool should be made case by case, process by process to analyze and use the best tools. The current function limits their use of high-volume rule-based task in handling digital data into structured/ semi-structured format. The interval of response was not lightning fast because of the delay in scheduling in carrying out the process and the traditional graphical user interface. It is essential to build background integration to accomplish smooth automatic process flow. He evaluated the efficiency and effectiveness of RPA with high level of user satisfaction. More quality assessment still needs to be done to measure the efficiency in RPA utilization and successful rate of RPA in overall.

Company C interview

The representative from company C is the Material Planner Officer for the operational purchasing process. His responsibility is to ensure no shortages in production line and to manage supplier relationship. Company C owns big production sites in some cities in Finland, hence, it requires a high level of response from purchasing function to meet the criteria for manufacturing lines. It is of importance that the stock balance be kept, and goal of company be matched with the ordered items or purchased spare parts. After suppliers and purchasers reach the agreement and sign contracts, the material planners will handle the operation purchasing functions. Different IT integrated solutions are used to deliver tasks and requirements in the operational phase.

“We setup the purchasing parts in the ERP system so that the system creates the ordering for those. We have to make sure that the order is met... We use BPM – product data management system, transportation system to follow up the shipment.”

The human workforce plays an important role in this specific operational state of purchasing process. To make the system work appropriately, in the beginning, he has to setup the parameters for the system to follow as instructed. Specifically, orders for each parts of the final product, which are based on calculated demands, are created in ERP system. Then, they are sent to suppliers via EDI or another system. At the end of the ordering stage, human intervention is needed to check quality output and fix issues if ones occur. He presented that all

his daily tasks involved multiple interaction from system to system. It is emphasized that each stage of the purchasing process cannot miss the human touch, although the automation function of ERP system has already brought significant advantages in task management.

“If it is not automated, we have to create order manually. We are there to make the system better every day.”

During the discussion, he assessed that the efficiency of ERP system was at good level already. However, the interviewee acknowledged the advantages and disadvantages of the current system. On one hand, ERP is a very robust system that have different configurations to utilize the automation process. On the other hand, the interface is not user-friendly. The system requires technical knowledge to find out these configurations.

“There is room for improvement. Some topics and issues can be improved.”

He also noticed that the time spent on manual tasks was considerable since his responsibility requires swivel chair multitask to various systems. He was to follow up closely the orders and shipments to keep pace with timeline of the plan. He was interested in RPA concept that aims at delivering automation solutions to the swivel chair problem. Until the discussion occurred, his department did not receive the offer for RPA implementation yet. He did not see RPA implementation as a threat of job replacement and was willing to have professional training. He stated that, to boost advancements in the current operation system, company C would find itself encounter barriers that are communication, resources, and time.

4.2 Summary of the interview

The synopsis of results from the meeting will be presented and analyzed in three aspects:

- The maturity of current systems and processes
- Financial ability
- Human workforce acceptance

THE author aimed at evaluating the current system, financial ability, and human workforce acceptance of each company. Key results are presented in table 3.

Table 3. Synopsis of results from the interview

Attribute	Current systems and processes	Financial ability	Human workforce
Company A	Use 2 separated ERP systems for indirect/direct procurement. Manual work is needed after ordering phase.	Consider the cost of initial investment.	Require time to get used to the new system.
Company B	Interact among ERP systems and legacy systems. Lack specific documentation of the processes.	A cost-benefit analysis was studied before RPA implementation. Initial investment was compensated in the first year of launching RPA project.	Require intensive training to use the systems properly. Do not have specific documentation of the target processes for automation.
Company C	Use ERP system in operational purchasing process. Complex system configuration to guarantee the quality of the process output. Require human intervention to check the quality at the end of each phase.	Consider the cost of initial investment.	Require specific training to interact between various system.

The assessment of the current system and processes is essential for the possibility of developing RPA application in organization's system. All interviewed companies operate in manufacturing industry. ERP system is trusted among three companies to perform day-to-day organizational activities. Beside ERP, each company has its own legacy systems to interact and exchange information in other routine works to communicate with suppliers and customers. The current ITPAs are dependent on the configuration and the support from IT department. As in company C case, the system required users to know its technical properties and configuration to implement it. To enhance performance of traditional integrated systems, developers are to possess technical knowledge to configure and implement the automation framework. For the users, they are to rely on IT department to make the system ready to run. On the other hand, switching between system can cause critical time-spent on unproductive tasks like data gather from various sources and influence the efficiency of the overall output. The lack of communication from system to system is a common by-product in organizations that requires interchange within various functionalized systems. Both representatives from company A and C acknowledged the necessity of human intervention at each breach of the process for quality management. It can be concluded, from the fact that human intervention is mandatory to assess the output of ITPA process, that the amount of time-spent on high-

volume manual tasks is notable and that the demand in FTE productivity and accuracy is highly stipulated. The representative from company B stated that complex operational systems made the data transferring from one system to another system more difficult. The gap in delivering easy usability and efficient multitasking has given RPA solutions opportunities to complement the current operational system. According to the interviewee from company A, despite the automation in ordering stage, the interviewee proposed that other processes of purchasing function, such as offer request, comparison of the offer, bidding, and other operational activities could be automated.

Resource is the common factor that all interviewees agreed on as a challenge to adopt RPA solution. Of all 3 selected companies, only company B has implemented and launched RPA project. In the first stage of the project, a cost-benefit analysis was conducted to investigate the financial impact of RPA implementation to business operation. After successful pilot automation, company B decided to use RPA as its daily integrated IT solutions. The initial investment compensated for 6-month benefits in the first year, hence, it did not cost a lot to invest in RPA. However, since company A and C are still on researching phase, the expenditure for a new technology can be regarded as a risky decision.

Human workforce is not excluded from the big picture or RPA implementation as it is the main force that will work and interact with any operational systems. Representatives from company A showed concern over employees' response to the new systems. He stated that employees found it difficult to adopt to the new change. Based on his previous experience during the ERP transition, employees took time to get used to the new system and required half-year training to operate appropriately. Conversely, the interviewee from company C showed interest in getting the training, if there were one, and was ready for any change in the new system. In company B case, the representative enlisted people as one of the challenges to RPA adaptation. The development of RPA solutions requires process knowledge within organizations. If the human workers do not have detailed knowledge of the process or lack process documentation, they will find themselves difficult to comply with automation solutions. People were also skeptical when thinking about RPA implementation as they were afraid of their jobs replaced by robots. As soon as they learned that RPA did not replace human workers, they believed that RPA helped them to decrease time-spent on repetitive tasks and focus on more value-added activities. The representative also mentioned the importance of having clear guideline from top management. Specific instructions from the top management board would increase the precision of the project objectives and prioritize suitable course of actions. The correct leadership at the top level will elevate the roadmap to reach tactical decisions in RPA development path.

5 Conclusion

In this section, the author analyses the findings from the interview and theoretical review. The results from the interview support author's statement on the challenges and barriers that are shared among organizations who want to adopt RPA solutions to their system. Moreover, the author observes that the theoretical and empirical studies are on demand on the issue of methodological approach to implement RPA, since the decisions to choose RPA solutions still require more in-depth knowledge and organizational impulse. Therefore, the author will present a method that can provide organizations a foundation to adopt RPA.

5.1 Suitable purchasing processes for RPA

RPA is a software that runs on user's desktop of to perform a course or predestined tasks that were once completed by humans. The process flow is then recorded for the robot worker to follow. The rule-based routine repetitive tasks are the object for RPA solution to carry out. The principle is well-suited to automate processes in purchasing function. During the operational stage of purchasing process, the volume of transaction (processing purchase orders, requisitioning goods and services, validating reception of materials, paying invoices) to be processed requires human worker constant attention on the recurrent procedure, which involves multiple system interaction and repetitive flow of tasks (Umbenhauer, 2017). As the daily established order of work circulation occupy a definite amount of time to resolve, it is at ease for human workers and for organizational benefits if recurring processes are to automate. For example, automating invoice processing by deploying RPA can save firm 80% of the cost spent on human resources (Jain & Woodcock, 2017). Normally, human worker is responsible for scanning and coding the invoices to ERP system. With the advantage gained from RPA solution, firms can assign more critically interpreted tasks to human workers to lever business operation. Moreover, the compliance of suppliers – process – buyers is enhanced, thus, driving efficiency and reducing errors and risks in execution (Umbenhauer, 2017). Automating purchase-to-pay process provides professionals the convenience of automatic notice of demand and replenishment deliveries from supplier, real-time signal delivery of payments.

5.2 Obstacles of RPA integration in purchasing process

It is of importance to acknowledge that RPA solution cannot be implemented without a result-oriented deployment and applicable subject for automation. In fact, the success of RPA solution relies on the correspondence of systematic orchestration of long-term vision, generated by correct leadership and execute plan, together with human acceptance and financial ability. Having correct leadership and suitable approach method at the beginning of the project, RPA's potential candidate is purposefully selected since target automation process is subject to the high level of process maturity. The level of maturity that the process reaches determines the selection of potential candidate and affect directly to the result of RPA performance. To guarantee the project's direction, firms are to develop target-oriented execution plan that has clear KPIs or metrics to evaluate at each phase of the project. A well-coordinated working dynamic between human workers and robot workers is the goal for firm to achieve desired outcome. Nevertheless, a strong and sufficient financial ability is supposedly deposited to run the project and equip human workers with proper training. It can be concluded that the subject for automation project and the elements, which govern or are resided in the subject itself, are factors that influence the launch of RPA solution. The empirical finding supported the theoretical finding on the challenges that organization faces when starting RPA project. In fact, the result from interview content stressed the significance of the subject process, the financial ability, and the human acceptance.

The theoretical finding reviewed that the subject process is required to reach process maturity level, which is measured by having limited irregularities in the process flow, explicit rules and instruction, steady operation environment, and predictable volume of data handling. In practice, the challenge to assess process maturity level is that the operation environment often consists of interaction among various systems ranging from legacy systems to new established systems. The complication in the swivel chair operation creates irregularities in task handling that pose difficulties to standardize the process with limited handling exceptions and clear rules. Moreover, the lack of process record and process documentation accumulate the complexity to identify the right candidate for RPA implementation. Even though the high volume of data processing and the need of reducing the amount of human intervention at each stage of process introduce high possibility to implement RPA solution, the precedent for new technology integration project, which is the standardization of the process flow, cannot be omitted from the planning of RPA implementation.

The financial factor is supported from the theoretical finding and empirical finding. For organizations that are at the beginning phase of planning RPA implementation, the cost of initial investment stands as a concern to depart RPA project. The cost analysis to compare FTE

of robot workers and human workers should be considered. The replacement of robot workers to manual repetitive work will become redundant when the need of human intervention is mainly required in particular processes and the efficiency of robot worker in decision-making tasks is not as high as human worker.

Beside process maturity and financial factor, human worker acceptance poses as a challenge dedicated to the purpose of achieving high productivity in operational activities. The training time and room for getting familiar to the technology should be considered. Define role and tasks for the human workers and compliance rate increase. Human workers are not replaced.

5.3 Method for RPA implementation in purchasing process

The target of RPA implementation draws the intention to the standardization of business process to reach the maturity and the disciplinary for further improvements. The process itself poses as the core criteria that implementation plan is derived from. In practical, it is usually the case that organizations do not know which process is the potential subject for RPA implementation. To look for the right process to automate, organizations require suitable method to evaluate the maturity of the processes. The author decided to adopt the process mining theoretical approach from the research of Geyer-Klingeberg et al (2018).

The theoretical findings and empirical findings both drew attention to the importance of process selection and process maturity. Because of the complexity in the purchasing process, the representatives from three companies showed concern over the possibility of automatic processes that would not take up resources and time. The possible reason that affects firm's decision to implement new technology to its system is because of the lack of firm's critical knowledge of current process. Firms often pay more attention to the improved to-be process than as-is process so that they do not possess the process know-how to make decision of whether the process is worth to invest or not (Davenport & Spanyi, 2019). This issue links to the others, which are financial confusion and human acknowledgement of the current issues of the process. Besides, the practice of ITPA displays an interruption between business processes organization's enterprise information systems. To acquire information of daily process performance, human workers are to manually gather and synthesize from various system to produce the final report. As there are many manual tasks involved in the process, the errors in the final output of the process performance remain unavoidable, indicating room for speculation because of not complete accuracy. In the other hand, when facing with threshold to improve processes with new technologies, organizations usually jump the process analysis

phase, make a shortcut to it, or spend a lot of money for consultants. To bridge the gap between process management and integrated IT system, process mining is a suitable method to preparing organization's operation for RPA implementation.

Process mining software tackles the hardest part of process analysis: providing detailed – data-driven - information about the key process performing. By creating event logs when the task is complete, it records and presents visible report of computer-mediated work attached with the information of the person in charge, task duration, and process bottlenecks (Davenport & Spanyi, 2019; Knuutinen, 2020). The fact-based process understanding is essential for business decisions. The transparency in facts and details provides business leaders with operation insights to make right decision and ask right questions (Knuutinen, 2020).

Process mining tool can portrait the nature of manual transaction through the record of event logs. By revealing the process details, process mining informs the processes that need standardizing before automation. The fact that process mining optimizes processes before RPA implementation guarantees the attributes which a potential process for RPA project should have. Standardized purchasing process will have unambiguous rules, limited exception handling, stable operation environment with high and predictable volume of data processing (Lacity et al, 2015). Users can see the automation rates of each process and then select suitable candidate for RPA deployment. Moreover, process mining approach help users to monitor and develop RPA performance after launching virtual bots. Process mining records and analyzes performance of the bots to manage and adjust bots' parameters or configurations. This will help firms to maintain the benefits of RPA success (Geyer-Klingenberg et al, 2018).

Process mining method can be first adopted with free demo license from Celonis Process Mining software in the Celonis Academic Cloud. Organizations can start their process analysis with the functions that the demo provides. However, there are some limitations to the process mining method that firms should consider before procuring the official license for process mining software (Knuutinen, 2020).

- Process mining does not discover all activities.

While process mining only works with the source data, which is event log, to identify the whole process, RPA can work with broader subjects not only with activities recorded in the event log. The limit of operation process mining is constrained in the event log, therefore, process mining cannot review too detailed tasks, such as take information on the screenshot level. (Knuutinen, 2020)

- Utilization of process mining requires efforts.

The quality of data determines the output of process mining analysis. If the quality of data is not maintained, process mining analysis cannot give the results that reveal the reality. Moreover, having good data knowledge is a requirement to use collect and translate the picture captured by process mining. Process mining does not present the whole picture but only high-level activities that touch the application configuration. (Knuutinen, 2020)

- Costs must be balanced.

A cost analysis should be considered with the estimated benefits from RPA and process mining. A link between RPA and process mining method should be established because “RPA robots should be standardized and re-usable to make process mining tool possible” (Knuutinen, 2020). The cost of process mining should be evaluated not only in terms of automation benefits because process mining benefits can be applied to other use cases. (Knuutinen, 2020)

6 Discussion

In the beginning of the thesis research, the author established the ground for the study with the research questions:

- What kind of purchasing process is suitable for RPA adaptation?
- What are the obstacles for company integration in its purchasing process?
- How can company adapt RPA in their purchasing process?

One issue with the new technology is that the availability of reports and research is limited. The shortage in proved theories or credible formulas is an incentive for the author to investigate the subject and find new approach. The importance of purchasing function in organization is undeniable in this modern time. That purchasing process is digitalizing, adapting new technology indicates the need of advancing purchasing function together with other functions in business operation. Purchasing process is divided into two parts: strategic purchasing and operational purchasing. Whereas strategic purchasing requires effort to build valuable partnership that influence organization's long-term vision, operational purchasing requires time and FTE resources to execute high-volume routine transactions, which can be optimized to support strategic purchasing activities.

Like human worker, RPA is a virtual robot worker which can perform human activities on the desktop, and which is driven by rule-based repetitive tasks. To start RPA implementation project, organization should look for processes or sub-processes that answer to RPA specific requirements, such as unambiguous rule, limited exception handling, stable operation environment, high manual work measures, multi-system data entry. It is of importance that operational processes and other factors be analyzed for the potential of automation. Otherwise, failure in RPA implementation is unavoidable even though firms recognize the impact of RPA to organization. The most common mistakes that organizations make and effect the success of RPA project are incorrect RPA leadership at the top level, no long-term RPA vision or roadmap, selecting incorrect RPA use cases and lack of clear business case, KPIs, or success criteria, dated project delivery approach for RPA, trying to deliver RPA benefits on shifting sands, lacking budget to begin, getting staff on board with automation initiatives. The empirical findings support the theoretical findings of challenges that firms usually face. It is the implemented process and the transition, the communication between people and employee's acceptance, the resources that make firms concern. These factors stand as strong pillar for the risks that organizations must study carefully before taking further steps.

The process mining technique is presented in the research as a method to tackle not only RPA implementation, but also process standardization. Process mining method has three

consecutive phases: assessing RPA potential by using the calculation of automation rate, developing RPA applications, and safeguarding RPA benefits. The focal point of this method is process analysis based on automation rate calculation, which shows the variance or non-standardization in process. RPA unlocks to its full potential in stable operation environment with limited handling excepting as it is trained much faster at less cost to execute standardized process. However, process mining technique also shows that low automation rate processes can obtain more benefits from RPA and impact organization in financial aspect. The value of economic is indicated through the application of process mining as the process mining platform supervises the efficiency of robots during pilot automation and then suggests suitable processes for robot deployment. When robots are ready to take on human work, the process mining platform can monitor and assess the performance of robots to adjust parameters to improve productivity of robots.

The thesis research has reflected the situations that organizations are to go through when deciding to adopt RPA solutions. Since the number of interviewees were limited, the results of this thesis research need further investigation in the future to increase reliability and adaptability in more case studies. Even though qualitative method gives flexibility in interpreting the results, the quantitative method will provide accuracy and logical approach to the issues. The findings from this thesis research can be a source for further investigation on the process analysis and process development topic.

The result of this research can be applied to firms that are in the pilot phase of implementing RPA solutions and that already start deploying RPA solutions but want to develop and monitor robot performance. Since the process mining technique assists users from end-to-end process of automation implementation, the application of process mining is not constrained in specific phase of the project. However, the limit in real case studies poses as a challenge for the validation of the theoretical findings and for the practice of process mining technique in organization environment. In the other hand, because of limited time-spent for the research, the author cannot cover more methods to assess the possibility to adopt RPA in business organizations. The suggestion for possible future research would be testing the efficiency of process mining technique in firm's operation and evaluating available process maturity methods.

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