

**The utilization of robotic process
automation in master data management in a
manufacturing company**

**Ohjelmistorobotiikan hyödyntäminen master datan
hallinnassa teollisuusyrityksessä**

Bachelor's thesis

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ABSTRACT

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Many organizations have noticed the various benefits of robotic process automation (RPA) in automating processes. Master data management (MDM) has been part of the business for a long time and is part of the company's processes, regardless of the size of the company. This research examines the benefits of RPA in managing master data. Research's case company purpose was to utilize RPA in managing for example in customer data. The goal of the research is to understand the characteristics and benefits of RPA and master data and how to use RPA in master data management. The goal is also to understand what should be done to succeed in implementing RPA.

RPA is quite new in the technology field so there is not much of literature. The theory of RPA and master data is reviewed as well as the link between them. In addition to literature, case-company employee has been interviewed using a semi-structured method. The result of the research shows the importance of investigation, continuous development, as well as co-operation between employees before implementing RPA. RPA brings value to the company in the long run. Using RPA to master data would speed up the process and work 24 hours a day. However, master data should be fully standardized to be able to implement RPA successfully.

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<p>Monet yritykset ovat kiinnostuneet prosessien automatisoinnista ohjelmistorobotiikkaa (RPA) hyödyntäen. Yritykset ovat hallinneet jo pitkään master dataa, ja master datan hallinta kuuluukin osana kaikenkokoisten yritysten prosesseja. Tutkimuksessa tarkastellaan RPA:n hyödyntämistä master datan hallinnassa. Case-yritys pyrkii hyödyntämään RPA:ta esimerkiksi asiakastietojen hallintaan. Tutkimuksen tavoitteena on ymmärtää RPA:n ja master datan ominaisuuksia ja hyötyjä ja sitä, kuinka RPA:ta voidaan hyödyntää master datan hallinnassa. Tavoitteena on ymmärtää myös, mitä onnistunut RPA:n implementointi vaatii.</p> <p>RPA on melko uutta teknologia-alalla, joten RPA:sta ei ole vielä kovin kattavasti kirjallisuutta. Kirjallisuutta on tarkasteltu sekä RPA:n että master datan kannalta myös siitä näkökulmasta, minkälainen yhteys RPA:n ja master datan välillä voisi olla. Lisäksi tutkimusta varten on haastateltu case-yrityksen työntekijää puolistrukturoidulla menetelmällä. Tutkimuksen lopputulos on, että onnistuakseen RPA:n implementoinnissa yrityksen tulee tehdä selvitystyö RPA:sta ja myös kehittää RPA:ta jatkuvasti. Lisäksi työntekijöiden välinen yhteistyö on tärkeää jo ennen RPA:n implementointia. Tutkimuksen mukaan RPA voi tuoda yritykselle hyötyjä pitkällä aikavälillä: master datan hallinta nopeutuu ja sen prosessit pystytään ohjelmoida toimimaan 24/7. Master data täytyy olla kuitenkin täysin standardoitua, jotta RPA:n implementointi olisi mahdollista.</p>	

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LIST OF ABBREVIATIONS

BI	Business Intelligence
BPM	Business Performance Management
DQM	Data Quality Management
DW	Data Warehouse
EDM	Enterprise Data Management
EIM	Enterprise Information Management
ERP	Enterprise Resource Planning
FSP	Financial Shared Platform
IT	Information Technology
MDM	Master Data Management
RPA	Robotic Process Automation
SAP MDM	SAP Master Data Management
SLA	Service-Level Agreement

1 INTRODUCTION

1.1 Background

The development of technology is growing all the time and organizations are continually trying to be aware of the risk and opportunities that technology brings with it. Organizations are also trying to search for various innovations and developments that could make the business processes more effective and with higher speed. The development of technology and automation technology has created more and more ways of replacing employees (Zhang & Liu 2019). Automation and robotics are not immediately reducing costs, but other benefits will come out when automation is implemented to operational processes (Cusack 1994).

The automation has affected the manufacturing field but also office functions, for example invoicing (Fox 2001). “Automation” is a method that allows a device, process or system to function automatically. Automation is already applied in many areas nowadays. Automation can process any system but integration between people and systems is not so easy to automate. (Madakam et al. 2019)

Robotic process automation (RPA) has received the attention of organizations. With RPA organizations are able to reduce costs and have more efficient processes. (ACCA et al. 2018) The term “Robotic Process Automation” is frequently linked to physical robots doing human tasks, walking around the office. The term actually means of automating the service functions. (Madakam et al. 2019)

The companies have to develop their operations using technology otherwise they will not be able to keep up with the business competition. The RPA is so called the new language of business. The physical robots have made a change in the industrial work and replaced many blue-collar works. The system-based robotic is going to replace many white-collar workplaces. (Madakam et al. 2019)

Organizations have developed their master data management (MDM) for about twenty years. With master data management, organizations can have more corporate collaboration between information technology (IT) and business stakeholders. The MDM is allowing organizations to receive more unite and available master data. (Ng et al. 2017) The master data is the basis information of business that drive the operational work for instance customer or vendor information (Deloitte Development LLC 2007). The data amount is constantly growing in organizations and that require well organized master data (Vilminko-Heikkinen & Pekkola 2017). The MDM is a tool for organizations to synchronize, store, manage and change master data more easily (Deloitte Development LLC 2007).

The RPA was planned to take over a part of customer master data in a manufacturing company. The company decided to end the RPA project mainly because the cost of the implementing become too high. The company has many different SAP systems and the implementing the RPA to all of them was too complicated. This study focus is on the basis of RPA and master data management. SAP is the most used software for enterprise resource planning (ERP) (Majed & Mohamed 2000).

1.2 Research questions and objectives

The aim of this research is to answer to why the robotic automation process can be used in master data management. It includes the benefits and challenges of master data management and the wider theme is what are the benefits and challenges when implementing RPA. The research includes also the steps of implementing RPA and what should be done before implementing MDM.

Research questions:

RQ1. *What can and should be done with robotics process automation?*

RQ2. *What are the benefits and challenges of RPA and MDM?*

RQ3. *What should be considered before implementing RPA and MDM?*

The concrete outcome of this research is showing the RPA advantages in master data management and the challenges regarding the automation implementing process. The answer also includes the benefits and challenges of RPA and MDM. The benefits of this research to the reader is a wider understanding of where and why we could use RPA and understanding why master data should be well-organized in an organization. The research is defined as RPA in master data management in a manufacturing company.

1.3 Research methods and structure

The theoretical framework is done by using qualitative methodologies and literature review is focused on understanding robotic process automation idea and master data management and their benefits and challenges. The theory is mainly article-based search from databases and the case study of the company is done using a semi-structured interview (Appendix 1). The semi-structured interview means that the interview has some kind of a structure and topics, but the interviewer has the freedom to ask other questions regarding the topics (Jarratt 1996).

First, the RPA and the master data ideas are reviewed and then implemented in the case company. The first chapter of literature review focuses on the robotic process automation in general, its application, benefits and challenges. In the second chapter, master data is studied in a general way, the master data management is investigated in detail, as well as its benefits and challenges. The case company is reviewed after the literature chapters. In the case company the theories from literature review are implemented to understand what benefits and targets the company can achieve.

2 ROBOTIC PROCESS AUTOMATION

The development has affected the global economy and the robotics process automation has become a more important tool and the fastest one in the technology field (Kedziora & Kiviranta 2018). In 2015 the robotic process automation has started to take place in service automation while cognitive and intelligent automation were still being tested (Willcocks et al. 2015A). The RPA is new on the technology side and is the most developed technology in the field of computer science, electronic and communications, mechanical engineering, and information technology. It combines hardware and software, networking and automation to perform in a simple way. (Madakam et al. 2019) The RPA is a very advanced solution and it has received the attention from the management of companies (Zhang & Liu 2019).

RPA is a new technology and is has an impact on business operational processes. The processes will change and needs to change during the development of RPA. Organizations have now a possibility to get the so-called digital labor to do tasks more efficiently, in a reliable way and reducing costs. Job descriptions are changing to more analyzing and complicated than before because the RPA is doing the manual tasks and reporting. (Madakam et al. 2019)

2.1 Robotic process automation idea

Robotic process automation (RPA) is a software automation tool that is able to minimize human work with computer systems by automating a repeatable routine (Zhang & Liu 2019). The software can be programmed to repeatable and rules-based everyday tasks. The RPA software is called “swivel chair” automation tool because it can perform the tasks the same way as human is accessing multiple systems. The RPA automates the rules-based tasks for data transferring and processes it fast and accurately. (ACCA et al. 2018) The RPA is able to do routine tasks similarly every time (Laserfiche 2016).

RPA is a tool for getting systems talk to each other and be integrated. The RPA is based on Software Robots which are called bots. They are the digital version of human labor. (Rajesh et al. 2018) The software’s robot has a user ID like a human. The RPA software can interact with the computer systems user interfaces with the user ID and a password as a human would. The

technology of RPA does not require new expensive applications or their creation, it is suitable for the existing systems. (Willcocks et al. 2015A) A robot is an electromechanical machine which is programmed by a computer and able to automate complicated tasks. (Madakam et al. 2019)

Leslie Willcocks says in the interview with Xavier Lhuer (2016) that the RPA is minimizing the routine repetitive work that the average knowledge worker used to do. Willcocks described that RPA's most usual flows are a three-lane motorway. The slowest lane is where the tasks of the user is to collect data, combine it and put it into a document. The second lane is where there is a template offered and well-developed programmers are designing a "robot" which is normally customized for the organization. The fastest lane is a software which can be scaled and reused for any organization.

The "process" is a generic term and is part of the everyday life of all people. Each system or company activity involves processes and can be performed by people or things. Regardless of whether the system is closed or open, the process takes inputs from different devices or people and performs the task according to predetermined rules to give the desired output. The process changes the input into output. The use of time, the amount of costs and the amount of labor and other quality parameters depend on the process and system. (Madakam et al. 2019)

The functions that the robot's user ID is able to perform are for instance calculations or creating documents and reports. (Berruti et al. 2017) The optimal functions for using RPA are high-volume, standardized, rules-based mature stable processes where costs are clear and the value-to-business is understood. RPA suits well to processes where a human takes information as inputs from a system, processes the inputs as the rules are set and then fills in the outputs to another system, for instance Enterprise Resource Planning (ERP). RPA is using the computer systems as human would work with them. As a result, the RPA should perform faster, better, with no mistakes and less expensive than a human. (Willcocks et al. 2015A)

Figure 1 is listing all the key characteristics of RPA. The RPA is a programmable software and not a human, even though it can act like a human when performing the user ID. RPA is able to automate specific tasks. The tool can be on top of the applications and not integrated in them.

The PRA can repeat rules-based tasks. There can be many robots doing one process or one robot doing many processes. (ACCA et al. 2018)

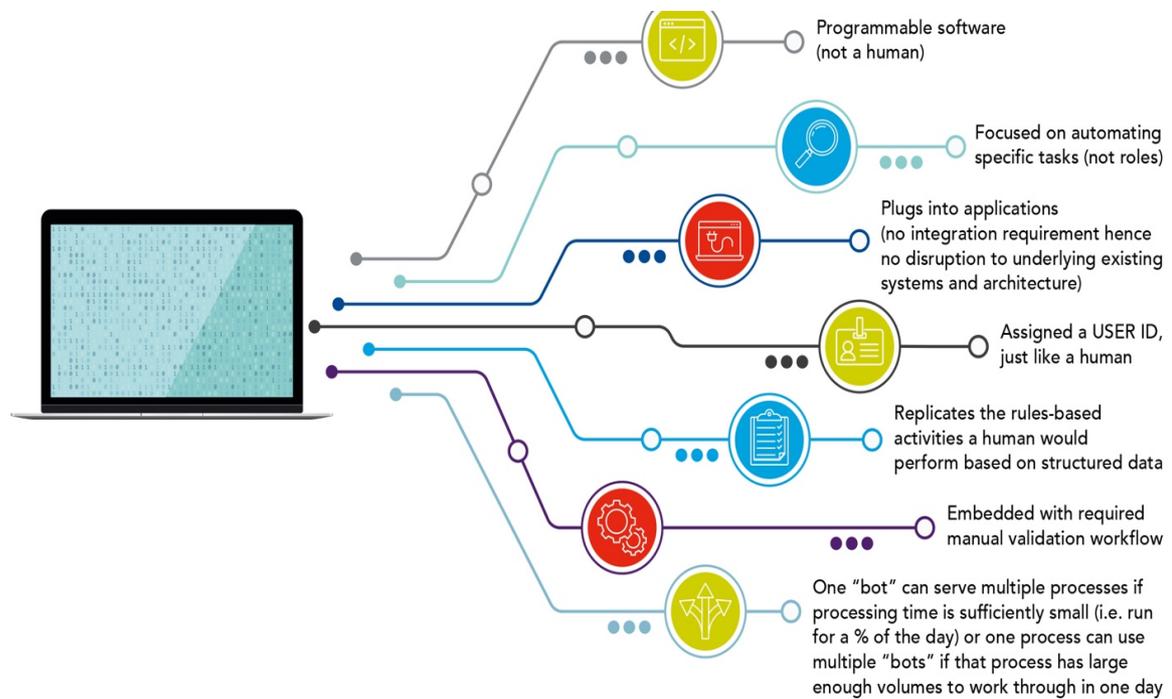


Figure 1 Key characteristics of RPA (ACCA et al. 2018, p. 11)

2.2 Implementation

Despite the growth of use of technology in business offices, the manual processes are still part of everyday work. The manual processes that are repetitive should be automated. RPA is an efficient tool for manual tasks that one can rely on. (Thornton 2018) Investing now in RPA will pay off in the future when machine learning and artificial intelligence can be integrated to create more powerful software (Colquhoun 2018).

Before adopting RPA in organizations, they should study about RPA and the benefits of it. Organization's employees should participate in different seminars and search for information, for example online. As a result, organization should have basic knowledge about technology and understand how it is developing before implementing RPA. Once the organization have decided to automate processes, they need to have advanced systems that are able to fulfill the requirements and achieve the goals. (Thornton 2018) The adoption does not need any changes

in the existing systems and it can be implemented on top of the system like a human would work (Rajesh et al. 2018).

The adoption of RPA requires cooperation between business operations staff and IT (Willcocks et al. 2015A). It is good to develop a roadmap for implementation. The roadmap should be done by finance leadership, stakeholders and team members and it should include the automation strategy. The roadmap should define steps of deployment, investment, benefits and savings drivers of each initiative, the organizational change impacts of transition, trainings needs and innovation encouragement. (ACCA et al. 2018)

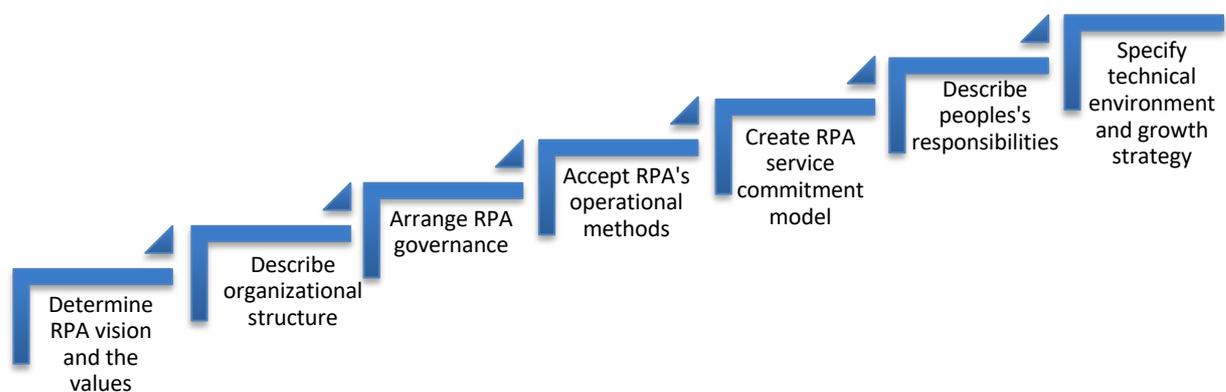


Figure 2 RPA implementing steps (adapted from Willcocks et al. 2015A)

Figure 2 shows the seven steps that are recommended when automating business processes. First, the organization should settle the Business-RPA orientation. The first step is to determine the RPA vision and the desired values to business against organization's strategy. In that way, the organization can figure out how the RPA can be a strategic capability and asset and how long. The second step is to describe organizational structure and the aspect of the RPA manager. The implementing should be done trying to fit the RPA to the existing applications of organization. The development of RPA will appear faster in single well-organized separate business units and may not be possible to scale it through the organization. It is recommended to have a leader to the RPA implementing project who can report to the management of organization. The leader is called Head of Robotic Automation. The Head is responsible for the cooperation of IT, business and other employees who are related to the RPA project. (Willcocks et al. 2015A)

The third step is to arrange an RPA Governance board that is observing the demand and weighing the capabilities of RPA. The RPA Governance consist of at least the Head of Robotic Automation, IT representatives and business unit representatives. The RPA Governance is responsible for instance for the control of demand, demand generation, benefit tracking, constant development initiatives and escalation point for appearing problems and risks. The fourth step is to accept RPA's operational methods and follow-up to its proper use. Delivery methods can be planned internally and implemented into how the redesign and IT project are delivered. The RPA vendor is also able to provide standardized methodology that can be implemented internally. Delivery methods move the attention from process management more to definition, design, configuration, testing and deployment of virtual robot workforce during execution demand management, technical infrastructure-related operational support, IT security and IT management. (Willcocks et al. 2015A)

The fifth step when implementing RPA is to create an RPA service commitment model that is needed to support one's operations processes. RPA is capable of optimizing the productivity of both human and virtual workforces with the right amount of the support of infrastructure. The operational support functions include the handling of the transfer and irregularity, business continuity, testing and deployment, system support, process support and product support. Such tasks should be divided to all project related people from business unit, operational, RPA and IT teams and also the RPA software vendor. (Willcocks et al. 2015A)

The sixth step is to describe people's part and duties in the implementation and provide them with the needed trainings in working effectively in the current organizational structure. The amount of people necessary to strong RPA capability is not that big. The importance of training the people is high. They need to be trained a little bit in every section; product induction, assessment, controller tasks, developer tasks and support tasks. The last, seventh step of the implementing process is to specify a scalable, low-maintenance technical environment and related growth strategy. Every RPA vendor is able to offer various technologies, software and components. (Willcocks et al. 2015A)

2.3 Applications

Software robots like RPA are typically used in finance and accounting, human resources, customer service operations and manual tasks. These tasks usually include plenty of data to process. (Kedziora & Kiviranta 2018) RPA is used to many different tasks in the area of HR, healthcare and pharmaceuticals, financial services, outsourcing and many others (Madakam et al. 2019). There is a fear that RPA will replace employees but actually when automating the repeatable tasks, employees can focus more on the tasks that require emotional intelligence, logical thinking and judgment. Then employees can also let RPA do the tasks without mistakes. (Rowe 2017) UiPath, Blue Prism and Automation Anywhere are the most used RPA tool vendors (Rajesh et al. 2018).

RPA software robots are programmed to follow “if-then” rules and that makes them important to rules-based tasks. When there is a need to have a subjective judgment to finish the task, then RPA is not able to process the task. Tasks that are manually-performed and repeatable routine work with low complexity but time-consuming are potential to automate with RPA. The software can do those tasks more efficiently and with better quality. (ACCA et al. 2018) RPA can be useful in systems where the system receives input in a form of a ticket and does different simple tasks, for instance changes password or creates a new user. The connecting factor for all RPA applications is that the steps of the process are always the same. (Rajesh et al. 2018)

The structured data is most suitable for RPA. Structured data can be, for instance, in a database with easy access. The most ideal processes for RPA are high-volume processes. One distinguishable strengths of the RPA’s are that it can perform well between different systems. (ACCA et al. 2018) The RPA software suits best processes which are very standardized, rules-based and not complex and where the transaction volume is high (Willcocks et al. 2015B).

RPA can be applied in many functions in an organization and the financial function is a good example of where it is really useful. Figure 3 shows the usage level in different functions. Purchase to pay and record report are the most frequent applications where RPA can be useful and used. The RPA has been also implemented to master data which helps to control the data of organization faster and more efficiently. (ACCA et al. 2018)

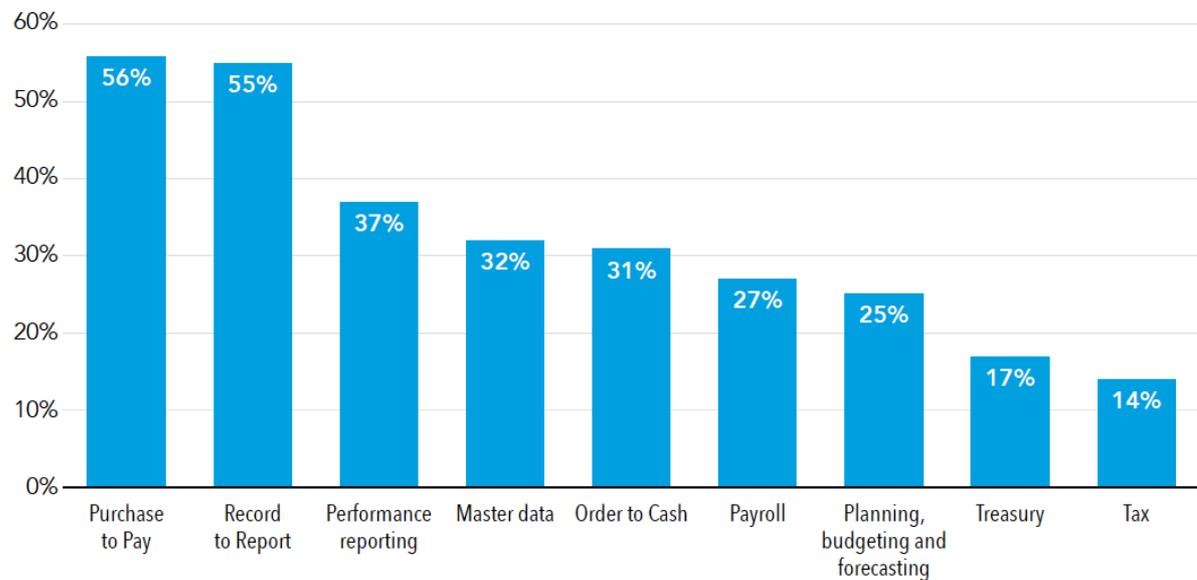


Figure 3 Where RPA is being applied in your organizations finance function. % of respondents who recognize where RPA is used in various financial function processes. (ACCA et al. 2018, p. 17)

For instance, a usual project in an organization was that an RPA “robot” was programmed to load the data requests in SAP after the customer master data updating fields were filled. The changing process was previously time-consuming and required a lot of manual work. In this example project, the new robot is automatically updating multiple types of SAP master data information. The robot was a success to this organization and managed to reduce the time taken to complete a request by 40% with 100% data. (ACCA et al. 2018)

2.4 Benefits

Main benefits of using RPA in an organization are operational efficiency growth and cost cuts (Rowe 2017). The costs reduction measurement should be done correctly after implementing RPA. The measure should be done as comparing the cost per robot to the target of cost reduction barrier rate. (ACCA et al. 2018) RPA is able to provide many benefits to operational processes and the most frequent ones are the cost reduction, less errors and risks elimination (Madakam et al. 2019). The probability of benefits gets higher when there is continual development during the implementation (Willcocks et al. 2015B). Table 1 shows the benefits and factors of RPA.

The software can be programmed to run 24 hours a day and 7 days a week for the whole year because of the robots, meaning RPA has a 24/7 operational capability (ACCA et al. 2018). RPA is usually programmed to operate all the time and a human is not able to work all the time (Thornton 2018).

Employees can also profit from the RPA in a different way because they do not have to repeat their work so much which has a positive impact on their attitude (Thornton 2018). RPA creates also time for employees to be used more on interesting work (Laserfiche 2016). When robots are doing the routine and repetitive work, people can focus on their knowledge and competences. Employees can develop themselves more easily. (Gawade 2017)

RPA creates reliability in the done process (Thornton 2018). The RPA can increase the security of data compared to how a human would be handling the data, especially sensitive information (Rowe 2017). The robot is programmed to have rules regarding which data it has access to. However, mistakes can be made while programming, so it is important to test the software carefully before introduction. (ACCA et al. 2018)

RPA applications are able to record all the steps taken as the human would also do between different systems (Rajesh et al. 2018). The tasks are done by a robot so every step is recorded and it can be checked. This makes the processes visible producing valuable information. (ACCA et al. 2018) The RPA's bot is programmed to follow the set rules and is offering a way to have the audit trail history of the processes (Laserfiche 2016).

Quicker response and doing processes faster are more and more appreciated. RPA can perform the daily routine tasks in seconds rather than a human. (ACCA et al. 2018) The RPA is more effective and the processing time is more less compared to doing it manually (Laserfiche 2016). The RPA affects also service-level agreements (SLAs), shortening them and doing all the time-wasting processes faster (Rowe 2017). In addition to time savings, the organization will have data integrity which is a notable benefit for the organization (Colquhoun 2018).

The RPA provides the accuracy of processes and consistency that lead to fewer mistakes (Laserfiche 2016). The transaction amount is higher comparing to how human would do the same. There is no need any more to recruit more people to do the manual work but the amount of software can be raised. (Barnett 2015) When the volume of the transaction is high, the probability of mistakes is higher when the human is doing them. The probability of mistakes will be lower when a robot is performing the process. (Willcocks et al. 2015B)

Table 1 Benefits of RPA (adapted from ACCA et al. 2018)

Benefits	Factors
Reduce costs	Less human work needed
Improved process speed	Daily routine tasks processed faster than by a human
24/7 operational capability	Software is able to operate all the time
Improved control	Software can be programmed to have access to particular area
Data accuracy	Human can make mistakes when processing big amount of data – software does not
Improved process performance visibility	Steps can be recorded and traced
Increased transaction volume throughout	Software can process big amount of transactions comparing to a human

Vodafone executes RPA in the Vodafone's Shared Service center and managed to have the total cost of the process decreased by 40 percent and the quality improved significantly. The RPA project was the first step of a larger project to have processes automated and the goal was also to use cognitive and artificial intelligence. Vodafone has also built a Centre of Excellence to have a team to supervise the project about implementing robotics to different processes. (Salvatore 2016)

2.5 Challenges

When organizations are adopting new technologies, they have to prepare to change and coordinate resources among different areas, like finance and IT. Once the RPA is implemented and running, it is simple to operate. (Thornton 2018) RPA is able to perform better than human regarding quality, speed and mistakes but only in the specific area where the robot is programmed to operate (Willcocks et al. 2015B).

The vocabulary of RPA can be confusing and that can be one of the challenges when implementing RPA. People can misunderstand and mix words like “robot” and “robot software”. The words “developers” and “analysts” may also be understood differently. To avoid misunderstanding while doing RPA project, it is important to clarify with colleagues what the meanings are. (Willcocks et al. 2015A)

Development of technology has created expectations for IT functions. They are expected to square the triangle on resources, time and quality. These three are usually part of a project seen as settlement. When prioritizing speed, the quality will suffer. The same effect happens when trying to reduce costs, the quality can be expected to go down. With the nowadays cooperation level, it is possible to expect IT to be delivered faster, better and cheaper, simultaneously, and evaluated primarily for business, not for IT. (Willcocks et al. 2015A) So when doing an RPA project, the three project components need to be in balance.

3 MASTER DATA

The amount of data has grown fast in the past years and has created issues regarding data management and caused data quality problems. The data needs to be available to many people and that can cause data discrepancies. Organizations are not able to manage to store the amount of data that technology nowadays is allowing. (Vilminko-Heikkinen & Pekkola 2017; Silvola et al. 2010)

Master data management is not new in technology area but it has had the attention of organizations. Organizations have noticed the big amount of master data to be managed and integrated. (White 2007) Master data management should not be taken as a strategic IT element but a part of the organization. MDM is offering one view for the key business elements. (Tuck 2008)

Data errors may lead to many mistakes and serious consequences. These are the reasons why nowadays business requires organizations to have centralized data management. Master data management solves data issues. (Silvola et al. 2010) Organizations should care for MDM, because the list of issues gets longer when ignoring MDM. That is the major reason for implementing MDM. (Russom 2006)

When any management of organization is considering MDM, strategy is important to start approaching it step by step and then refining it with time. The amount of data is usually high in organizations, in all the entities and systems. To have control of the data, management should have a corporation with employees with better understanding of the data; IT analyst, data stewards and data owners. (Fisher 2007) The last decade involved a lot of integration on IT side and the MDM became a candidate for more efficient integration (Russom 2007).

3.1 Master data idea

Master data, also called reference data, is the central business objects in an organization that define a business entity. The objects can be, for instance, customer, product and vendor and also finances can be modelled via master data. (Vilminko-Heikkinen & Pekkola 2017; Russom

2006) All those objects create master data which data has been cleansed, rationalized and integrated into all systems of organization to be used in different business processes (Silvola et al. 2010). Master data is a set of key elements related to the associated hierarchies, attributes, properties and dimensions, like an employee or vendor that covers the organization's IT systems and operates the business. (Deloitte Development LLC 2007)

Master data has a very important role in an organization, it includes important information and it is rarely changing (Prokhorov & Kolesnik 2018). Master data also brings challenges to a company because its amount is growing and that can cause data quality issues (Silvola et al. 2010). When the organization is growing, the amount of master data is also growing so then the management of master data becomes a more crucial factor in organization's success. Every development in organization brings new master data information to be incorporated in the existing business. (Graham 2010)

One master data is the subdivision of "the single version of truth". This means that raw master data from separate systems is combined into one format and distributed across the organization. "The single version of truth" helps organization to notice the factors that may have an impact on the business. Figure 4 shows the three elements that concern one master data and they are data, processes and information systems. All these three elements together build a management structure for successful MDM adopting. (Silvola et al. 2010) When it comes to information technology side, the single version of truth through the organization has become a goal (Deloitte Development LLC 2007).

Data models, attributes and definitions are included in data. The accuracy of data comes from excellent data quality throughout the life cycle. Processes include data ownership definitions and procedures for data cleansing, publishing and sharing. The third element is the information systems which includes the applications and technologies for automated sharing and integrations of the data. (Silvola et al. 2010)

All the three elements of one master data build a framework, combining the core entities into one master data system; parties, places and content. Parties is the most important entity and it covers organization, the roles and responsibilities and data owners. Places include locations and

processes. The entity of content understands the exact master data of the product, as well as component and software. (Silvola et al. 2010)

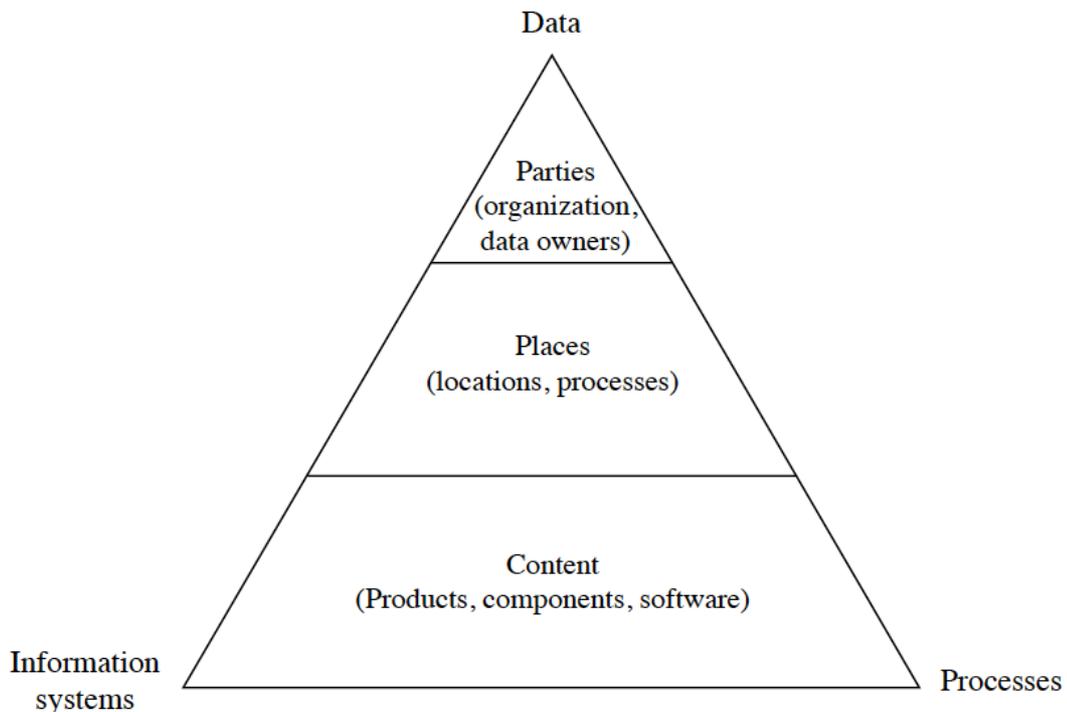


Figure 4 The concept of one master data (Silvola et al. 2010, p. 151)

Master data has different elements than other types of data. Master data is about the basic characteristics, for instance height or weight of a real item and not like transaction data or inventory data. Usually the parts of master data do not change. For instance, the characteristics of the material is the same all the time, so the master data does not have to be changed. The product may change during the life cycle but the basic data stays the same. The classes of master data, for example customer data, stays the same when compared with, for example, transaction data. The fourth element that makes master data different than other types of data is, for example, making a purchase order when the master data of material and supplier is needed. (Silvola et al. 2010)

3.2 Master data management

A master data management solution can offer organization a system where all data is standardized, more exhaustive and more accurate and, as a result, a single system of record for every entity without multiple systems (Apostol 2007). MDM solution can define and maintain all the business main data and then have it integrated with different systems in organization. The MDM is collecting, developing and sharing the master data. (Russom 2006) When the MDM is well done and productive, it helps to create a tool for controlling shared internal information. The MDM tool is giving the possibility to find out the records of changes made to the information when the master data is strongly standardized and managed. It is also allowing well-done reports and that can lead to helping an organization to do changes faster and in a more flexible way. As a result, the MDM is a tool for having the information and the decisions uniformed. (Deloitte Development LLC 2007)

Enterprises data management (EDM) includes six components and one of them is the MDM. The other are enterprise information management (EIM), business intelligence (BI) and data warehousing (DW), enterprise portals, master data management (MDM), business performance management (BPM) and data quality management (DQM). The aim of the six components is to help organizations to develop the latest technological innovations and more effectively manage their information. (Apostol 2007)

The idea of data management and data control is not so simple to comprehend. Data problems cannot be taken seriously enough and that has impact on insufficient resources. The data management project can turn into an information technology project if the resources are allocated and then the money spent does not give any benefits at all. The MDM should have the aim to business and not to technology. (Silvola et al. 2010)

Organization typically form a work group called “Centre of Excellence” that helps with the MDM project, having the cooperation with IT and business users. The Centre of Excellence offers guidance and support. It has the power to define the parameters of master data and controls how one is allowed to input and change system data. (Fisher 2007) Master data management is a way to get business and IT stakeholders to work together and this helps

stakeholders to take decisions with more trustful data sources, practical insights and holistic customers, products or services. Making more decisions based on more reliable data has been one on the reasons to implement MDM. (Ng et al. 2017)

Table 2 is introducing how master data management is important to all size of organizations and the size has a critical role in how the implementation is done. Small organizations may think that the master data management is not so important in their business but actually that is the time when it needs to be implemented. That is the time to implement MDM so that the organization can grow with success. Mid-size organizations have already many systems depending on the master data so it would be good to start integrating systems together. (Graham 2010) To grow and succeed, an organization has to pay attention to MDM to make a harmonized, precise, timely and complete set of data needed. (Silvola et al. 2010)

Large organizations have difficulties with implementing all the master data in a comprehensive manner. They have plenty of silos of master data and there are several stakeholders for each silo. As a result, stakeholders need to coordinate the data well and have to focus on it. Conglomerate organizations are the most complicated challenges in master data management. Usually conglomerate organizations have a diverse range of products that makes the master data bigger. (Graham 2010)

Table 2 Challenges of different-size organizations (adapted from Graham 2010)

Organization Size	Characteristics	Central Challenge
Small	Small amounts of master data. Data integration is not a top priority.	Creating a plan that will scale with the business.
Mid-size	Data integration starts to become difficult for an organization. Data controllers can be clearly defined.	Implementing effective controls and data stewards.
Large	Huge amounts of master data and system integration. Mostly homogeneous data silos with relatively consistent attributes. Data controllers may now have a full-time role.	Building consensus among large number of stakeholders, managing numerous integration points.
Conglomerate	Many disparate businesses that may create many groups of data.	Determining the level at which master data lives.

The main mission of MDM is to make sure that there is no duplicated, incomplete or inconsistent data in different areas of the organization's activities. The MDM system is a combination of processes, control systems, standards and integration of systems to help one work in a consistent way. (Prokhorov & Kolesnik 2018) Data management practices are collected by MDM and are organized by key stakeholder, participants and corporate clients. MDM is an organizational function, rather than an application system. (Vilminko-Heikkinen & Pekkola 2017)

MDM solution types are generally built in or integrated closely with other bigger applications or systems. Due to the links, MDM solutions are divided into three categories. (Russom 2006) MDM is usually divided into two parts; operational MDM and analytic MDM. Operational MDM integrates business operational functions, like customer relationship management

(CRM) or supply-chain management. Analytic MDM can be seen in practices that resemble a data warehouse (DW), like customer data integration and financial efficiency management. (Apostol 2007) The third category is enterprise MDM which is an autonomous infrastructure that is able to merge master data into various IT system and businesses. Enterprise MDM contains the requirements of operational MDM and analytic MDM, meaning that they form enterprise MDM. However, MDM is advantageous for organizations, as it can expand beyond organizational boundaries and IT silos. (Russom 2006)

3.3 Master data management implementation

Before implementing some kind of data management system, the employees in organizations are using a lot of time to search for information in different systems, rather than searching for it in one system only. All the data is usually in people's mind and in the computer and needs to be collected into the system. (Obank et al. 1995) The organization needs to pay attention while implementing it in the process and not in technology, have understanding of the organization master data flow, performance improvement opportunities and data pain points and also to business managing (Deloitte Development LLC 2007).

One of the best-known platforms is SAP Master Data Management (SAP MDM). The SAP MDM is a tool for harmonizing information that is in various applications. (Woods & Word 2004). SAP system has SAP MDM and it is an MDM component for the system. The SAP MDM is able to make company's all main data to be united and integrated through all the systems interfaces in the company. The component can help, for instance, in distributing master data in different systems using automated publishing and subscription models. The SAP MDM helps organizations in business processes and, therefore, reduce costs and optimize the decision-making process. (Prokhorov & Kolesnik 2018)

The organization needs to have a good understanding of data management and data governance when adopting MDM. Customer master data is usually the first data for organization's MDM. Data elements are usually for instance marketed and sold. (Silvola et al. 2010) When approaching MDM organizations usually start with creating system of records. The idea is that

organizations gather all the information in different forms. Typically, the central database is created where all master data, metadata and physical data are synchronized. (Russom 2006)

When choosing the style of implementing master data management organization-wide, it requires the approval on the highest level of an organization. The other factor that is contributing is the size of the organization and the structure of the current organization. The organization should know how many people are involved in the master data and what is the amount of records that needs to be stored for each data set. When it comes to the structure of the organization, it is good to know how large it is and how it is located. The important information is also to know how many organizational units need to be synchronized. It is also good to consider how the customer's records will reflect in the system and to evaluate the complexity of every system to be integrated. (Graham 2010) The MDM process should link business people to manage the master data and IT employees to support business achievement in the entire organization. (Silvola et al. 2010)

Before the master data management, the centralized master data management system has two stages. The two stages are consolidation and harmonization. Consolidation is about processing data structure and the collection of data. The harmonization includes alignment, normalization and classification. The master data management process includes maintaining centralized basic data, providing role-based access to the main data, arranging the process of checking incoming new data information, implementing a uniform interface to maintain basic information and storing main data in a central repository. (Prokhorov & Kolesnik 2018)

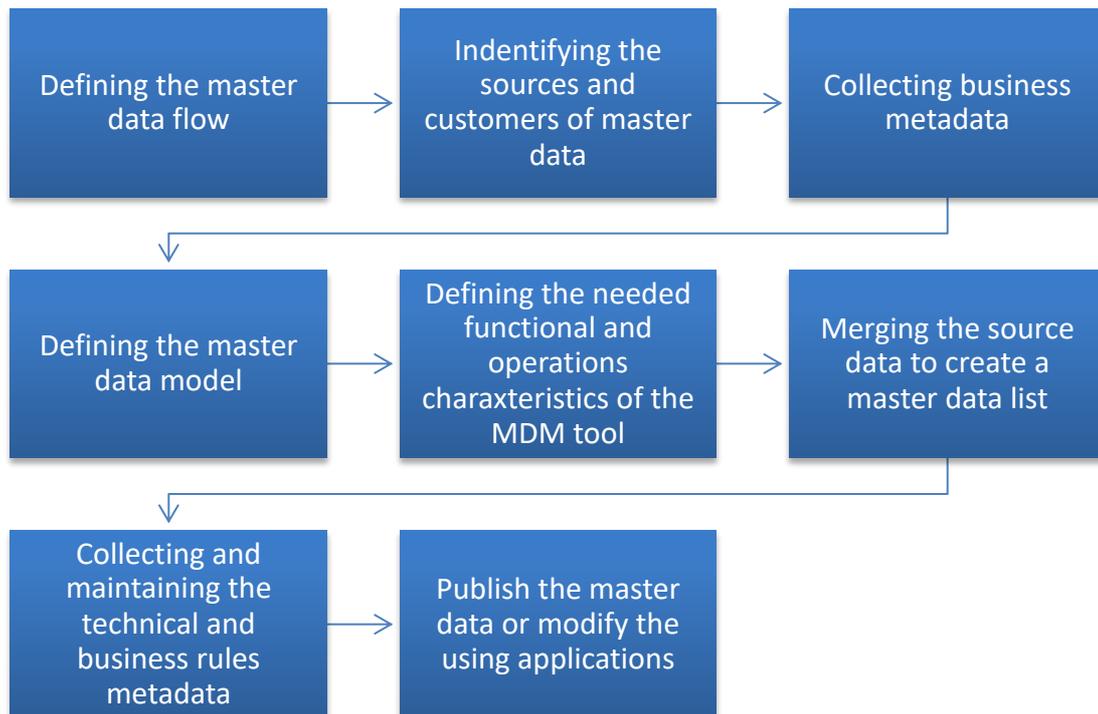


Figure 5 Steps for successful MDM process (adapted from Silvola et al. 2010)

Figure 5 is introducing the steps for successful MDM process. A successful MDM solution requires a list of data structures throughout the company. It also requires methods for identifying candidate data to be integrated into main data. Other factors are solving definitions, usage scenarios and intentions and meanings for these entities and ability to smoothly facilitate standardized data transfer, sharing and delivery. A quality-controlled migration process combined with data retention rules confirms the “best information” of the main data asset has an impact on having a successful MDM solution. The last two factors are an approach to openly providing services to corporate customers and managing the resources of the main data and a management framework for managing the continuous integrations of business information environment. (Silvola et al. 2010)

3.4 Benefits and challenges

Benefits of MDM are related mostly to data warehousing and related data management practices. Benefits are commonly such as improvements in data quality, accurate reporting, better decision making and easier auditing of information’s origins. Advantages related to

general data management issues are for instance data quality, consistent definitions and data governance. Not so commonly, benefits are general business issues like risk reduction, superior customer service and supply chain optimization. (Russom 2006)

In the study of Silvola et al. (2010) the results of the challenges of data was that companies have the data in different formats and it is difficult to define the actual master data. The amount of data is growing all the time in organizations which causes challenges in storing the data. Companies had also different data masters so the definition process is long. The data quality control demands a lot of time. As a result, the amount of data is still growing and different sizes of organizations need to take control of the data and create a master data management process. The master data management is easier to start when the organization is growing and not when the amount of data is enormous.

People usually think that MDM is only technical and belongs to the IT side because the implementing requires developed technology. Actually, the MDM belongs to the business side as well. The business workers have the knowledge of the processes, vocabulary, data hierarchies and rules. This is why the IT and the business employees need to have good cooperation. IT employees are focusing on the implementing task and the business is sharing the knowledge of the standardized master data. (Deloitte Development LLC 2007)

One challenge of implementing MDM is the need for change in management. The organization's master data is continually changing because the way of doing business is changing all the time. As a result, there will always be only the master data that is accurate at a certain time, which also has an impact on the reports. So, the challenge is to have a timely and accurate synchronization between varied systems, because the systems can have different ways to express the same information. The differences cause troubles to keep master data updated with changes. These are the reasons why the organizations have to manage the master data well and spread the changes. (Deloitte Development LLC 2007)

4 CASE MANUFACTURING COMPANY

4.1 Implementation

The case company is a manufacturing company in the forest industry. The company's sales in 2018 was over 5 billion euros. It is located in 30 different countries and the number of employees is over 10 thousand people. The manufacturing company wanted to implement robotic process automation to customer master data process. The RPA was supposed to be used to maintain data in every SAP system and automatically trigger data synchronization to financial shared platform (FSP). FSP is company's internal platform for financial processes. System architecture turned out to be more complex than expected by consultants. Due to increasing cost and implementation time, the project was closed for the time being. As the company is planning a bigger system architecture change, there is a big chance that the project will be picked up in the future again, as the topic of RPA in master data is still seen as very important by the company. Master Data Manager also thinks that RPA could be used to reporting, analysis and periodic quality checks.

The project was cancelled and one of the reasons was the high price for the project. The company's various SAPs have different input lines which made the automation harder. The company is thinking about implementing the RPA to the customer master data management later when the master data is more synchronized and the amount of various systems is smaller. The Master Data Process Manager has worked in the company for seven years and has worked with master data for eleven years.

According to the Master Data Process Manager (2019) the company has automated some tasks in master data processes. For example, the SAP mass change component is in use and many Excel macros are in use. There is also another SAP component that is used for different reports but not changes. The company wanted to have RPA for the customer master data changes.

The set up was recommended by a consulting company, to use RPA instead of building integrations between different systems.

During the project of implementing RPA, according to Master Data Process Manager, it was important that the process and the errors were monitored. The manager highlighted that the monitoring is very important so that it is possible to know what errors are happening and why. During the planning of the project, the importance of the IT side knowledge came out. Every system and data have exceptions and there has to be people to have the understanding of them and to be able to explain them. The Manager also mentioned that it is good to have a backup team to cover the tasks if the RPA suddenly stops working or is not working.

4.2 Benefits and challenges

It would be good to have the customer master data automated but, for instance, material and other information where data amount is higher, would be even better. The bigger the amount of data is, the more valuable it would be to have it automated with RPA. Similarly, the more manual work you have to do to make the changes, the better it would be if it was automated. The systems need to be also simple so that it is possible to build a robot between them. (Master Data Process Manager 2019)

According to the Master Data Process Manager (2019) the quality has different perspectives. The first is that the RPA may not offer good quality because it is really important what one inputs to the RPA and what it is outputting. There has to be a way to have the knowledge of what happened in the RPA and what the error could be. When the RPA is doing the task, it is good to monitor the input or RPA. The other point of view is that the quality is better when there is, for example, 300 the same manual repeating tasks to be done. In that case, the RPA would perform it with better quality than an employee.

The Master Data Manager thought about the benefit of time of RPA. She has some doubts about the time reduction because it takes so much time to have it implemented. The advantage of the time reduction appears in the long run after implementing RPA. The implementing of RPA itself is expensive and the benefits are only visible after a while.

5 CONCLUSION

This research was about how the robotic process automation can be useful in master data management. Figure 6 is introducing what should be done before implementing RPA to master data process, where RPA could be implemented and what are the benefits afterwards.

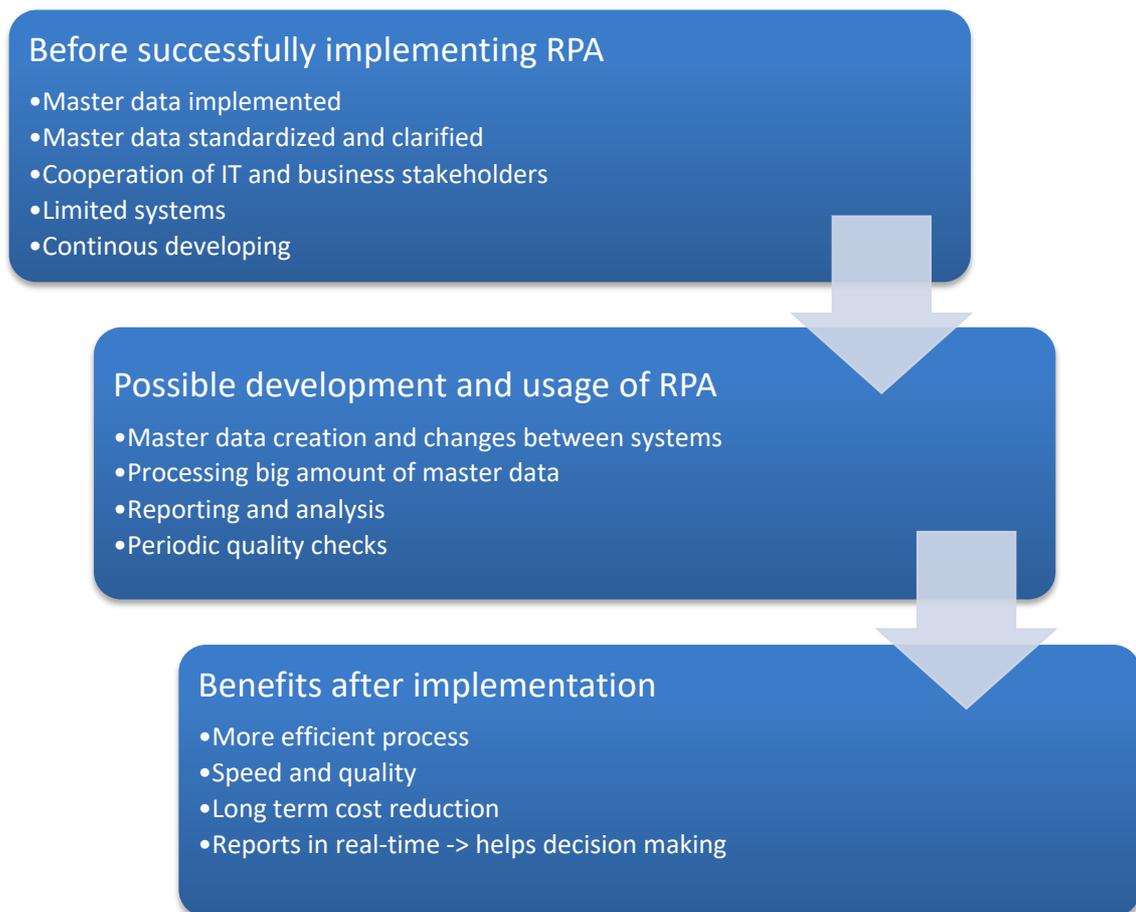


Figure 6 RPA implementation to master data management processes

Robotic process automation is a software tool that every organization should have in consideration to implement to repetitive, manual and simple processes. For example, for simple repeated tasks where the input is taken from a system and then it is output to another system. This simple task can take much more time by human than by robot. Especially in financial filed in organizations there are many processes that are repetitive and can be automated by RPA. The RPA offers a possibility to reduce costs and it is much faster to do tasks than human. The RPA is making organization process more efficient as well. The benefits of the RPA are not usually

seen right away after the implementation, but after a longer period of time. The implementation is expensive when the it is done but the lead time of the task decreases and the efficiency increases a little later. The case company recognized that the implementation of RPA is expensive at this stage but that it will reduce costs in the long run.

Master data management is part of all of the organizations even though they do not realize it. There is always master data on some level in every organization. When the organizations are taking the master data under control, that is when the master data starts to be standardized and managed. The organizations need master data management because it makes it easier to analyze the organizations situation and to make reports to support the decision making. The changes in MDM can be a challenge because the changes are not in real-time and then also the reports are not in the real-time. The RPA is able to help MDM to manage the information changes on time because the RPA is faster than a human in doing repeatable changes. As a result, the reports will be in the real-time and then the decisions can be made more easily and based on the real-time information.

In master data management there are many repetitive tasks, for instance when the changes and creations are done. The changes require taking the information from another system and putting it to the other. That could be automated with RPA because it is simple but it requires the data to be harmonized and the task to always be the same. The possibilities for implementing RPA in master data management are also reporting, analysis and periodic quality checks. Case company is also considering implementing RPA to many different processes in master data management. The case company is considering RPA implementation in reporting, analysis and periodic quality checks. These processes are mostly manual tasks that can be automated using RPA.

The benefits of speed for the case company when it comes to implementing RPA in master data processing is visible especially in big amount of data that needs to be processed or changed. Then there is also the benefit of a more efficient process. The reduction of time would be noticeable much later because the process of implementing can take a lot of time. The benefits of MDM is that the information is available all across the organization and the quality of the information and reports are higher.

The master data has to be well-organized and standardized so that the changes are possible to be automated with RPA. Often the master data is already very standardized because needs to be manageable. This is why the master data processes can be automated with RPA. RPA is a good tool to automate, for example, the master data changing process. Before implementing master data management, the data should be collected and centralized. The case company noticed the high importance of standardization of master data before RPA implementation.

The master data management needs to be implemented well before adopting RPA. Before implementing RPA to master data there is a lot of preparation that needs to be done. The most important is to have good work cooperation between the IT responsible and business units. It is also important to have an employee who handles the both sides so that the employee can “translate” the business unit’s requirement to the IT “language” and other way round. The importance of the corporation was visible in the case company’s project. The work between IT and business should be developed and also last during the whole project. The importance of the cooperation was visible during the case company’s project and they managed to build a successful collaboration between IT and business stakeholders .

The case company noticed that the master data process needs to be clarified at a really detailed level so that it can be automated. The case company has the master data management already well-standardized so the RPA is possible to be implemented. There are still different systems with different architectures and this is was making the RPA implementation harder. The case company made the decision to implement the RPA to customer master data when the architecture of systems is simpler. This decision is good because then the RPA is easier to implement and the company will get more value out of it. The RPA requires that all the data in the systems that the robot is using are standardized, otherwise there will be system errors. When the case company will have standardized all the systems better, the data will be more harmonized.

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Appendix 1. Master Data Process Manager interview questions

1. How much have you automated processes in master data?
2. What is the target with RPA in customer master data?
 - How do you think you will achieve it?
3. What is the motivation for RPA?
4. How should the implementing be done?
 - What should be noticed during implementing?
 - What about employees training situation?
5. What values and benefits do you expect?
 - For example: cost reduction, 24/7 running, better quality and less mistakes?
 - What is the most expected benefit?
6. What may be a challenge when implementing RPA in customer master data?
 - How does it affect the implementation or even master data processing?
7. What are the business benefits from RPA?
 - How can they be measured?