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MASTER'S THESIS

IMPLEMENTATION OF ROBOTIC PROCESS AUTOMATION IN A RETAIL COMPANY

Ljubljana, July 2021 FRANZISKA KAISER

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LIST OF ABBREVIATIONS

AD	-	Active Directory
AI	-	Artificial Intelligence
API	-	Application Programming Interface
BPA	-	Business Process Automation
BPM	-	Business Process Management
BPMN 2.0	-	Business Process Management Notation 2.0
BPMS	-	Business Process Management Systems
CSF	-	Critical Success Factors
ERP	-	Enterprise Resource Planning
GUI	-	Graphical User Interface
HR	-	Human Resources
iBPMS	-	Intelligent Business Process Management Suites
IPA	-	Intelligent Process Automation
IT	-	Information Technology
KO Criterion	-	Knock Out Criterion
ML	-	Machine Learning
MS	-	Microsoft
NLP	-	Natural Language Processing
OCR	-	Optical Character Recognition

RDA	-	Robotic Desktop Automation
ROI	-	Return on Investment
RPA	-	Robotic Process Automation
SPA	-	Smart Process Automation
UI	-	User Interface

INTRODUCTION

Every company has business processes that need to be done regularly. Depending on the process, the activities within can be complex or rather simple and repetitive. Especially for those simple, structured, non-critical processes human intervention is not necessarily needed (Power, van Nueten, Chandler & Fulton, 2017). Extracting data from an Enterprise Resource Planning (hereinafter: ERP) system, export it to Excel, and process the data to create a comprehensive weekly or daily report is just one common example most companies are familiar with. Depending on the company a lot more examples of similar activities or subprocesses can be found. Since continuous improvement is crucial for companies to stay competitive, it is a major challenge to always think of ways on how to improve the business processes (Vanwersch et al., 2016). New technologies emerging due to digitalization offer support to exploit given improvement potentials.

One improvement idea is the introduction of Robotic Process Automation (hereinafter: RPA). RPA is an umbrella term for software tools to automate repetitive and simple processes by programming bots to act in a way just as humans would do (Gartner, n.d.). RPA's goal is to picture tasks initially done by humans 1:1 by bots. Instead of employees manually writing data entries in e.g., ERP systems the bots are programmed to do so. Through the usage of surface automation, RPA can be implemented without major changes to any application systems used by the company. Furthermore, RPA can lead to a decreased number of mistakes made by humans, higher process throughput, and consequently increased efficiency (Santos, Pereira & Vasconcelos, 2020).

The importance of the technology can be underlined by considering Gartner reporting that current spending by companies on RPA software were above $1.5 billion in 2020 and are predicted to expand to $2.9 billion in 2021 (Rauch, 2020). Also, the company Deloitte estimated that RPA will hit almost universal adoption in companies by 2023 (Casey, 2020). Furthermore, the pandemic caused the RPA demand to spike since companies were forced to work with less staff, cut employee hours and provide home office possibilities (Rauch, 2020).

Even though process automation is often perceived as a game-changer, RPA also has some drawbacks. One problem is that in practice RPA is used to automate inefficient processes by "patching" non-existent Application Programming Interfaces (hereinafter: API) through the usage of surface automation (Koch & Fedtke, 2020). If the risks of automation for the targeted processes are not evaluated in advance, the impact on the company can be tremendous (Power et al., 2017). Therefore, it is important to understand how to choose suiting processes for RPA (Santos et al., 2020).

Given the relative newness of the field, the factors that influence the success of RPA projects are not well identified yet. Any company which aims to implement RPA needs to be aware

of general critical success factors (hereinafter: CSF). CSF are the most important key areas which need to be considered to reach the goal of a successful implementation of a project (Bullen & Rockart, 1981) like introducing RPA. The success of fields related to Business Process Management (hereinafter: BPM) can be achieved if the pre-defined short and long-term oriented goals are continuously met (Trkman, 2010).

The purpose of the thesis is to contribute to understanding the relevance, potentials, and benefits of introducing RPA. First, the goal of the thesis is to analyze the possibilities and outcome of RPA by implementing a non-attended automation for two defined Logistics processes in a retail company. Second, the thesis aims to provide a frame of how to find suiting RPA use cases and to create an evaluation about the limitations of RPA for the specific use cases in the studied company. Third, the goal is to create a collaboration concept between RPA developers and users for upcoming RPA use cases. The thesis aims to answer the following research questions:

- Research question 1: "How can RPA be introduced in a department?"
- Research question 2: "Which are the factors that increase the likelihood that seamless interaction between RPA bots and people can be achieved?"
- Research question 3: "How can RPA bots be controlled to avoid security, compliance, and economic risks?".

The thesis is written in collaboration with a subsidiary of a retail company. For confidentiality reasons, the name of the company is not mentioned. For data collection, I use primary as well as secondary data. For the first part of the thesis, I conduct a detailed literature review including related books, recent research papers, and case studies. For the second part of the thesis, I conduct semi-structured interviews with Logistics process owners in the selected company to gather insights about the processes. I record videos of the manual process execution as a basis for the programming and as a backup for eventual problems with the bots. Furthermore, I consult internal process documentation like e.g., click-instructions in a Microsoft (hereinafter: MS) Word file. Next, I create process models of both processes and the collaboration concept using Business Process Management Notation (hereinafter: BPMN 2.0). For the programming with RPA, I use different online sources.

The first chapter of the thesis defines relevant aspects of BPM. The second chapter focuses on the main topic RPA. The third chapter is about the theory related to project management in BPM. Those three chapters form the theoretical foundation of the thesis. The fourth chapter consists out of a case study. In this chapter, the theory will be applied in practice by the usage of primary data from a Logistics department of the selected company. The fifth chapter includes a discussion with the answers to all research questions and the different opinions from employees in the company about RPA. These insights will form the basis for the evaluation of how successful the introduction of RPA in the given case was. The last chapter summarizes the findings, states the research limitations, and gives an outlook for future research.

1 BUSINESS PROCESS MANAGEMENT

Before defining how to automate processes, it is first necessary to define what a process in general, as well as what BPM is. Therefore, this introductory chapter aims to provide a definition of business processes and BPM. Furthermore, the process management lifecycle, as well as process automation, is explained. Finally, critical success factors for successful business process management in companies are provided.

1.1 Definitions

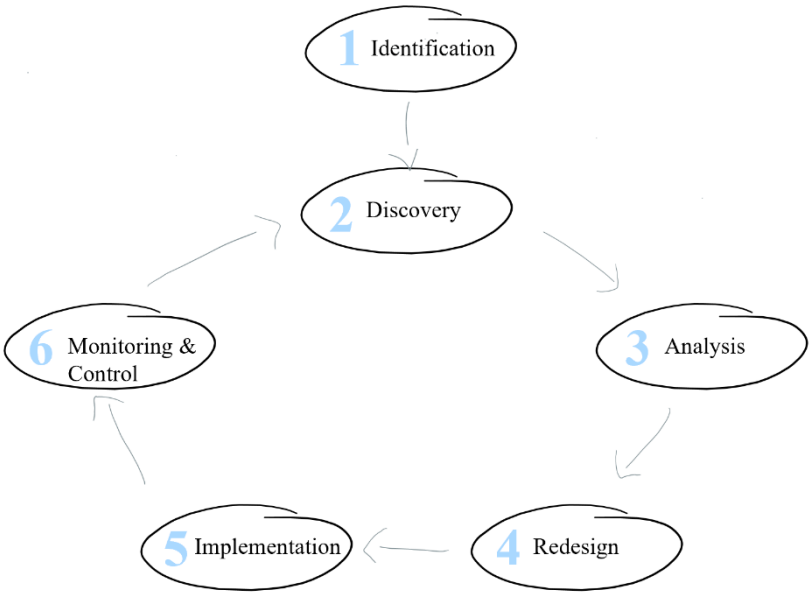
Business processes are a set of coordinated activities which take place in a defined order, have a start and endpoint, and aim to create value for the customers or support another strategic goal of an organization (vom Brocke & Rosemann, 2010). They are a core asset of organizations and have a direct impact on the attractiveness of their products or services (Dumas, La Rosa, Mendling & Reijers, 2013). Business processes can be divided into sub-processes. They represent procedures that integrate e.g., systems and data but also require resources such as time and money. Business processes can be triggered internally as well as by external events (Flechsig, Lohmer & Lasch, 2019).

BPM is a holistic management concept that supports the alignment of processes with the overall business strategy (Flechsig et al., 2019). BPM focuses on providing an overview of how work is performed to ensure consistently positive results and to take advantage of improvement opportunities (Dumas et al., 2013). BPM in the context of organizations can be defined as the efforts of continuously improving activities in each department such as e.g., Logistics, marketing, or human resources (hereinafter: HR) (Trkman, 2010). Aspects of BPM are the analysis, documentation, design, optimization, implementation, and measurement of automated and non-automated business processes (Langmann & Turi, 2020). Advantages of BPM are cost reductions, improvement of process quality, increased organizational flexibility, as well as increased customer and employee satisfaction (Flechsig et al., 2019). Furthermore, different researches found a positive correlation between process management and business success, which underlines the importance of the field (McCormack & Johnson, 2001).

1.2 Business Process Management Lifecycle

The BPM lifecycle is often used in BPM to structure and manage business processes in an organization (Bergener, Räckers & Stein, 2019). It also supports understanding the role which technology plays within BPM (Dumas et al., 2013). Since RPA is a new technology, the definition of the BPM lifecycle is important for this thesis. The BPM lifecycle consists out of different stages which names vary depending on the source. For this thesis the following stage declarations are used as shown in Figure 1: Process identification, discovery, analysis, redesign, implementation, monitoring, and control (Flechsig et al., 2019).

Figure 1: BPM Lifecycle



Source: Adapted from Dumas et al., 2013.

In the process identification phase, a business problem is presented, and processes that are related to this problem are identified. The result of the phase is a new or updated process architecture. The architecture includes an overview of the processes and their interrelations (Dumas et al., 2013). The process discovery phase is also called AS-IS modeling. It includes the consideration of any relevant process documentation. The AS-IS model helps to understand the order of activities and decisions. Also, the responsibilities of employees within the process are clarified. The process analysis phase aims to find improvement potentials and weaknesses within the process. The outcome of the analysis phase is a structured collection of all issues which can also be prioritized based on their impact or estimated effort (Dumas et al., 2013). The following stage is called the process redesign phase. Once, the process is understood in detail including all possible exceptions, it can be improved or even redesigned (Flechsig et al., 2019). Possible improvement measures are the following (Langmann & Turi, 2020):

- Eliminating unnecessary process activities,
- parallelizing process activities,
- changing the order of process activities,
- accelerating process activities,
- eliminating loops,
- adding activities that could potentially reduce loops like e.g., quality checks and
- consolidating process activities.

The goal of the redesign phase is to find the suiting change measures. The outcome of the redesign phase should be a TO-BE model (Dumas et al., 2013). The implementation phase

puts the redesign measures into practice. It covers organizational change management but depending on the use case, also process automation may be involved. The implementation stage often requires training for the personnel to assure that the changes are understood and adopted successfully. Depending on the changes, this means e.g., explaining new systems to the employees. Finally, the process needs to be monitored and controlled in the last stage following the prepared and implemented process descriptions. Corrective actions for dealing with identified bottlenecks, recurrent errors, or deviations may be taken within this phase (Dumas et al., 2013). New technologies such as process mining, machine learning (hereinafter: ML), and also RPA help within these stage (Flechsig et al., 2019).

1.3 Process Automation

Establishing an information technology (hereinafter: IT)-enabled process orientation supports companies to address e.g., technological changes or changing customer needs efficiently (Lederer, Knapp & Schott, 2017). Converging BPM and digital innovations is important for companies as different authors state (Mendling, Pentland & Recker, 2020). One option to do this is process automation. Since process automation is the key topic of the thesis, this sub-chapter provides relevant definitions.

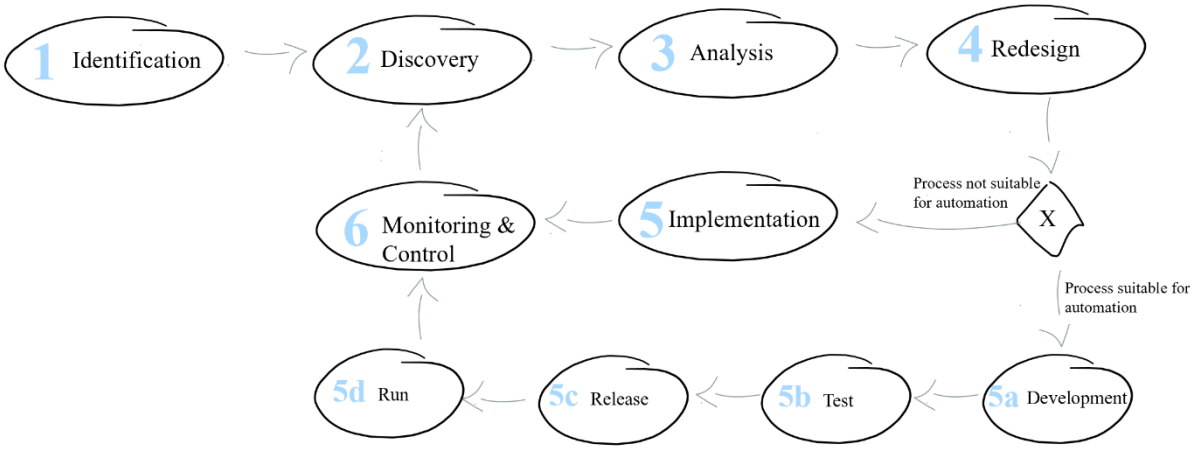
"*Process automation is defined as the level of human interaction with equipment and technology during the value-creation process. In general, the goals of automation are to minimize total system cost by reducing labor cost and to improve process stability and system reliability*" (Wang, Mileski & Zeng, 2019, p. 547).

The purpose of automating processes is the optimization and more specifically the improvement and the simplification of the process execution (Lexa, 2021). Process automation can have a positive impact on the process flow and the product or service variety. Also, the process speed may increase compared to manual process execution by humans (Lexa, 2021). The prerequisite for successful process automation is a high degree of standardization within the process (Heukrath, 2010). Also, changes like eliminating unnecessary process activities should be implemented before considering process automation (Smeets, Erhard & Kaußler, 2019).

In general, it is not necessary to automate entire processes. Another option is to automate a part of the process, or only a single activity within a process (Dumas et al., 2013). It is also possible to automate processes with different characteristics meaning complex, simple, repetitive, or processes that take place one-time-only (Dumas et al., 2013).

The literature provides an adjusted BPM lifecycle, when adding process automation such as RPA. Due to the limited size of the thesis, this chapter thematizes process automation using software only. Physical robots which may help to automate e.g., processes on the production line are not considered. An example of the adjusted BPM lifecycle can be found in Figure 2.

Figure 2: BPM Lifecycle including Process Automation



Source: Adapted from Flechsig et al., 2019.

As shown in Figure 2 the decision to use process automation causes the necessity to consider additional phases in the BPM lifecycle. The additional phases are the development, test, release, and run phase. The development phase targets the programming of the process automation with a suiting tool. Once, the process automation is developed, it needs to be tested. After successful testing, the process needs to be released. Next, the process can run either on the computer of an employee or on a virtual machine (Flechsig et al., 2019). After these four additional steps, the traditional lifecycle continues with the monitoring and control phase.

Automating processes in organizations is not a new practice and has been done for decades by e.g. using business process management systems (hereinafter: BPMS) (Langmann & Turi, 2020). BPMS serve two different purposes. On one hand, the BPMS enable a precise definition and documentation of processes to analyze, model, and simulate the targeted processes (vom Brocke & Rosemann, 2010). On the other hand, BPMS can use program codes that enable the automated execution of processes (Flechsig et al., 2019). Depending on the BPMS vendor the features vary: some systems offer the design and automation of business processes only, whereas other systems also integrate process intelligence like process mining (Dumas et al., 2013). Process mining aims to visualize business processes to be able to analyze the processes and find improvement potentials. The basis for using process mining is data that already exists in the company and data which is generated through the process execution (Koch & Fedtke, 2020). The prerequisite before being able to run processes with BPMS is to provide a format with which the BPMS can execute the process. The main goal of BPMS is to coordinate an automated business process so that all work can be done at the right time by the right resource (Dumas et al., 2013). Consequently, the goal of BPMS and RPA are the same. However, the usage of BPMS requires the integration of different backend systems, usually with APIs (Allweyer, 2016). The implementation of APIs causes high configuration efforts and consequently high costs. Therefore, one disadvantage

of using BPMS are the high related IT costs. The next chapter provides details about why the new approach of RPA does not require any APIs and is less costly.

Intelligent business process management suites (hereinafter: iBPMS) are an upgrade of traditional BPMS. The conventional BPMS cannot manage uncertain, non-rule-based situations where human intelligence is needed. By adding components like integration with social media, streaming analytics, real-time decision management, or complex event-processing the drawback of BPMS is tackled (Gartner, n.d., Wasilewski, 2016). An iBPMS is a low- to no-code application development platform which enables dynamically changing procedures and models (Szelągowski & Lupeikiene, 2020).

1.4 Critical Success Factors

To evaluate whether the BPM in a company is successful, it is first necessary to define what success in this context means: BPM can be called successful, whenever it continuously meets the predefined goals of a company in the short and the long run (Trkman, 2010). The definition of CSF can help to achieve the goals. CSF are defined as a limited number of areas that assure a satisfactory performance if they are met (Trkman, 2010). CSF are usually case-specific since they depend on the goals of a company.

One crucial factor which needs to be mentioned considering CSF is the success of IT investments. IT is the enabler and the facilitator of changes related to BPM projects (Attaran, 2004). Since this thesis is focusing on the introduction of a new technology, the IT investments related to the introduction of RPA play a major role.

According to the task-technology fit theory, IT has the best impact on the performance of an individual or a company whenever the capabilities of IT match what the user does (Goodhue & Thompson, 1995). This is the case when using RPA. Consequently, IT impacts organizational performance positively if it matches the business processes. The importance of choosing the right IT investments creates the need to implement an IT strategy that is aligned with the overall business strategy. It does not create a competitive advantage to introduce new technologies in a company if the processes themselves do not create value for the customer. Related to the task-technology fit theory the CSF are process standardization, process informatization, automation, and training of employees (Trkman, 2010). Standardizing processes is important to create a basis for technological solutions as a support for the process execution (Koch & Fedtke, 2020). Informatization considers that a cost-benefit analysis measures the economic viability of informatization. Consequently, top management commitment and financial support can be achieved. IT can also help to ease the communication with the customer by e.g., automatically sending electronic bills to the customer. Automation is closely linked to informatization (Trkman, 2010). In this context, IT can help to replace routine tasks initially done by the employee with new technologies such as RPA (Koch & Fedtke, 2020). CSF automation plays the biggest role throughout this

thesis. Training and empowerment of employees on executing the processes as desired are highly important whenever processes are changes or new technologies are introduced.

Furthermore, the strategy of a company including its specific needs must be aligned with BPM. The contingency theory states in this context that there is not only one single way to define the organizational structure (Fiedler, 1978). It is rather advisable to align the organizational strategy with the competitive environment the company operates in. Related CSFs with the contingency theory are e.g., performance measurement, strategic alignment, and level of employee specialization. Performance measurement emphasizes tracking the time, productivity, cost, and value of each process, which is important for new processes, as well as when an existing process is reengineered. Strategic alignment considers the importance of matching BPM with the organizational strategy to maximize the value from process improvement (Hung, 2006). The level of employee specialization tackles the decision of whether employees should rather be experts in their field to maximize efficiency and the quality of their results, if they should rather be generalists which adds flexibility or if a mix of both is needed (Trkman, 2010).

Another important theory in the context of CSF in BPM is dynamic capabilities. Dynamic capabilities refer to a company's ability to build, integrate, and reconfigure internal and external competencies (Teece, Pisano & Shuen, 1997). Dynamic capabilities are needed to be innovative as a company and to achieve a competitive advantage and consequently a favorable market position (Teece, 2018). In this context, it is highly important to consider BPM on a long-term oriented basis and always strive for continuous improvement to achieve a sustainable competitive advantage from BPM. CSF that are related to dynamic capabilities are organizational changes, the appointment of process owners, implementation of proposed changes, and the use of a continuous improvement system (Trkman, 2010). Organizational changes are often necessary when BPM is initially introduced in a company. The focus shifts towards a customer-centric organization resulting in breaking silos and horizontal end-to-end customer processes. By appointing process owners, the company has a responsible person for each process who designs, reviews, and measures the process and its performance. The process owner also trains the employees on the execution of the process. The implementation of the proposed changes has a direct impact on the success of BPM in the company. Within this context, it must be ensured that employees understand the changes and work according to them. A joint effort between the employees and the management is needed. Using a continuous improvement system helps to always question the status quo and strive for development to stay competitive which is the main focus of dynamic capabilities (Trkman, 2010).

2 ROBOTIC PROCESS AUTOMATION

Robotic process automation is one possibility to automate processes and the main topic of the thesis. This chapter provides the theoretical foundation of RPA including definitions and

necessary prerequisites before RPA can be implemented in a company. Also, the term enterprise architecture and the interrelation with RPA are explained. Finally, potential benefits, limitations, and new developments regarding the technology are introduced.

2.1 Definition

A suiting definition of RPA from my point of view, by using only one sentence is: RPA provides the possibility to automate digital process activities by using a licensed software tool (Koch & Fedtke, 2020).

To differentiate between a physical robot in e.g., a production hall it needs to be mentioned upfront that RPA is used for software automation only. The parent term of RPA is business process automation (hereinafter: BPA). BPA includes besides RPA also automation with e.g. unstructured databases, chatbots and, artificial intelligence (hereinafter: AI) (Koch & Fedtke, 2020). RPA can be seen as a virtual assistant which imitates a predefined digital activity choreography just as an employee would do (Hofmann, Samp & Urbach, 2020). RPA is a technology that uses orchestrated user interface (hereinafter: UI) interactions and can consequently be described as surface automation (Ray, Villa, Tornbohm, Rashid & Alexander, 2020). This means the user who runs the bot attended on his computer can also watch the bot e.g., using the mouse on the desktop to perform transactions.

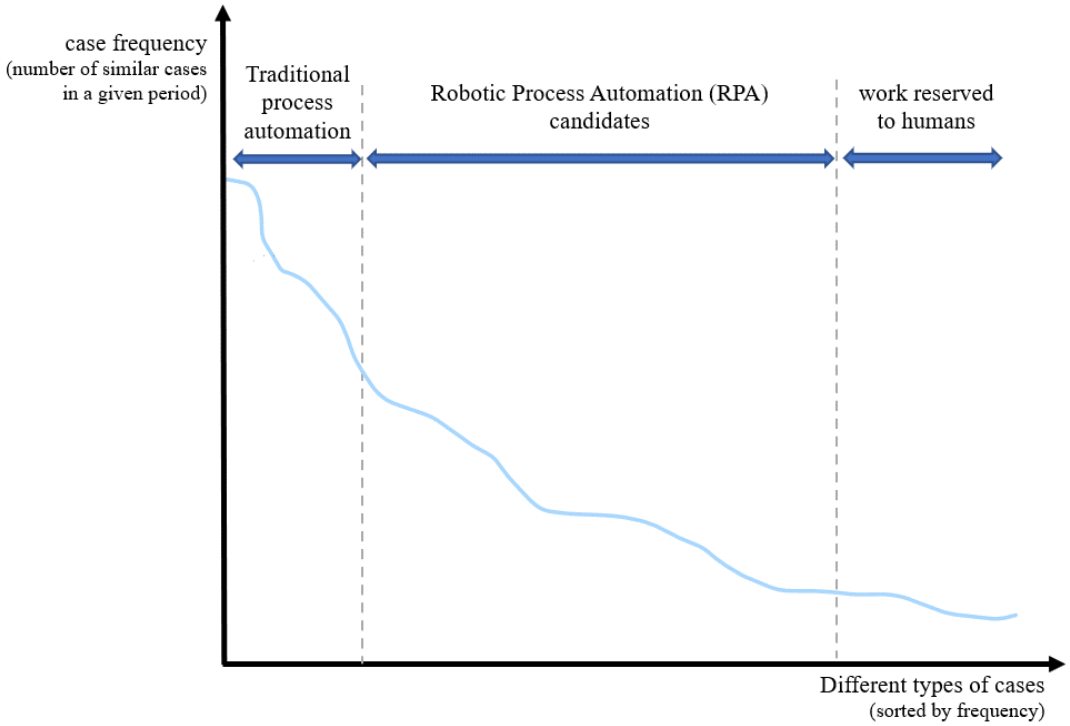
The biggest application fields of RPA are currently seen in industries like Finance, banking, insurance, healthcare, and auditing (Eikebrokk & Olsen, 2020). Nevertheless, most companies no matter to which industry they belong to have repetitive and rule-based processes where systems like office-suites, email programs, or ERP solutions are used. If a process in a company e.g., needs to be done daily and looks as follows:

1. Log into the ERP system and run a defined transaction to receive a certain data set,
2. export the data table to an Excel file,
3. send the Excel file via email to an email distribution list.

The bot executes the steps one after another just as an employee does but without being exhausted from doing the same each day. Other benefits associated with RPA are cost reductions, increased flexibility, speed, and more efficient resource utilization, as well as improved service capabilities and quality (Eikebrokk & Olsen, 2020). Also, Gartner defines RPA as a non-invasive technology (Ray et al., 2020). This refers to the fact, that RPA can be used in a company without any need to adjust IT systems since it can overcome interfaces. Especially overcoming interfaces of different systems is a major challenge for companies since it is usually cost-intensive. Consequently, one advantage of RPA compared to the previously described BPMS are the lower IT costs (Allweyer, 2016). Therefore, RPA potentially generates savings since it is a comparably low-cost technology with the potential to accelerate process efficiency. The relevance of RPA is also justifiable by considering the Pareto distribution. Therefore, Figure 3 illustrates different types of cases on the x-axis

sorted by their frequency and the case frequency on the y-axis showing the number of similar cases in a given period. The Pareto distribution says that 80% of all cases can be explained by 20% of the different case types. Consequently, many case types are comparably rare. When planning to automate cases or processes, it is logical to automate the most frequent cases. The less frequent case types are typically not automated with traditional process automation since it would bring high costs. Therefore, humans need to execute the remaining cases manually. However, these cases may still consume a lot of working time from employees. RPA provides a solution whenever cases do not happen often enough to be automated with traditional process automation (van der Aalst, Bichler & Heinzl, 2018).

Figure 3: Relevance of RPA



Source: Adapted from van der Aalst et al., 2018.

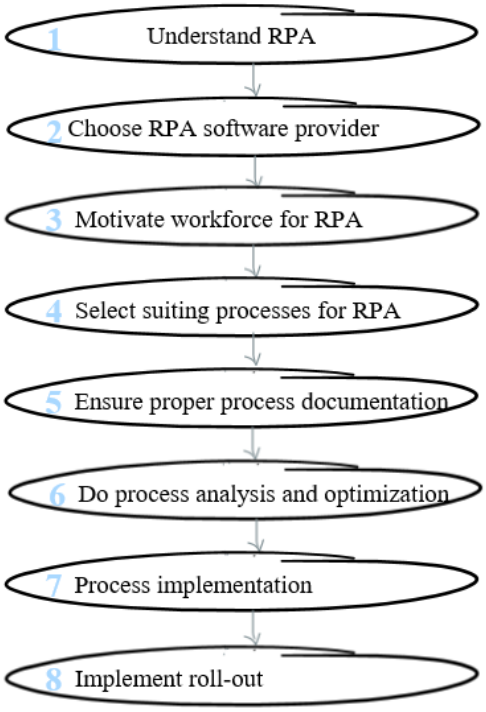
The current savings generated through RPA can be up to 20% according to recent research (Koch & Fedtke, 2020). Nevertheless, it is important to always weigh up the potential future savings against the development costs (Koch & Fedtke, 2020).

2.2 Robotic Process Automation Roadmap

As with the introduction of any new technology in a company, it is necessary to consider different steps. These steps can be summarized in an RPA roadmap. The roadmap is necessary to understand the scope of introducing the technology in a company. While the programming of bots using an RPA software provider is relatively simple, - creating a

companywide concept for RPA is more demanding and is crucial for a successful introduction of the technology (Koch & Fedtke, 2020). Figure 4 represents an overview of relevant steps when planning to introduce RPA in a company. Depending on the case, the order of steps may differ, or some steps need to be repeated several times.

Figure 4: RPA Roadmap



Source: Adapted from Koch & Fedtke, 2020.

To be able to successfully assess the potential for the use of RPA in practice, it is essential to first shed some light on the misconceptions surrounding software robotics (Kleehaupt-Roither & Unger, 2018). Consequently, the first step is to understand the technology of RPA. If a company decides to establish an RPA team, the team members should take time to research process-related success factors when using RPA to evaluate potential use cases. The process-related success factors target the characteristics, that the process should have so that the process can be considered as suited for the usage of RPA.

First of all, the process itself should rather be a support process than a core process in the company (Langmann & Turi, 2020). Another "must" criterion is digitally readable data. If the data which needs to be used in the process is coming from e.g., an email attachment, it needs to be ensured, that the data is readable for the bot, meaning that it is not handwritten and not in a picture format. Otherwise, the bot is currently not able to process the data further. Also, structured and uniformly prepared data is needed. If the bot needs to process e.g. dates, it is highly important to define the format of the date, differentiating between e.g.

dd.mm.yyyy format and mm/dd/yyyy. Finally, the activities within the process must be rule-based. The bot needs rules on when to follow which process flow. If a process has e.g. many exceptions or needs human intervention, it is for now not suitable for RPA (Koch & Fedtke, 2020).

Furthermore, some process-related criteria are beneficial when using RPA. The technology is suitable for repetitive tasks which require lots of work time of the employees. Typical use cases for activities that can be implemented with RPA are opening emails and attachments, logging into web or company internal applications, moving data from one folder to another, copying and pasting data, filling documents, reading and filling databases, connecting with API systems, calculating, extracting structured data from documents, merging statistics and generally following "Do while" or "if/else" logic.

Also, RPA suits stable processes which are well established in the company and will not change soon. It is ideal for processes with a low complexity meaning the process includes simple rule-based activities with only a few exceptions, processes using different applications like SAP, Excel, and email (Koch & Fedtke, 2020), and processes with complicated mathematical calculations which are difficult to do for humans, but easy to do for bots. There is a difference between a complex process due to activities that need human intervention because they are not rule-based and simple process activities but complex mathematical calculations. Mathematical calculations are not a problem for bots and therefore a good use case for RPA (Langmann & Turi, 2020). Depending on the company and the process, any of the criteria mentioned above can be seen as more or less relevant when choosing suiting processes. Therefore, it can help to establish a scoring system in the company which defines the importance of each criterion. Once the scoring system is done, the person responsible for choosing processes uses the scoring model to evaluate the suitability of the process for RPA (Langmann & Turi, 2020).

After establishing a general understanding of the technology, a suiting RPA software provider needs to be selected. The selection of an RPA provider the second step in the RPA roadmap. One approach to identifying the most relevant players on the RPA market is to use the magic quadrants published yearly by Gartner. The magic quadrant can help companies with choosing a suiting RPA software provider. The magic quadrant differentiates between challengers, leaders, visionaries, and niche players (Gartner, 2020). The minimum requirements each provider should fulfill are a solution to build automation scripts with low-code capabilities, the integration with enterprise applications, and the possibility to orchestrate and administer the bots (Ray et al., 2020). However, depending on the budget of the company for RPA, the number of potential use cases, the required support of the provider, etc. the choice of the provider will differ since each provider has its strengths and weaknesses.

Figure 5 illustrates the magic quadrant from 2020 to provide an overview of software provider market.

Figure 5: Magic Quadrant for Robotic Process Automation

Source: Gartner, 2020.

The most popular vendors are Automation Anywhere, UiPath, and BluePrism (Zhang, 2019). Automation Anywhere's main strength is the strong innovation profile and competitive pricing, but the company struggles currently with customer service resulting in lower customer satisfaction. UiPath on the other hand is strong regarding its customer support and helping to build and scale-up RPA programs. BluePrism has a strong product portfolio which is useful when planning to integrate ML or natural language processing (hereinafter: NLP) but is less intuitive in usage compared to the competitors (Ray et al., 2020).

Next, it is important to motivate the employees for the topic of RPA. This is important since it may be possible that employees are afraid of bots taking over their work and making the employee obsolete (Asatiani, Penttinen, Ruissalo & Salovaara, 2020). Therefore, it is important to communicate why and how RPA potentially reveals employees of the burden of doing repetitive, rule-based tasks and consequently creates more time for other tasks.

However, it is highly important to provide a realistic picture of RPA explaining the benefits and drawbacks of RPA. Studies have shown that 30-50% of RPA projects fail. One reason for RPA projects to fail is the missing communication of actual application fields for RPA (Eikebrokk & Olsen, 2020). Consequently, the research which has been done in the first step needs to be communicated transparently in step 3 to be successful in step 4 where the suiting processes are selected.

The fourth step in the roadmap considers the selection of suiting processes for RPA. The processes which are chosen should have the characteristics which have been described within step 1. The goal of step 4 is to determine processes that can be RPA candidates (Jimenez-Ramirez, Reijers, Barba & Del Valle, 2019).

The fifth step is ensuring proper process documentation which is of high importance due to different reasons. One reason is that the process documentation will serve as a basis for the bot development. The other reason is that a backup is needed in case a bot may crash in the future. It must be ensured that documentation is available to execute the process manually in case a bot does not work as it should (Koch & Fedtke, 2020).

The sixth step is process analysis and optimization. In this step, it is highly important to collaborate with employees knowing process reengineering in general and about RPA as well as process experts. This is necessary because it is not target-oriented to automate a process with RPA which is inefficient. Also, the possibility of automating a process using other automation methods such as e.g., backend automation should be discussed. If the result of the sixth step is that the process should be automated using RPA, the specifications of all activities, data flows, etc. need to be designed (Jimenez-Ramirez et al., 2019).

The seventh step includes the process implementation and robotization. In this step the programming with the selected RPA software takes place. Depending on whether the bot should run on the computer of an employee or a virtual machine, also other aspects like granting relevant system rights to the bots need to be done (Jimenez-Ramirez et al., 2019). Depending on the goals of the company this step can include a green field to write a general concept about the bot development in general (task force vs. employee enablement), user-right concept, etc. (Koch & Fedtke, 2020). Furthermore, the developed automation needs to be tested to detect errors and analyze those (Jimenez-Ramirez et al., 2019). The testing should be done continuously since RPA bots are volatile and system updates may let the bot crash.

If the company decides on a company-wide concept, the last step is to roll out the concept and communicate the guidelines (Koch & Fedtke, 2020). It is advisable to set up a company internal RPA-guideline. This guideline should regulate clearly which characteristics of processes are needed to be a suitable RPA use case and which characteristics are the “Knock Out (hereinafter: KO) criteria”. Also, a concept clarifying the responsibilities of employees developing and using bots, the definition of a user-right concept, a concept for testing, a maintenance concept, etc. is needed. The guideline is important to prevent a company from having a shadow-IT that automates processes with RPA without considering all relevant aspects. Such a shadow-IT is dangerous not only because of potential mistakes made by bots due to wrong programming but also since external auditors may request user right concepts (Koch & Fedtke, 2020).

2.3 Robotic Process Automation Architecture

Enterprise Architecture (EA) is a relevant part of IT management in companies (Auth, Czarnecki & Bensberg, 2019). It is a structural element to support the technical overall solution design in companies. Specifically, EA is about the combination of different artifacts like the organizational structure, business processes, and data structure in the company. The purpose of EA is to align strategic and operational but also business and technical perspectives. EA concepts are about modeling the development, optimization, or implementation of information systems (Auth et al., 2019). The major challenge of EA is to coordinate all systems, new processes, and interrelations in a holistic way. New technologies being introduced in a company usually have an impact on EA. Therefore, the EA and RPA need to be brought in an understandable context. The impact of RPA on EA can be considered rather low. This is the case since no changes need to be made to any systems because RPA is a surface automation solution.

Even though the final RPA architecture depends on the RPA software provider selection, the general architecture is comparable since it always consists out of the following components: the developer-component, the bots, and the monitoring/controlling component. The developer component is the actual software that is used to develop the bots. The second component is the actual bots. Those bots picture the targeted process 1:1 (Langmann & Turi, 2020). The monitoring or controlling component is only necessary if the company decides to implement non-attended bots. When deciding about how and when the bots should run, there are two possibilities which are attended and non-attended bots.

Attended bots run on the desktop of an employee. This is why it is also called Robotic Desktop Automation (hereinafter: RDA) (Langmann & Turi, 2020). Usually, the employee develops the bot himself, triggers it when needed, and watches the bot execute the process steps. Alternatively, the bot runs on a private server or a cloud. Benefits of using attended bots are fast adjustments in case the process changes or if the bot does unforeseen mistakes, enablement of employees in developing bots and consequently using new technologies, and the possibility to start the process execution individually with time-based, activity-based or manual triggers. Furthermore, the development of simple robots does not necessarily require strong programming skills. Consequently, even employees without any technical background can develop their own attended robot for simple tasks, which is another benefit (Langmann & Turi, 2020). Disadvantages of using attended bots are that the employee usually cannot use his computer while running the bot, no central quality checks, higher costs for contracts with RPA software provider since more licenses and training are needed, access to the bot's codes is exclusively granted to the developing employee and difficulties in checking whether standards and rules in developing bots are followed by the employees or not (Koch & Fedtke, 2020).

Non-attended bots run on virtual machines in the background. The orchestration is organized centrally by using a cockpit (Langmann & Turi, 2020). The cockpit triggers each process.

The benefits of non-attended bots are that an expert team ensures the safe and stable performance of the bots. Related additional advantages are the process triggers which are assignable as desired (e.g., run process X each day at 3 PM), the prioritization which is definable to ensure that the process steps are executed in a defined order, the team of experts which holds a high level of expertise and helps to develop the bots efficiently, the central quality check instance and fewer costs of training and development licenses. Another advantage is that employees who executed the processes before can use their time for other tasks which cannot be performed by bots. The disadvantages of non-attended bots are that process experts of the department need to explain the process in detail first, before the team of experts can implement and develop the bots, the company needs to establish an RPA team, and adjustments of bots may take more time (Koch & Fedtke, 2020).

2.4 Potential Benefits and Limitations of Robotic Process Automation

RPA is currently a widely discussed trend (Koch & Fedtke, 2020). As with any trend, it is highly important to understand the added value a new technology can bring to a company and where the limits are. Therefore, an understanding of the added value RPA can bring and for which situations it may even cause harm for companies using it in an unsuitable way needs to be created.

The possible added value of RPA for companies consists out of different components, which vary depending on the use case.

- Personnel cost savings: Companies can reduce e.g., their internal personnel expenses by introducing RPA. The bots may overtake the tasks of an existing employee or prevent hiring new employees (Scheppler & Weber, 2020). If the bots also run processes e.g., on weekends, the company saves the additional costs they would have needed to pay employees for working on the weekend. External expenses also have the potential to be reduced. Companies can rethink whether their currently outsourced processes could be implemented by using bots instead and consequently save costs (Langmann & Turi, 2020).
- Increased process speed and scalability: Even though it is highly important to understand, that the bots imitate human behavior and consequently do not execute processes in seconds, they can still save time (Scheppler & Weber, 2020). Bots are never sick, they do not go on vacation, they do not have working hours, they are never distracted by colleagues, and they do not get tired while doing repetitive tasks. All those characteristics save time and lead to increased process speed (Auth et al., 2019).
- Quality: Furthermore, RPA can have a positive impact on the quality of process activities. All the typical human errors which happen due to distraction or general loss of concentration can be avoided by the usage of bots (Koch & Fedtke, 2020). According to research made by the RPA provider UiPath, a financial service provider was able to reduce their error rate down to 0% by introducing RPA (Langmann & Turi, 2020).

- Potential of AI-combination: RPA is currently suitable for rule-based and repetitive processes only. Extending the technology by adding AI in the future would increase the value of RPA for companies. Consequently, companies should consider introducing RPA soon to guarantee an early mover advantage in case the technology gains even more relevance (Auth et al., 2019).
- Reusability of modules: The processes which are suitable for RPA often look similar. Consequently, certain modules can be copied and reused for other RPA use cases. This results in the faster development of bots (Langmann & Turi, 2020).
- Overcoming APIs: RPA helps to automate entire processes using different systems which do not have an API yet. APIs are usually expensive to implement especially compared to RPA. By using surface automation, systems interfaces can be overcome without any need to change the systems (Koch & Fedtke, 2020).
- Improved process documentation: Before a process can be automated with RPA, detailed process documentation is needed. The documentation serves as support with the bot development, as well as a backup in case the bot crashes in the future and the process needs to be executed manually until it can be fixed. There are several options to document processes like e.g., recording videos, click-instructions gathered in a word file, or even using BPMN 2.0 models (Langmann & Turi, 2020).
- Process optimization: Before the bot implementation takes place, the process itself needs to be rethought and if necessary optimized. Consequently, even if the process will not be automated with RPA, it may still be improved only by reconsidering the activities and finding improvement potentials (Langmann & Turi, 2020).
- Employee satisfaction: Employees which are revealed by the burden of executing repetitive tasks may become more satisfied with their work. The reason is that the employees will have more time for doing value-adding tasks (Scheppler & Weber, 2020).
- User-friendliness: RPA vendors like Automation Anywhere, UiPath and BluePrism focus on providing a UI in their product that is easy to use and does not require a lot of programming skills (Zhang, 2019). Consequently, processes can be automated by employees who do not have a strong IT background.

Summarized RPA sounds like “better, faster for less” (Scheppler & Weber, 2020). However, also RPA has limits that need to be considered as a company.

- New processes: RPA is currently not suitable for processes that are completely new to a company and are volatile or unstable. The reason is that bots need clear if/else instructions to be able to execute processes successfully. If a process does not follow strict rules, RPA is currently no solution (Langmann & Turi, 2020).
- Structured data only: Also, RPA needs structured data as input. If a process includes videos or pictures, RPA is currently not a satisfactory solution (Langmann & Turi, 2020).
- The volatility of bots: Furthermore, it is advisable to first reflect whether the process can be automated without RPA through e.g., backend automation. Backend automation often

works more stable than RPA if a process does not require the interaction between different systems or applications where no API exists. Also, the process speed is usually faster when backend automation is used. Furthermore, the bots themselves are often rather volatile and should therefore not be used for the support of critical processes. Whenever a system changes even slightly e.g. when the layout of the SAP graphical user interface (hereinafter: GUI) is updated, a bot may crash, and adjustment is needed (Koch & Fedtke, 2020). Therefore, periodical check-ups are needed to track whether all bots run without any problems. Those check-ups generate additional effort for the responsible RPA-team in the company.

- Limited process speed: The process speed of RPA is faster than a human but since the bot imitates human behavior the final process speed also depends on the systems which need to be used and the time those need to e.g., load or export data.
- Risk of obscuring outdated IT: Another aspect that needs to be kept in mind is that RPA should not be used to overshadow the outdated IT infrastructure in a company (Eggert & Moulen, 2020). The temptation to do so may be higher, since RPA potentially enables companies to automate processes with any IT systems, no matter how up to date the system itself is.
- Costs: Also, even though RPA is considered a comparatively favorable solution when considering costs, the costs should not be underestimated. Especially when introducing RPA, the license cost for the RPA software provider, the bot development costs, costs for virtual machines, and e.g. user costs for the bot to use systems like Office365 or SAP need to be considered (Langmann & Turi, 2020).
- Expenditure of time: The successful and sustainable introduction of RPA needs time. An example is, that the processes should be rethought before starting to automate. Even though it might be a quick task to develop the bot with RPA, it is advisable to reconsider the process activities first and to reflect whether the process can be redesigned in a leaner way. This is necessary because otherwise, the bot also wastes time while executing the process and the capacity could be used for other process activities (Koch & Fedtke, 2020). As with any technology introduction several other time intense aspects need to be considered, so companies should evaluate whether the effort potentially pays off or not.
- Data security: Another aspect stated in a recent article are the growing concerns of data privacy and RPA. This aspect becomes more important when e.g. an HR department which typically works with sensitive personal data aims to automate processes with RPA (Casey, 2020).

2.5 New Developments

RPA can be defined as a “bridge technology” which currently already has the potential to generate time and money savings but also develops further. Therefore, some developments and trends associated with RPA are mentioned in the following:

If a company aims to combine RPA with AI, this step is also called Smart Process Automation (hereinafter: SPA) or Intelligent Process Automation (hereinafter: IPA) (Zhang, 2019). AI provides the possibility to integrate human intelligence in executing tasks, whereas RPA focuses on executing tasks where no to limited human intelligence is required since all activities are rule-based (Zhang, 2019). A combination of both technologies may potentially enable the automation of more complex processes. Consequently, current drawbacks of RPA being only able to automate structured, simple, and repetitive processes could be bypassed in the future. Different RPA providers as e.g. UiPath are currently already working on adding AI to their RPA solutions (Ribeiro, Lima, Eckhardt & Paiva, 2021).

Another new term in the field of automation is hyperautomation. Hyperautomation integrates different new technologies such as NLP, intelligent optical character recognition (hereinafter: OCR), communication analytics, process optimization, machine learning deployments, and AI into the route of process automation (Walker, 2020). Intelligent OCR for instance potentially helps to read non-structured data from e.g., handwritten scans which was another limitation of RPA. Furthermore, hyperautomation aims to process high volumes of data seamlessly and automate entire RPA processes in one process (Rauch, 2020).

Other articles predicting the future of RPA mention the possibility of associating RPA with process mining. The idea of using process mining to improve the process itself before automating it with RPA could potentially lead to a better chance for successful use of the technology. The benefit would be that companies will not adopt automation for automation's sake, but instead focus on higher success rates (Casey, 2020).

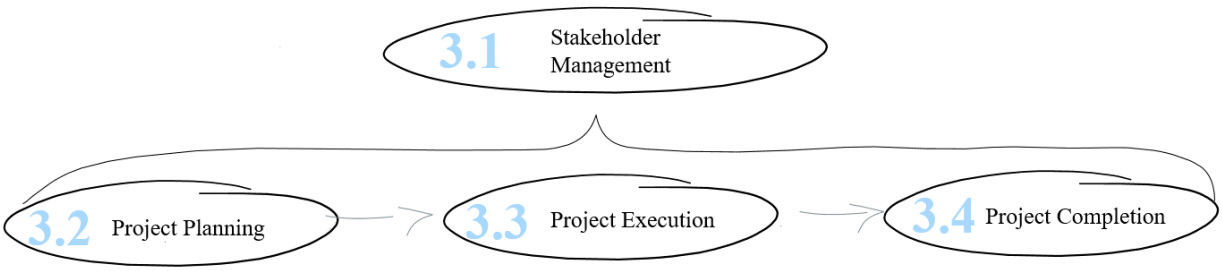
Another potential new development is autonomous automation. The idea behind autonomous automation is that the bots themselves will be enabled to automate processes so human development of bots will not be needed anymore and consequently even the automation could be automated (Casey, 2020).

3 PROJECT MANAGEMENT

The introduction of RPA in the Logistics department of the selected company has a defined scope, is unique and new, interdisciplinary, and has a start as well as an endpoint. Consequently, the introduction of RPA is a project (Meyer & Reher, 2016). Therefore, this chapter defines the important aspects of managing, planning, executing, and completing projects like the introduction of a new technology.

Figure 6 provides an overview of the relevant phases and gives an orientation on which subchapter will deal with which phase. The phases are stakeholder management, project planning, project execution and project completion. These project phases will be used to structure the case study presented in Chapter 4.

Figure 6: Project Phases Overview



Source: Adapted from Meyer & Reher, 2016.

3.1 Stakeholder Management

Stakeholder management is an overarching task within a project and needs to be done continuously throughout the whole project (Meyer & Reher, 2016) as illustrated in Figure 6.

Stakeholder management is about addressing the wishes and needs of different interest groups of the project. Stakeholders can be employees from different departments of the company, managers, suppliers, customers, society in general, etc. Stakeholders can help to provide information about the definition of project goals, the scope of the project, provide insights on potential hurdles of the project, and the risk management. This information is the basis for deciding on a project strategy and measures. The goal of successful stakeholder management is to understand, evaluate and address the needs of different stakeholders (Meyer & Reher, 2016).

One approach within stakeholder management is to start with a stakeholder analysis. This analysis includes the identification of relevant stakeholders and their individual needs. Furthermore, it includes the evaluation of the importance of the stakeholder for the project. Next, it is advisable to decide on measures and strategies which consider the stakeholder interest of the most important stakeholders since their interests may diverge (Becker, 2014). Also, it is beneficial to continuously communicate with the stakeholders to see if the needs have changed in the meantime or if they stayed the same (Meyer & Reher, 2016).

Stakeholder interests should be considered early in the project since stakeholder commitment can have a direct impact on the success of the project. If e.g., managers are in favor of the project, they are more willing to provide financial support for the project. In contrast, it can harm the project if stakeholders reject any decisions made in the project. Consequently, the commitment of the management is a CSF for projects (Becker, 2014). Another important CSF especially when introducing a new technology is supplier management. Supplier management in this context refers to the software supplier and includes adequate cooperation with the technology provider (Becker, 2014).

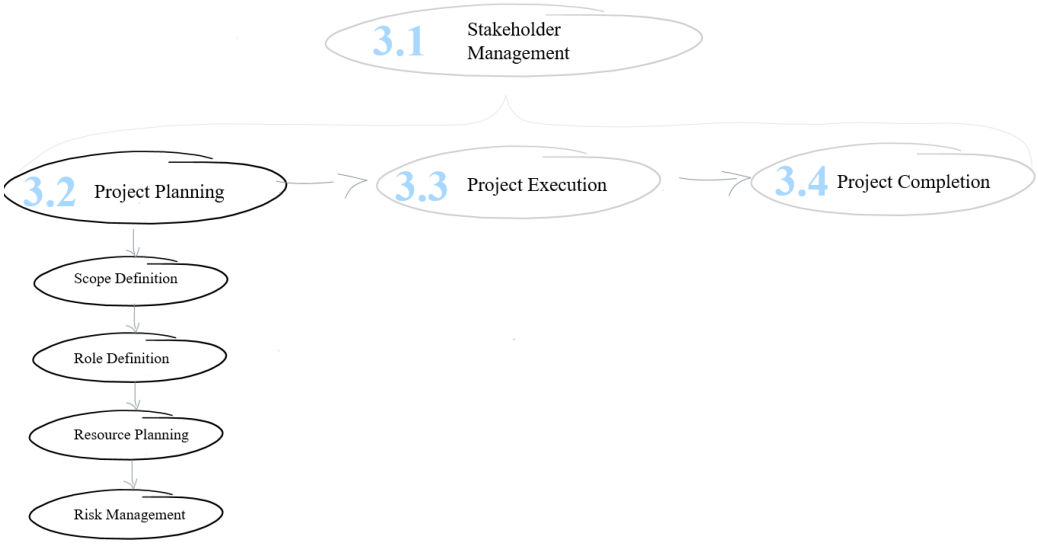
Within RPA, the relevant stakeholders differ depending on the organizational structure of the company and the relevance RPA has for the company. However, possible stakeholders

which need to be managed can be representatives from business, IT, risk and compliance, operations, and HR (Overby, 2020).

3.2 Project Planning

When planning projects it is highly important to define clear project objectives and stick to these goals throughout the project execution (Becker, 2014). Part of the project planning should be the scope definition including the project goals and a time plan, the role definition for the different stakeholders within the project, the resource planning, and the risk management as summarized in Figure 7.

Figure 7: Project Planning



Source: Adapted from Becker, 2014.

All the components of the project planning phase should be summarized in a project plan (Sanghera, 2019).

Whenever a company decides to work on a project, the scope of the project needs to be defined in detail. Therefore the goals of the project need to be defined in detail (Becker, 2014). Each goal can be separated into milestones. It should be planned until when which milestone should be achieved by using a time plan. It may also be advisable to explicitly define what is not part of the project scope to prevent misunderstandings. The definition of the project goals and the time plan should be communicated transparently.

When planning a project, the role definition plays a major role (Sanghera, 2019). Role definition is important because it helps to assign tasks, responsibilities, and expectations. Depending on the size of the project one single person can take different roles or only one. The roles which should be defined within the project are the following: There should be one project owner who initiates the project and can be seen as the principal or client. Another

role is the project leader who continuously checks on the status, assigns new tasks, reflects on passed milestones, plans upcoming milestones, etc. He or she is working closely together with the project team. The project team can consist out of people from different departments who collaborate for only one project or all team members are from the same department. Within the team, the role can either be broad or more specific by assigning e.g. a quality manager, risk manager, and stakeholder manager (Meyer & Reher, 2016). It is important to have one or more knowledge bearer in the project team who work solution-oriented whenever problems may arise. These team members help to keep up the motivation within the project team even if challenges arise (Becker, 2014).

It is important to consider the financial impact the project will have on the company (Sanghera, 2019). An approach to estimate the impact is to calculate the return on investment (hereinafter: ROI). The ROI compares the estimated costs for the project in terms of e.g., personnel costs, costs for a new software tool or license against the estimated value it will bring in the future. Especially, when considering the introduction of a new technology like e.g. RPA it is important to think long-term oriented and estimate the potential value creation in the future (Becker, 2014).

Projects usually contain certain risks due to uncertainty (Sanghera, 2019). Possible risks can be related to events happening within the organization or even with external factors (Meyer & Reher, 2016). If a risk becomes reality, it often has a direct impact on the revenues or savings expected from the project. Therefore, it is important to consider possible risks already in the project planning phase. This can be achieved by creating e.g. a risk register. The risk register includes detailed information about possible threats and opportunities which may arise throughout the project (Sanghera, 2019).

Within RPA, the RPA roadmap which has been presented in chapter 2.2 provides some orientation on how to plan the project of introducing RPA in a company.

3.3 Project Execution

The main goal within the project execution is to stay on track. Therefore, it is highly advisable to follow the project plan which leads to achieving the defined project objectives. It is necessary to continuously track the project progress and compare the target values against actual values in terms of e.g. costs, planned deadlines, and other resources (Meyer & Reher, 2016). However, it is also an important factor to consider whether any changes in the goals or in the timeline are needed due to unforeseen circumstances or mistakes made in the initial plan (Meyer & Reher, 2016). If change is needed, measures should be taken accordingly. Possible measures could be to e.g., increase the personnel capacity working in the project, redefine the timeline or even redefine the project goals. Within the RPA roadmap, some steps may need a second iteration, or the order of steps needs to be adjusted depending on the individual case. Furthermore, it is also important to keep up the motivation within the project team through developing a positive corporate culture during the project

(Becker, 2014). This culture can be achieved by e.g. focused collaboration between all project members and transparently involving all parties in the execution process (Becker, 2014). Also, regular reviews during the project may help to reflect on all milestones which already have been achieved and to define the upcoming steps (Meyer & Reher, 2016).

3.4 Project Completion

When all project goals are achieved or the deadline arises it is time for the systematic closure of the project (Meyer & Reher, 2016). If the project has been done for a customer, the final customer approval is part of the project completion. To transparently communicate the results of the project in the organization a final report as a summary can help to evaluate the success of the project. This report should contain all outputs in detail and provide a target against actual comparison. Furthermore, the most important learnings should be integrated to spur continuous improvement in the organization for upcoming projects (Meyer & Reher, 2016).

4 CASE STUDY – RETAIL COMPANY

This chapter forms the empirical part of the thesis by describing the case study which has been carried out. The research object of the thesis is two processes within the Logistics department of the selected retail company. The goal of the case study is to study the use of RPA to support processes in the Logistics department of the retail company. As mentioned in the previous chapters, the introduction of RPA is a project within the selected company. Therefore, the different project phases which have been defined in chapter three will serve as an orientation guideline throughout the chapter. With the case, I try to identify the relevant considerations when choosing a process for RPA, how to ease the interaction of bots with employees, and thematize what to consider about compliance and IT-security topics. Also, I develop a collaboration concept between the Logistics department of the selected company and the IT subsidiary for RPA use cases.

The boundaries of the case study are the following. Only Logistics processes are considered for the automation with RPA. The time frame of the case study is three months, starting from March 2021 until the end of May 2021. The RPA software provider UiPath has already been selected before. Also, the infrastructure has already been staged. The infrastructure includes the management of the virtual machines of the company and the UiPath Orchestrator where all processes are managed.

4.1 Methodology

The research strategy of the thesis is a case study. A case study is a deep analysis of a research object and its environmental conditions (Oehlrich, 2019). The case study has been selected as a research strategy because it is the most suitable strategy for analyzing real-life

data of a research object and gain in-depth insights (Saunders, Lewis & Thornhill, 2016). Within the case study, the company's internal primary data is collected.

For the discovery of the relevant processes in the department, I conduct interviews with one to two responsible employees of the department for each process. In-depth interviews are the most suitable data collection method because detailed process expert knowledge is required (Saunders et al., 2016). The interviews are semi-structured, with pre-defined key questions, and depending on the complexity of the process, additional questions are asked. The semi-structured interviews have been selected to certainly cover all general RPA-specific questions but also have the flexibility of adding process-specific questions. The goal of the interviews is to generate a detailed understanding of the process itself including the relevant systems which are used, the activities, and the exceptions within the process. Furthermore, the goal of the interviews is to enable the evaluation of whether RPA is suitable for the given process or not. Lastly, the manual execution of the process is recorded in a video during the interview. The recording serves as process documentation in case the bot crashes in the future and to help while developing the automation.

The collected data from the interviews form the basis for the development of the process automation with UiPath. Also, I consider already existing process documentation within the department. The video and the already existing process documentation help to model both processes with BPMN 2.0. BPMN 2.0 provides a notation that is generally understood by business users. It allows the creation and visualization of end-to-end processes by providing a set of rules and conventions for the model (vom Brocke & Rosemann, 2010).

Since the bots will run non-attended many more aspects need to be considered besides the programming in UiPath such as questions concerning user rights. These user-right questions are clarified in interviews with employees working in the user-rights department. As with the process-specific interviews, also the user-right interviews are semi-structured to cover relevant key questions and still be flexible to ask additional questions. The results of the interview help to collaboratively create a concept that is auditing acceptable.

4.2 Overview AS-IS Situation

The selected firm is a big German retail company. The thesis is written in collaboration with the in-house consulting subsidiary of the selected company. The subsidiary consults the selected company when it comes to any IT-related topics.

The selected company organizes new projects as follows: It is always necessary to officially release projects. This is done by providing a project plan and officially request project approval. Relevant aspects within the official project plan are:

- technical and economic considerations,
- impacts of non-implementation,
- goals,

- premises,
- time plan,
- planned expenses and
- project participants.

The main communication channel of the company is Microsoft Teams. For each project, the creation of an MS Teams channel is one of the first steps. The channel helps to communicate, assign tasks, and share relevant information with colleagues.

The provision of the RPA infrastructure for the entire company was one project which has been completed successfully before my project. The goals of the project were to find a suiting RPA software provider, to prepare the RPA infrastructure, and to assign a responsible for the RPA infrastructure. The first goal of finding a suiting RPA software provider has been achieved after analyzing the different software providers. The company decided on choosing UiPath as the RPA software provider. UiPath is currently the market leader for RPA (Gartner, n.d.). The strengths of UiPath are the strong partner ecosystem with more than 250 technology partners, a strong development community, and the continuous focus on providing learning resources like online training (Ray et al., 2020). Also, the possibility of using UiPath also for other purposes like e.g., process mining or testing automation leads to the decision of selecting UiPath as the software vendor.

For attended bots, each employee can download the UiPath Studio version and start programming. For non-attended bots, the RPA infrastructure needs to be used. The RPA infrastructure is managed through the UiPath Orchestrator. Employees, bots, and virtual machines can be assigned to department folders which are managed by the administrators. The employees within the folder can upload UiPath process files and start the processes. There is no company-wide concept for how the departments should organize process automation with RPA. Each department decides individually how to use the technology and the existing infrastructure. The Finance department is the only department that already implemented more than 10 non-attended RPA bots. The project management phases which have been defined in Chapter 3 are used as an orientation for the following subchapters.

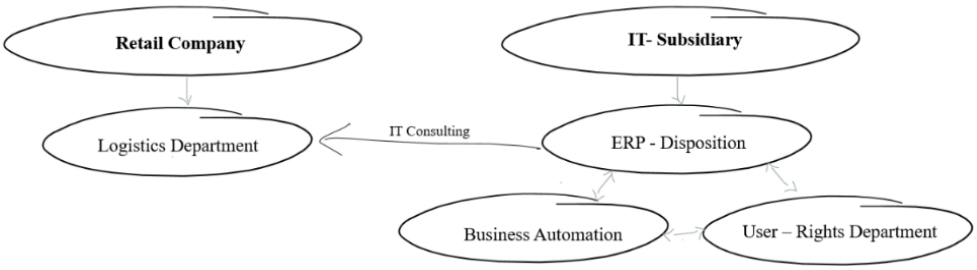
4.3 Stakeholder Management

Within the project, several different stakeholders are involved. One of them is the Logistics department of the retail company. The Logistics department ensures an optimal supply of materials and services, both, within the company and with suppliers and customers. Also, Logistics enables an optimal supply of materials, parts, and modules for production and the markets (Hausladen, 2020).

Another department that is involved in the project is the Business Automation department which is responsible for providing the RPA infrastructure. Furthermore, the SAP user rights department, which assigns rights to employees is involved, since the bot users need SAP

roles to execute processes non-attended. The last department which is involved is the department I am employed at, the "ERP Disposition" department. This department is the IT consulting department for the Logistics department with a focus on ERP topics. Figure 8 provides an overview of all departments which are relevant for the thesis project.

Figure 8: Department Overview



Source: Own work.

All employees working in any of these departments can be considered as stakeholders. All departments are interested in designing processes more efficiently by using process automation. The biggest concerns are expressed by the user rights department since they need an auditor proof user right concept to avoid assigning powerful user rights to bots without having a responsible person for mistakes done by the bot. These concerns are addressed throughout the project execution. Also, all stakeholders are updated regularly about the project progress to increase internal transparency and to keep up the motivation of all the project members.

4.4 Project Planning

When planning the project, different aspects have been considered. Therefore, the official project release template of the selected company has been used, as well as the phases explained in the project management chapter.

The scope of the project has been defined by conducting several meetings with employees from the ERP Disposition department, as well as with the Logistics department. The project scope is the following: The name of the project is "RPA infrastructure onboarding with two pilot-processes". The project starts on the 15th of March 2021 and ends on the 31st of May 2021. The goals of the project are the following:

- Implementation of non-attended automation for two defined Logistics processes on the RPA infrastructure.
- Clarification regarding potential fields of application and limitations of RPA.
- Orientation guidelines to support deciding whether RPA is a suitable automation method for a process or not.

- Creation of a collaboration concept between Logistics and the ERP Disposition department for upcoming RPA use cases.

The focus topic of the project is to gain knowledge about the technology and how to make processes run non-attended. Also, the creation of a collaboration concept between Logistics and ERP Disposition should ease the implementation of upcoming use cases.

The roles within the project have been defined as follows: The Logistics department has the most profound knowledge about the processes. Consequently, the Logistics department provides detailed process documentation. Logistics sends already existing process documentation like click-instructions in an MS Word file to ERP Disposition. Additionally, I record meetings with the process owner from Logistics who executed both processes manually. The videos serve as a basis for the programming. After the development of the bots with UiPath, the Logistics department is responsible to approve the bot implementation. This is done within a meeting where the functionality and the content of the bots are tested by comparing the data generated by the bot vs. the data from the manual process execution.

I functioned as a member of the ERP Disposition department. Together with another working student, I was responsible to program the bots using UiPath. Also, I was responsible to provide any relevant updates about the project status to the Logistics department and other stakeholders concerning RPA. Furthermore, I was the main responsible person for the entire project in general. My role can be summarized as the project leader. Consequently, I also did other project management responsibilities like organizing and moderating meetings with the different departments, tracking, and communicating the project progress, assigning, and fulfilling operative tasks. The bot responsibility was assigned to the ERP Disposition department too. The reason is that for development and testing purposes it is necessary to know the passwords for the bot users.

To calculate the estimated resources for the project, man-days and license costs for users need to be considered. Due to confidentiality reasons, the actual numbers are slightly changed, however, the proportions are true. The costs for the RPA-infrastructure are not integrated into the calculation, because these costs were considered in the previous project. Since the ERP Disposition department is the consultant department for the Logistics department, the Logistics cost center needs to bear the project costs.

The company differentiates between a man-day fee per permanent employee and a fee for a working student. The costs per day for a working student are estimated at 200€. The costs per day for a permanent employee are 675 €. Within the ERP Disposition department, it was estimated that 10 working student man-days are needed and one man-day for a permanent employee to achieve the project goals. Consequently, the costs caused by ERP Disposition are 2,675€. The Logistics department estimated 5.5 permanent employee man-days, resulting in costs of about 3712€.

Besides costs for man-days, also license costs for tools are required. The licenses which are needed to implement the two processes are Office365 and SAP. The Office365 license causes costs of 20€ per month. These costs occur for every new employee who needs Office365, so since the bot is handled as an employee, the license causes costs. The SAP user license causes are estimated at 150€ per month. The SAP costs are internal allocation cost rates. Assuming both licenses are requested at the beginning of the project and calculating the sum for the entire project duration causes license costs of 50€ for Office365 and 375€ for SAP.

The ultimate sum for the entire project is about 6,812€. An overview of all costs is provided in Table 1.

Table 1: Project Cost Overview

Description	**Costs in EUR**
ERP Disposition working student (10 man-days)	2,000
ERP Disposition permanent employee (1 man-day)	675
Logistics (5,5 man-days)	3,712
Office365 license (2,5 months)	50
SAP license (2,5 months)	375
Sum	*6,812*

Source: Own work.

Concerning the risks, the possible negative impacts of a non-successful project execution should be considered but also the impacts if the project would not be implemented at all. Overall, the negative economic impacts of a non-successful project would be comparably low. The infrastructure for RPA has already been created and the project costs are consequently rather low. The only negative impact if the project fails would be a loss of time and the money spend on man-days and licenses. However, it would still generate lessons learned which can help the company for upcoming projects.

Other risks of using RPA relate to e.g., IT security since bots receive user rights to operate in systems just as humans would. Consequently, one risk is that the bots do mistakes in the ERP systems. Mistakes in the ERP system can have a huge negative impact since highly important data like master data about products, availability information, picking dates, etc. are managed. However, the company has testing systems, which are used while programming the bots to ensure that no damage to important data is done.

If the company would decide to not implement the project, this would result in:

- Higher probability for human mistakes within the two processes which will be automated. The mistakes would also lead to lower process efficiency and quality.
- Lack of knowledge and competencies regarding RPA and associated advantages and disadvantages.

- Loss of potential when dealing with a future technology and unused efficiency advantages.

The reasons for implementing the project thus likely outweigh the risks of a potential project failure.

4.5 Project Execution and Personal Contribution

The first goal of the project is to automate two processes and make them run non-attended on the provided infrastructure. The BPM lifecycle including process automation which has been presented in Chapter 1.3 provides the relevant phases to achieve this goal.

4.5.1 Identification

The first phase in the BPM lifecycle is the identification phase. However, as mentioned in the RPA roadmap it is crucial to understand the technology first, before selecting the use cases. Therefore, I researched about RPA in general and consulted the theoretical aspects summarized in chapter 2. I scheduled a kick-off meeting with the Logistics department to get to know each other and clarify goals and expectations. For the initial kick-off meeting I created a PowerPoint presentation where I summarized the definition of RPA, as well as important characteristics for processes that can be automated with RPA. I included the benefits of introducing RPA in a PowerPoint slide to motivate the colleagues for the topic.

Since the employees were motivated since the beginning, so the third step in the roadmap could have been kept short. The fourth step in the roadmap is to find suiting processes for RPA. This step thematizes the actual identification of the RPA candidates.

Therefore, I defined eight questions that should be answered with “yes” and two questions requesting additional information about a process. I selected these questions to cover all must-criteria for RPA candidates which are stated in the different theoretical sources. The goal of the questionnaire was to identify two use cases where RPA can be a good solution. The questions are the following:

1. Is the process rule-based? (It is possible to create a process model which does not contain too many exceptions.)
2. Does the process include structured data only? (The input data is electronic and has a defined format, e.g., item number, prices, etc.?)
3. Is the process repetitive? (The process is executed regularly, e.g., weekly, or daily.)
4. Is the process stable? (The process is not new and will not change soon.)
5. Are no activities included in the process which need to be done manually? (The process does not need any non-digital activities, e.g., signatures)
6. Is the process itself non-critical for the company? (If the bot crashes, this has no impact like sales slumps.)

7. Is it possible to provide a timeframe when the bot can run the process without interruptions?
8. Does the process contain system breaks? (Not a must-have criterion.)

Additional information:

9. How complex is the process? (Low, middle, high)
10. How long does the process execution need? (In hours per week)

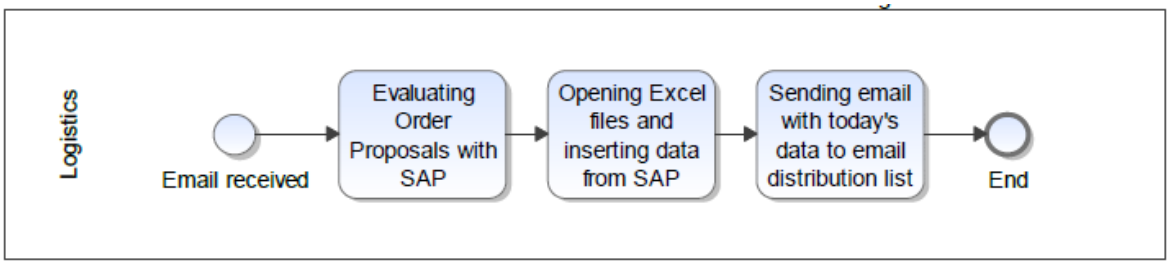
I asked the Logistics department to provide two processes for which the answer for each of the eight questions is yes and the complexity of the process is rather low or middle. We agreed in the meeting that implementing two different processes serve as a perfect number of use-cases for the onboarding project. The Logistics department identified two cases that match the requirements. Both processes are rather support processes, than core processes and consequently meet the RPA requirement stated by Langmann and Turi. After identifying the two processes, the first four steps of the RPA roadmap were completed. These steps include understand RPA, choose a software provider which has already been done before the project, motivate the workforce for RPA, and select suiting processes for RPA.

4.5.2 Discovery

The next phase in the BPM lifecycle is the discovery phase which is about understanding the processes in detail and create the AS-IS models. Therefore, I scheduled one meeting per process to conduct semi-structured interviews. In the meetings, I asked for the manual execution of the processes and recorded a video of it. Also, I asked for any existing process documentation. I uploaded all the process documentation in the MS Teams channel which I created for each bot. To understand both processes, a detailed process description follows.

The first process is called “Gross Load Preview”. Figure 9 shows the BPMN model of the process. Since it contains three activities only, the process complexity is rather low.

Figure 9: BPMN model »Gross Load Preview«



Source: Own work.

The process is executed daily by a Logistics department employee, so it meets the requirement of repetitiveness. There is not only one employee doing the process but whoever

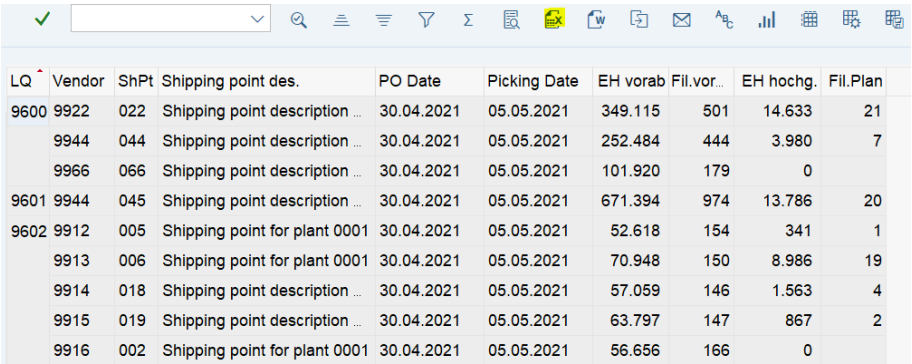
is available. All employees in the department know how to execute the process and have the required user rights. The employee needs about 10 minutes for the manual execution of the process. The process uses SAP, Excel and sends emails, so there are system breaks. The process is stable, and it is completely rule-based. No signatures or similar activities are needed within the process, so the bot can execute the whole process. The process is not complex. The goal within the process is to evaluate the order proposal units for a picking date for each distribution center of the company. After evaluating the proposal units by using SAP, the numbers are sent via email to an email distribution list.

Each morning, at around 7:30 AM the Logistics department receives an automated email informing the employees regarding the completeness of the order data. This automated email is the trigger for the process to start. Next, an employee logs into the SAP system, uses a transaction, and selects a variant that prefills relevant data into the SAP input mask like the identification number for all relevant distribution centers.

One difficulty within the input screen is to select the suiting picking date. Usually, the picking date should be the current day plus three workdays. However, it may be possible that the picking date varies because one distribution center is in a region which is e.g., on holidays. The employees within the Logistics department are aware of these holidays per region and change the picking date accordingly manually. For the bot implementation, clear rules are needed. After consulting several colleagues, a solution was suggested to use another transaction that provides the delivery schedule for each distribution center. Within this transaction, it is possible to get the right picking date for each distribution center, copy it and paste it in the order proposal transaction.

After executing, the evaluation looks as shown in Figure 10. The evaluation is exported in an Excel file by clicking the icon which is indicated in yellow in Figure 10. The order proposal numbers are indicated in the column “EH hochg.”.

Figure 10: Process A – SAP Evaluation of Order Proposals



LQ	Vendor	ShPt	Shipping point des.	PO Date	Picking Date	EH vorab	Fil.vor...	EH hochg.	Fil.Plan
9600	9922	022	Shipping point description ...	30.04.2021	05.05.2021	349.115	501	14.633	21
	9944	044	Shipping point description ...	30.04.2021	05.05.2021	252.484	444	3.980	7
	9966	066	Shipping point description ...	30.04.2021	05.05.2021	101.920	179	0	
9601	9944	045	Shipping point description ...	30.04.2021	05.05.2021	671.394	974	13.786	20
9602	9912	005	Shipping point for plant 0001	30.04.2021	05.05.2021	52.618	154	341	1
	9913	006	Shipping point for plant 0001	30.04.2021	05.05.2021	70.948	150	8.986	19
	9914	018	Shipping point description ...	30.04.2021	05.05.2021	57.059	146	1.563	4
	9915	019	Shipping point description ...	30.04.2021	05.05.2021	63.797	147	867	2
	9916	002	Shipping point for plant 0001	30.04.2021	05.05.2021	56.656	166	0	

Source: Screenshot SAP.

The next step is to open two Excel files that are used by the entire department. Next, the numbers from the SAP-export need to be copied into the corresponding fields in the Excel

file. The corresponding field means that for each row in the SAP-export the "EH hochg." number needs to be copied and pasted into the two excel files when the source of supply and shipping point match with an entry in the Excel. One Excel file contains all numbers concerning the distribution centers and the second Excel contains the pre-distribution centers. In general, the Excel files have a similar layout. An excerpt of the distribution center Excel file is shown in Figure 11.

Figure 11: Process A –Excel File Distribution Center

Date	Distribution Center	Data mining forecast	Orderforecast	Commisioning units beforehand VZ	Forecast pallet replenishment
29.06.2021	A	161.384	213.898	208.300	30.289
29.06.2021	B	161.369	210.911	203.683	28.772
29.06.2021	C	48.607	66.035	65.152	9.479
29.06.2021	D	390.651	464.101	328.956	0
29.06.2021	E	168.581	217.931	154.803	0
29.06.2021	F	50.047	58.824	59.626	0
30.06.2021	A	310.139	399.693	375.174	57.592
30.06.2021	B	354.370	467.989	441.396	65.471
30.06.2021	C	108.685	143.667	126.141	20.779
30.06.2021	D	600.040	699.023	588.925	0
30.06.2021	E	275.200	336.333	278.410	0
30.06.2021	F	53.245	52.744	51.385	0

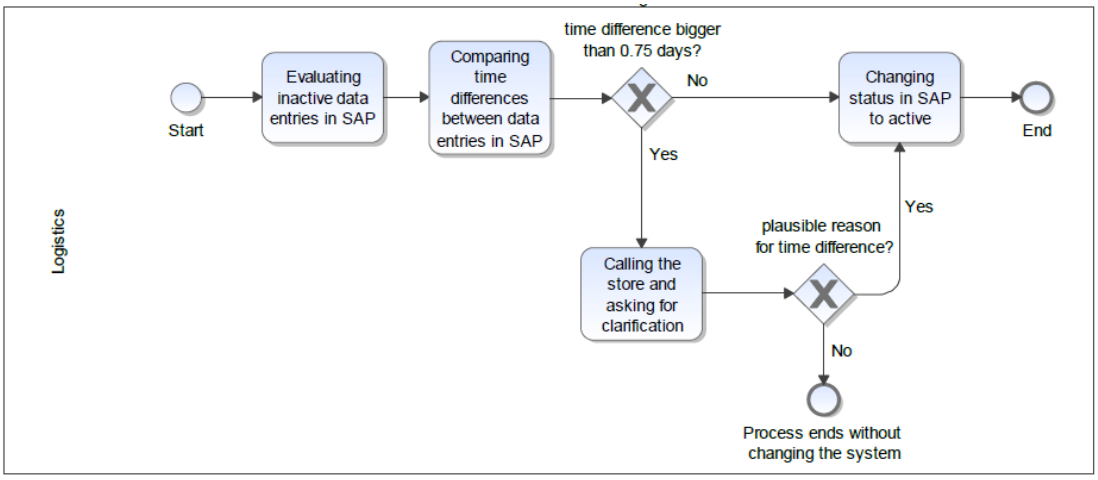
Source: Screenshot Excel.

The last step in the process is to send an email to a defined email distribution list with an excerpt of the two Excel files showing the picking units for the most recent picking date for all distribution centers and pre-distribution centers. After the email is sent, the process ends. The process is uncritical since the bot does not change any data in the system, it only exports data and copies it in Excel files. Since the process is completely rule-based, the exceptions with the picking date are solvable, no unstructured data like e.g., pictures is used and all other requirements for RPA are met, the process is selected as the first RPA use case to be automated using UiPath.

The second process is called "Availability Maintenance". Each store can change its availability times for delivery. When a store changes the availability time, this change has the status "inactive" in SAP and needs to be changed manually by the Logistics department to "active" under defined conditions. Whenever the time change is greater than 0.75 days, an employee from Logistics calls the store and asks for clarification why the times were changed. When the time change is 0.75 days or less, the Logistics employee would just change the status manually. The process uses SAP only and no Excel files.

Figure 12 explains the process flow in the form of a BPMN model.

Figure 12: BPMN model »Availability Maintenance«



Source: Own work.

Process B is also executed daily and needs about 10-30 minutes for an employee, depending on the number of inactive entries. The process looks as follows:

The process needs to be executed before 3 PM. An employee logs into SAP at 2:30 PM the latest, calls a transaction, and selects all data with the status “I” for “inactive” in the SAP input mask. After executing, the employee sees a table with all inactive data entries for the relevant stores as shown in

Figure 13. The store identification numbers need to be copied (third column “KUNNR”) and pasted into another transaction. Also, the most recent date indicated in the fourth column “DATAB” needs to be copied for the second transaction.

Figure 13: Process B – SAP Inactive Data Entries Table

Data Browser: Table YRFILPRM1 Select Entries 11

Check Table... Cancel More

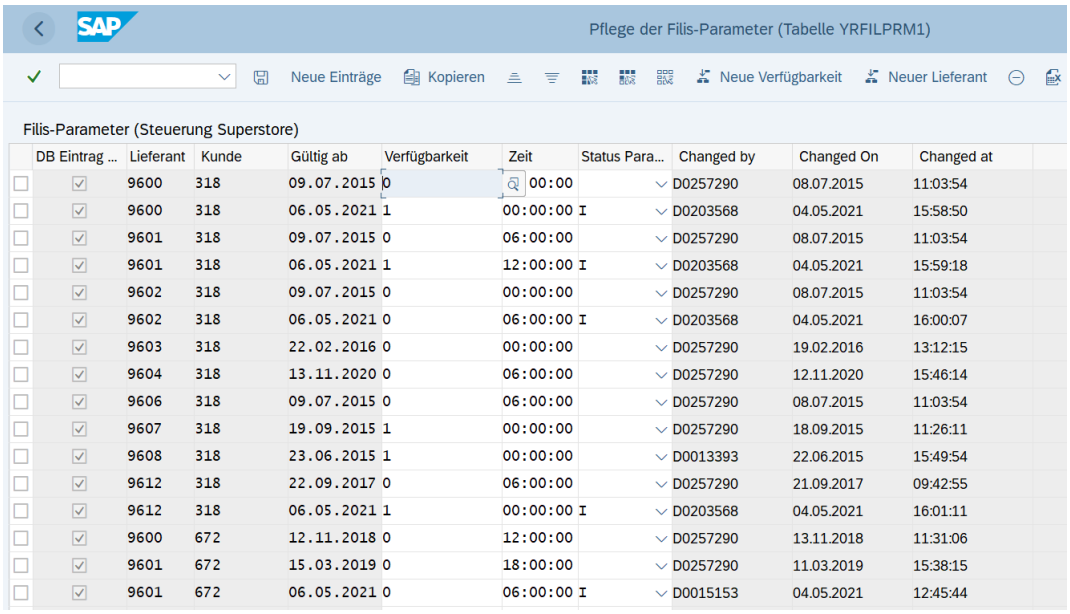
Table: YRFILPRM1
Displayed Fields: 10 of 10 Fixed Columns: 4 List Width 0250

MANDT	LIFNR	KUNNR	DATAB	VERFUEGBAR	ZEIT	STATUS	AENAM	AEDAT	AEZEIT
100	0000009600	0000000318	06.05.2021	1	00:00:00	I	D0203568	04.05.2021	15:58:50
100	0000009600	0000002310	11.05.2021	2	00:00:00	I	D0228402	05.05.2021	07:52:34
100	0000009600	0000002848	05.05.2021	2	00:00:00	I	D0238511	04.05.2021	23:14:46
100	0000009601	0000000318	06.05.2021	1	12:00:00	I	D0203568	04.05.2021	15:59:18
100	0000009601	0000000672	06.05.2021	0	06:00:00	I	D0015153	04.05.2021	12:45:44
100	0000009601	0000002848	05.05.2021	2	00:00:00	I	D0238511	04.05.2021	23:15:44
100	0000009602	0000000318	06.05.2021	0	06:00:00	I	D0203568	04.05.2021	16:00:07
100	0000009602	0000001997	11.05.2021	1	12:00:00	I	D0219462	05.05.2021	11:32:10
100	0000009602	0000002310	11.05.2021	1	18:00:00	I	D0228402	05.05.2021	07:53:04
100	0000009612	0000000318	06.05.2021	1	00:00:00	I	D0203568	04.05.2021	16:01:11
100	0000009612	0000002848	05.05.2021	3	00:00:00	I	D0238511	04.05.2021	23:16:58

Source: Screenshot SAP.

The next SAP transaction changes the availability entries. In this transaction the employee enters the store identification numbers, the date from the "DATAB" column minus one day and executes. The employee sees a table as shown in Figure 14.

Figure 14: Process B – SAP Table to Change Availability Status



DB Eintrag ...	Lieferant	Kunde	Gültig ab	Verfügbarkeit	Zeit	Status Para...	Changed by	Changed On	Changed at
☑	9600	318	09.07.2015	0	00:00		D0257290	08.07.2015	11:03:54
☑	9600	318	06.05.2021	1	00:00:00	I	D0203568	04.05.2021	15:58:50
☑	9601	318	09.07.2015	0	06:00:00		D0257290	08.07.2015	11:03:54
☑	9601	318	06.05.2021	1	12:00:00	I	D0203568	04.05.2021	15:59:18
☑	9602	318	09.07.2015	0	00:00:00		D0257290	08.07.2015	11:03:54
☑	9602	318	06.05.2021	0	06:00:00	I	D0203568	04.05.2021	16:00:07
☑	9603	318	22.02.2016	0	00:00:00		D0257290	19.02.2016	13:12:15
☑	9604	318	13.11.2020	0	06:00:00		D0257290	12.11.2020	15:46:14
☑	9606	318	09.07.2015	0	06:00:00		D0257290	08.07.2015	11:03:54
☑	9607	318	19.09.2015	1	00:00:00		D0257290	18.09.2015	11:26:11
☑	9608	318	23.06.2015	1	00:00:00		D0013393	22.06.2015	15:49:54
☑	9612	318	22.09.2017	0	06:00:00		D0257290	21.09.2017	09:42:55
☑	9612	318	06.05.2021	1	00:00:00	I	D0203568	04.05.2021	16:01:11
☑	9600	672	12.11.2018	0	12:00:00		D0257290	13.11.2018	11:31:06
☑	9601	672	15.03.2019	0	18:00:00		D0257290	11.03.2019	15:38:15
☑	9601	672	06.05.2021	0	06:00:00	I	D0015153	04.05.2021	12:45:44

Source: Screenshot SAP.

Next, the employee compares every row where the status parameter indicates "inactive" with the previous row to determine the time difference. When the time difference is 0.75 days or less, the employee changes the status, if the difference is greater, the employee calls the store and asks for clarification. Afterward, the process ends. Consequently, the process is completely rule-based, only includes structured data, is repetitive and stable. When using UiPath as RPA solution only, the calls would need to be done by a human since UiPath does not support call activities yet. However, a bot could still picture all activities which happen before the calls. The activities which would be implemented with the bot do not contain a system break since all of them happen in SAP. The complexity of the process is low. Even though the complexity is low and only SAP is used, there is still one interesting difference compared to the first process. Process B does not only export data but also changes data in SAP. Also, there would be no need for an employee to use SAP anymore for the process. The employee could get all necessary information via email from the bot. Another major advantage of implementing this process with RPA is that it can run on the weekends. Stores can change their availability times 24/7, so even on e.g., Saturdays. Since no office employees are available to adjust the status of the availability change request in SAP, the request would have the status "inactive" until Monday. By implementing the process with RPA, this problem would be solved.

4.5.3 Analysis and Redesign

The next two phases in the BPM lifecycle are the analysis and process redesign phases. These phases are also part of the RPA roadmap, named process analysis and process optimization. Due to the limited time frame of the project and the primary project goal of creating knowledge about RPA development in general the process optimization has been neglected. For this case, the fact that the processes meet the general RPA criteria has been defined as sufficient for choosing to automate those. For upcoming use cases, process optimization needs to be considered in more detail.

However, the "Gross Load Preview" process has been slightly redesigned. The reason for the redesign is the problem of RPA working with unstructured data like e.g., pictures. The email which is sent in the "Gross Load Preview" process contains a screenshot of the Excel file. Since screenshots and pictures, in general, are unstructured data and consequently difficult to use with RPA one suggestion was to create a table and send the table instead of the screenshot. In a meeting, a colleague expressed the concern that tables are not ideal since opening the mail from a mobile phone result in an unclear view since the table has too many columns to fit in the mobile view. However, the drawback within the email was accepted by the majority of the Logistics department.

Another aspect that has been redesigned in the "Gross Load Preview" process is the location of the Excel files. Before introducing RPA, the employees used an internal drive to save their Excel files daily. A problem with the Logistics internal drives is, that only one person at a time can work on a file. This means if one person has opened an Excel file, another person cannot access it. Consequently, if the bot aims to write in an Excel file that is locked by another user, the bot will crash too. Unfortunately, there is also no time slot where it can be ensured that no employee opened the Excel files since some colleagues would keep it open in the background and forget to close it. The approach to inform the employees in the department that e.g., 6-7 AM no one should access the Excel files was evaluated to not be safe enough. Another solution is to let the bot write in its own Excel files and integrate VLOOKUPs in the department's shared Excel files which update automatically. One problem with the second solution is that whenever the department's Excel files are changed in their layout, this needs to be done to the bot's files too, otherwise an error may occur. Due to bad experiences with the VLOOKUP solution, also this idea was discarded.

Since the company plans to switch to SharePoint during 2021 anyway, the traditional drives for departments will not be used anymore. These circumstances lead to the decision to create a SharePoint where the bot saves the updated Excel file daily. On SharePoint, more than one person can access a file. However, the risk of merging conflicts due to two users trying to write in one cell or poor internet connection for one person still needs to be kept in mind. For the "Gross Load Preview" process the risk of bot and employee trying to write in the same cell has been evaluated as rather low because of two reasons. One is, that the bot needs only seconds to write the values into the Excel file. The second reason is that the employees

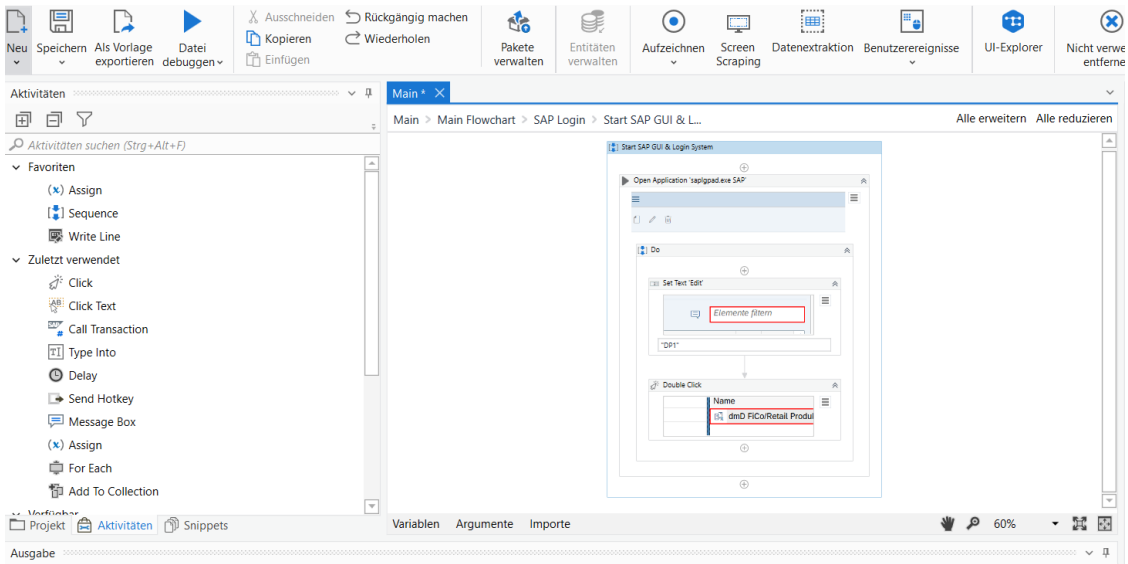
receive the current picking values in the email as a table anyways and if the bot also writes the picking units into the cells, the employees do not need to write in the Excel file anymore. The aspect of moving the Excel file from the internal department drive to SharePoint can be seen as process optimization.

Also, the "Availability Maintenance" process has been redesigned. The employees from Logistics need the information of the bot which data entries were not changed to "active" since the time difference was too big. This can be implemented by sending an email to the employee with all entries having a larger time difference than 0.75. Consequently, the bot would use SAP and emails. Emails have not been sent before within the process. Also, the bot changes data in the system. To ensure traceability of the changes, one suggested change is to let the bot write a log with all data which has been changed in SAP.

4.5.4 Development

The next step in the BPM lifecycle, as well as in the RPA roadmap is the bot development. In this case, the phase includes primarily the programming with UiPath. As members of the ERP Disposition department who work as the consultants for Logistics, all necessary user rights e.g., in SAP were already assigned. The company does not only have the productive SAP system with actual data but also a testing system with old data. To ensure that no actual data is changed, the development has been done in the test system. We consulted several tutorials to understand how to use UiPath. In general, the development of bots with UiPath is intuitive and the UiPath community is strong so whenever a question comes up, a solution can be found quickly. For simple click and write activities low to no coding skills are required. One example is the following: For both processes, a sequence to log into SAP is required. To provide an example of how the programming looks like, the sequence for logging into SAP is illustrated in Figure 15.

Figure 15: User Interface UiPath



Source: Screenshot UiPath.

The activities are shown on the left side of the UI and can be dragged and dropped into a sequence as shown in the middle of the screen. There are activities for opening applications, setting texts, assigning values, clicking a defined icon, image, or text, etc. Besides the activity panel on the left side, there is also the possibility to use the "record"-function which is on the upper navigation bar. The record function works similarly to the record function when programming macros in Excel: When the developer clicks the record-icon and starts to execute the process manually, UiPath tracks the activities and writes them into the process flow. After that, eventual adjustments need to be made. The log into SAP sequence requires the three activities, "Open Application" to open SAP, "Set Text" to write the required system into the menu, and "Click" to double-click the required system. By clicking on the "play"-icon on the upper left side of the screenshot, the bot starts executing the process.

For both processes, it is also necessary to develop sequences that require more programming skills. One example is that in both processes, some identification numbers need to be read, copied, and pasted into another transaction. This requires the creation of a temporary data table so that the bot remembers which data to paste into the other transaction.

To implement the logic of changing a data entry status within the "Availability Maintenance" process, also other activities are needed. In this case, the data in the table needs to be read and values need to be calculated to get the time difference between two rows. Then a so-called "flow decision"-activity helps the bot to decide whether it can change the status himself or should write the information of the entry in an email so that the employee can call the corresponding store. Doing the actual changes to the status was implemented by the already introduced click activities.

UiPath also has activities that are useful for working with the Orchestrator in the case of non-attended bots. There is an activity called "Get-Credential" which gets the assets that are stored in the Orchestrator. We agreed to store the password encrypted as credentials in the Orchestrator. Through using the activity "Get-Credential", the bot gets the password and username without any colleague knowing the password. Consequently, even if we share the bots code with other colleagues trying to program with UiPath, they would not know our bots password which tackles concerns regarding data security.

The "Gross Load Preview" process was the first process to implement and took about three full days of programming, whereas the "Availability Maintenance" process took only one day of programming. Reasons for the time difference are the lower complexity of the "Availability Maintenance" and the fact that the other working student and I were already more skilled with programming in UiPath and some sequences could be reused like the "log into SAP" sequence. Consequently, the initial programming did not take a lot of time. It is likely that for upcoming use cases even less time will be needed depending on the complexity of the use case and the similarity compared to the two initial use cases.

To let the bots run non-attended on the provided infrastructure different steps need to be considered. A checklist with all necessary steps was provided by the responsible colleagues from Business Automation who manage the infrastructure. I created a PowerPoint with click-instructions for the Logistics department as a guide on how to complete the necessary steps. The Logistics department was actively involved in the process of getting the automation to run on the infrastructure. I arranged a meeting with the Logistics department to start requesting all necessary users and user rights for the non-attended bots together and guide them through the process.

The first step which needs to be done is to request a service user in the identity management system of the company for the bot. Since the bot can be seen as an additional employee, it is necessary to request a user for the bot. In this step, it is important to define whether the bots will only work on processes being relevant for Germany or may also run internationally relevant processes. We decided to request a service user for Germany only. The responsible employee for the user is a permanent colleague from ERP Disposition. First, it was planned to assign this responsibility to Logistics. However, especially when testing the bots, it was necessary to access virtual machines with the user login data to see what the bot does. Therefore, it is more practical to assign the responsibility for the bot user to the developers, in this case, ERP Disposition.

Next, it is important to assign different Active Directory (hereinafter: AD) groups to the user. These AD groups control which accesses the user has. The bot user needs the basic package for service users, access to the internet, and access to the virtual machines. Each AD group has a unique name and can be requested through the identity management system of the company.

The next step is to request Office365 rights to ensure that the bot can use Excel. The Office365 rights can be requested through an online service portal of the company and are available within one workday.

Also, it is necessary to request an SAP user. This user can be requested quickly in the service portal of the company. An SAP user without defined user rights is not able to execute any transactions in SAP, so SAP roles need to be assigned to the user. Since a lot of damage can be done by mistakenly changing data in the productive system, the SAP user right management is very strict. The company has an entire department being responsible for user rights management. The idea of assigning user rights to bots and not having a responsible person whenever mistakes happen was initially seen as a high risk. A solution that has been defined together with the SAP user right department was to strictly define a role per process. In a meeting between the user rights department, me, and the second working student, the processes were executed once manually, and a trace was recorded. The trace included the exact description of which transactions were used and if the bot only needs read or also write rights per transaction. Next, the user right department created the role per process by using predefined name conventions and assigning the role to the bot user. Next, I tested the role

by executing the processes once manually with the bot user and checking whether all activities work. However, the user right department still needed to have one responsible person for the bot's eventual mistakes. For the SAP-roles, a permanent employee from ERP Disposition is lodged as the responsible person.

Another step that needs to be done is to set up the virtual machine. This is done after all user rights have been received. In collaboration with the Business Automation department, I scheduled a meeting to check if all AD groups have been successfully assigned and consequently all accesses work. In the meeting, we checked the internet connection, SAP GUI settings, and user rights, Office365, synchronized the SharePoint, and tested Outlook.

Also, the two bots needed to be uploaded to the Orchestrator. With the help of the Business Automation department, this step has been completed successfully. Also, the process triggers needed to be set up in the Orchestrator. For the manual execution of the "Gross Load Preview", the trigger is an email in the morning. Unfortunately, there is currently no option in the Orchestrator to use emails as process triggers. However, the email is usually sent around 7:30 AM. Times are possible triggers in the Orchestrator. The "Gross Load Preview" process needs to be executed before 8 AM and the "Availability Maintenance" before 3 PM. Therefore, we set the daily execution time for the "Gross Load Preview" process to 7:30 AM and the time for the "Availability Maintenance" process to 2:30 PM. The time buffer of half an hour is sufficient because the bot execution takes about five minutes only.

Also, the credentials of the bots needed to be set up as assets in the Orchestrator. This is necessary for the bot execution to ensure that the bot has the relevant passwords and usernames. The passwords are encrypted in the Orchestrator to ensure, no one can copy them.

4.5.5 Test

The fifth phase in the BPM lifecycle is the testing phase. This phase showed how volatile the implementation with RPA is. If the second working student and I had differing language settings within e.g., Excel or SAP or different GUI settings in SAP, the bot crashes. However, the goal is to run the bots on virtual machines whose settings will not be changed without an announcement by the Orchestrator administrators from the Business Automation department. Another problem that came up during the programming was that the bot always crashes if the SAP application was already opened in the background. The solution for this problem was to integrate a sequence at the beginning of each process that closes all applications before starting the actual process. Similarly, a sequence was created to close all applications at the end of each process. Those two sequences are useful for any RPA bot and potentially help to make the processes run more stable.

Another example of a bot crash was that MS Teams would open up automatically in the background while the bot was executing the process. The solution for the problem was to

block any automated program starts in the task manager of the virtual machine to avoid the problem.

Furthermore, bots crashed from time to time because of trying to execute activities faster than the application would load the data. A solution for this problem is to integrate “Delay” activities that advise the bot to wait e.g., two seconds before starting with the next activity. Another reason for a bot crash was an empty table in SAP even though the bot expected the table to include data. This happened when the “Gross Load Preview” bot iterated over the distribution centers to get the right picking date, but one distribution center did not pick in the selected time interval, so the table was empty. These exceptions were intercepted by adding a sequence that causes the bot to skip the distribution center when the table is empty instead of crashing.

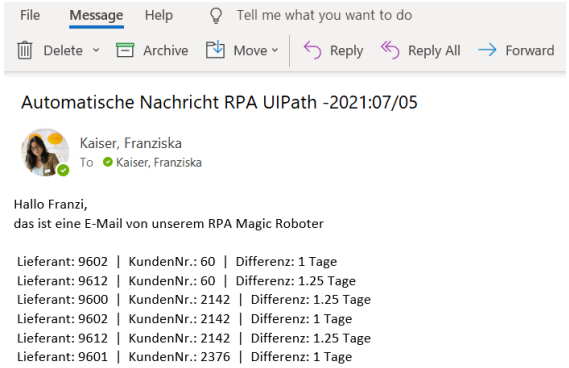
The bot needs about five minutes for the execution of each process. The reason why the bot is not faster than five minutes is that bots need to wait e.g., for transactions in SAP to load just as humans would do since RPA is surface automation only. Consequently, backend automation would be a faster and more stable solution compared to RPA. However, compared to a manual execution of up to 30 minutes for the Availability Maintenance the bot is 25 minutes faster. After two weeks of testing the bots continuously and fixing all issues, the bots ran stable, and no problems arose anymore.

4.5.6 Release

After finishing the development and the tests, the bots had to be approved by colleagues from the Logistics department. Therefore, another meeting has been arranged to let the process experts check whether the bots come to the correct results or do any mistakes and ask if an improvement could be made to the bots.

With the second process, I clarified which information would be needed by the employee receiving the email to know which stores to call for clarification. We agreed on integrating the supplier number, the store identification number, and the actual time difference. This resulted in an email which looks as shown in Figure 16.

Figure 16: Process B - Email



Source: Screenshot Email.

After all desired adjustments have been made, we asked for “customer approval” in written form. Therefore, we demonstrated automated process execution in a meeting to the colleagues from Logistics. The colleagues watched the bot and did check-ups on the data generated by the bots. Afterward, they confirmed that the bots execute the processes correctly and I documented the confirmation in facts sheets for each bot. After getting the approval for the programming, the Logistics department is responsible for any mistakes made by the bots.

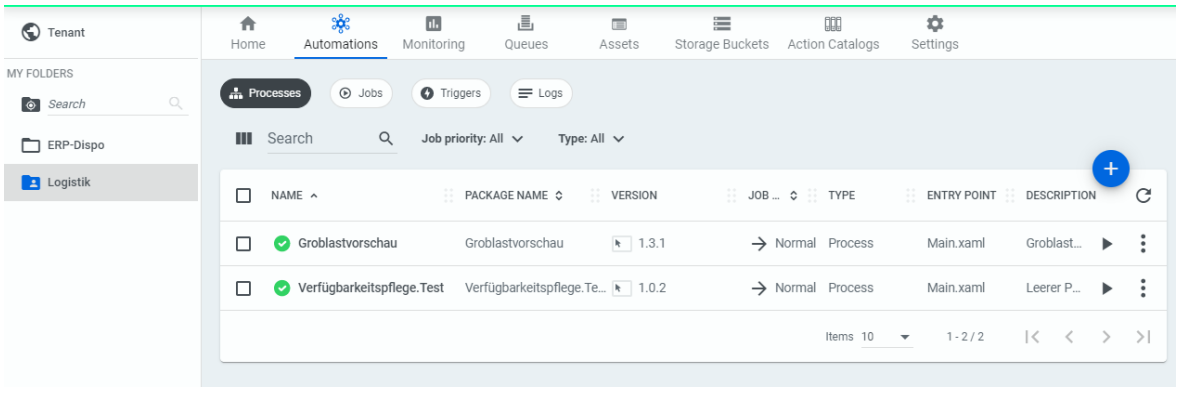
4.5.7 Run

Both bots run productive starting from June 2021. The other working student and I did daily check-ups and checked whether the data generated by the bot is correct or not by executing the process manually and checking the results. Fortunately, no differences were found. Also, we asked the colleagues from Logistics to report any concerns with the data generated by the bots. However, even while running the bots productive, we still found some exceptions which we did not catch before, so the bots needed additional adjustments. One example is that within the “Availability Maintenance” we found out after not receiving an email from the bot once, that no data might need to be changed in the system for a day. To avoid confusion in the Logistics department we added a sequence in the bot’s code that whenever no data needs to be changed, the Logistics department receives an email that informs the colleagues of this fact.

4.5.8 Monitoring and Control

The last step in the BPM lifecycle is the monitoring and control phase. The Orchestrator is the tool to monitor and control the non-attended bots. An overview of the Orchestrator is shown in Figure 17.

Figure 17: Overview Orchestrator

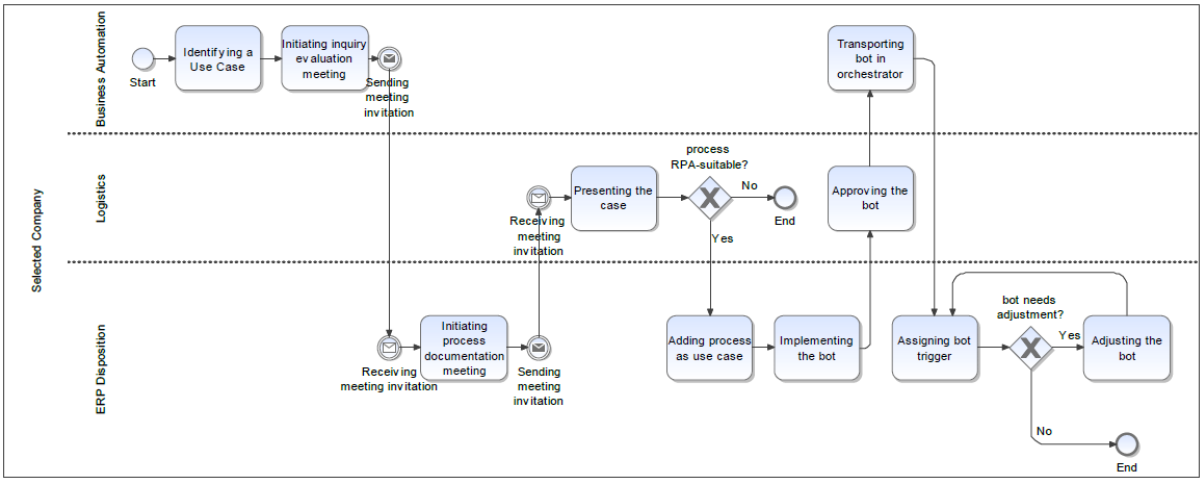


Source: Screenshot Orchestrator.

I scheduled a short meeting with Logistics to explain the most important functions of the Orchestrator to the Logistics colleagues and created a pdf file with instructions for the most important functions. One important tab is the “Automations”-tab. This tab includes the function to trigger the processes. Consequently, the employees can trigger the processes manually if needed. Furthermore, new bots can be uploaded in the Orchestrator, whenever a new RPA case is implemented. Another valuable function within the Orchestrator is the “Jobs”-section, where any member of the folder can see whether the process execution was successful. If the execution was not successful, the user can click on an information icon to see screenshots about the process execution. These screenshots help to understand the problem of the bot.

Besides making two processes run non-attended, the project also had the goal of agreeing on a collaboration concept between ERP Disposition and Logistics for upcoming RPA use cases. This collaboration concept will also help to monitor and control the topic of RPA in general and is consequently also part of the last phase in the BPM lifecycle. The collaboration concept defines roles between ERP Disposition, Logistics, and Business Automation. However, the adaptability of the concept for other departments has been kept in mind. The concept clarifies who is responsible for the programming, for updating the bots, for the processes, the bot users, etc. One aspect of role definition is to define if the employees from the Logistics department want to be enabled in using UiPath themselves or if the programming will be assigned completely to the ERP Disposition department. A meeting with the head of the Logistics team was scheduled to showcase the basics of UiPath. Additionally, I recorded a video tutorial with some basics on how to program an attended bot that opens SAP, executes a transaction, copies data, and pastes the data in an output message box. This video has been watched by colleagues from Logistics and lead to the decision that the department will leave the responsibility of programming to ERP Disposition. The relevant parties for the collaboration concept are the ERP Disposition department, the Business Automation department, and the Logistics department. Figure 18 provides a BPMN model of the planned collaboration concept for new use cases.

Figure 18: Collaboration Concept for new use cases as BPMN model



Source: Own work.

Since all departments belong to the same parent company, I decided to model the three departments within the same pool, called "Selected Company". Each department has its swim lane and within the collaboration concept for new use cases, the Logistics department initiates the process. The first thing when planning to automate a process with RPA is to identify an RPA use case. This responsibility is assigned to the Logistics department because they know their processes best. Since RPA is currently an important topic in the company, the challenge will rather be to decrease the number of inquiries than to inspire colleagues to consider RPA as a solution for their processes. Reasons for the popularity of the topic are the following.

In general, the employees welcome the idea of not being obliged to do repetitive processes manually anymore so many employees already started to consider automation solutions for their processes. Also, there are monthly meetings organized by a colleague from Business Automation and from the Finance department which is currently the department with the most experience with RPA. The meetings are called "RPA-Community" where all employees who are interested in RPA can join and talk about their current use cases or their pain points while developing new bots. I attended the meetings regularly showcased our bots or gave updates about our project status. The RPA-Community meetings lead to even more interest in the topic. Also, whenever a colleague starts a project in their department, the head of the project sends the project description to the entire company email distribution list. Consequently, the entire company continuously gets to know about current RPA cases.

To help in deciding if a use case is suitable for RPA, I designed a questionnaire that is accessible for all employees of the company through a SharePoint link. The questions are similar to the questions from the first questionnaire in the kick-off PowerPoint slides but with more detailed questions e.g., about systems that are used in the process. Whenever an employee feels like his process could be automated with RPA, he or she should first click through the questionnaire. I implemented the questionnaire by using MS Forms since this tool is used by the company for questionnaires. MS Forms is a tool provided by Microsoft which enables the user to create surveys, quizzes, and questionnaires. Furthermore, the answers are saved and can be used as a basis for upcoming meetings.

The benefit of introducing the MS Forms questionnaire is that the quality of the requests will potentially increase since the inquirer already provided important information about the process within his questionnaire responses and requests which are completely non-suitable for RPA will not even be posed. The questionnaire contains 23 questions in total. MS Forms allows to do question branching, so depending on the answers not all questions are asked. The questionnaire includes mainly yes or no questions like "Are all process steps known?" or "Does the process require human intervention?". It also includes questions like "Is the process stable?" where the respondent needs to select between "very stable – no changes since more than one year", "stable – the process might change within a year", "not very

stable – the process might change more than once in a year" or "unstable – the process changes continuously". One question also contains a multiple selection option where the user selects all relevant Office365 tools which are used in the process. After presenting the questionnaire to the Logistics department I was asked to add three free text questions. One question refers to international processes and asks for the number of countries where the process is relevant. This question will help to evaluate the potential economic viability of automating the process. If a process takes 30 minutes daily and is necessary in 10 other countries the company operates in, the potential time savings are consequently 10 times higher. The second question asks for the name of the process, to ease the identification of the evaluation. Also, I was asked to add a question about a rough description of the process which should also help to evaluate whether a process is suitable for RPA or not. The full questionnaire can be found in Appendix 2.

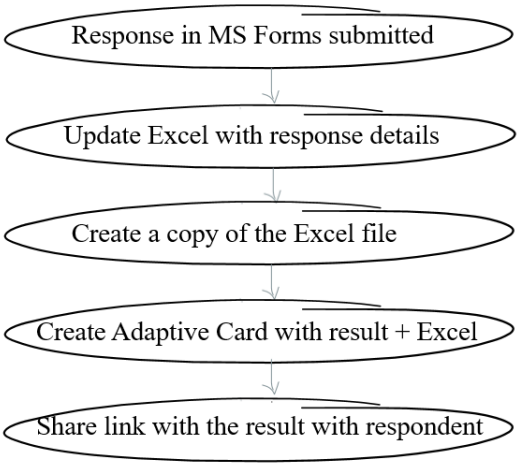
The problem with the sole use of MS Forms is that it is not possible to provide different recommendations for action depending on the different answers. The solution is the creation of a Flow by using Microsoft Power Automate. Compared to UiPath, Power Automate helps to connect different Microsoft Office tools only and organizes them in a so-called "Flow" (Microsoft, n.d.). Consequently, I implemented the evaluation of the questionnaire by creating such a Flow with Microsoft Power Automate. The trigger of the Flow is whenever a questionnaire has been submitted within MS Forms. Then I created an Excel-Mapping file where I assigned points for the answers. If a process e.g., contains system breaks, no APIs between the systems, is rule-based, and repetitive it will get a high score and the respondent will receive a result that indicates that RPA could be a suitable solution for the process. I also defined criteria like e.g., if a process includes unstructured data, is not rule-based, or needs human intervention which will automatically null the scoring of a respondent. For each question, the answers are rated with numbers from 2 to -1. 2 is the highest number a respondent gets per question if the selected answer option suits well for RPA. 1 is the number that is assigned if RPA works but is not the best solution. 0 points are assigned if RPA is not suitable but not a KO criterion. KO criteria are indicated with -1. The other working student and I assigned the points per question based on the knowledge we have about RPA. If a respondent selects an answer which is indicated with -1 in the mapping file, the result will automatically be "KO criterion met" no matter what other answers the respondent gives. An excerpt of the Excel mapping file can be found in Appendix 3.

Furthermore, I inserted additional columns for other process automation options like e.g., SAP automation called Automic and Power Automate. A colleague from the department of Business Automation filled the scoring for Automic. Currently, the Flow considers RPA and Automic only but an extension to more tools is simple to implement. Whenever a response is submitted, the responses are written into a second tab of the Excel file. By using different formulas within the Excel file, I compare the responses with my mapping and get a final result whether RPA is "suitable", "unsuitable but still ask for consultation", "unsuitable" or "KO-criteria met". Also, the flow creates a copy of the Excel File with the given answers

and the current time to differentiate between the answers. The user receives a link after submitting a response that directs to an MS Teams channel. Within the channel, he or she sees the result and the possibility to download the result by clicking a button in an Adaptive Card.

Adaptive Cards are an open card exchange format provided by Microsoft enabling developers to exchange content with users (Microsoft, 2017). By using Adaptive Cards, the problem has been solved of not being able to give different recommendations for action depending on the answers of the questionnaire. The content of the Adaptive Card is partly static and partly dynamic. The introductory text is static, whereas the header, the result for RPA and Automic, as well as the tagged Excel file adjust automatically depending on the answers of the respondent. The introductory text includes information about who to contact for which automation solution. The header includes the process name which has been stated as a response in one of the free text questions to make sure that each respondent identifies his or her Adaptive Card in the MS Teams channel. Figure 19 shows what the Flow does in a simplified way.

Figure 19: Flow



Source: Own work.

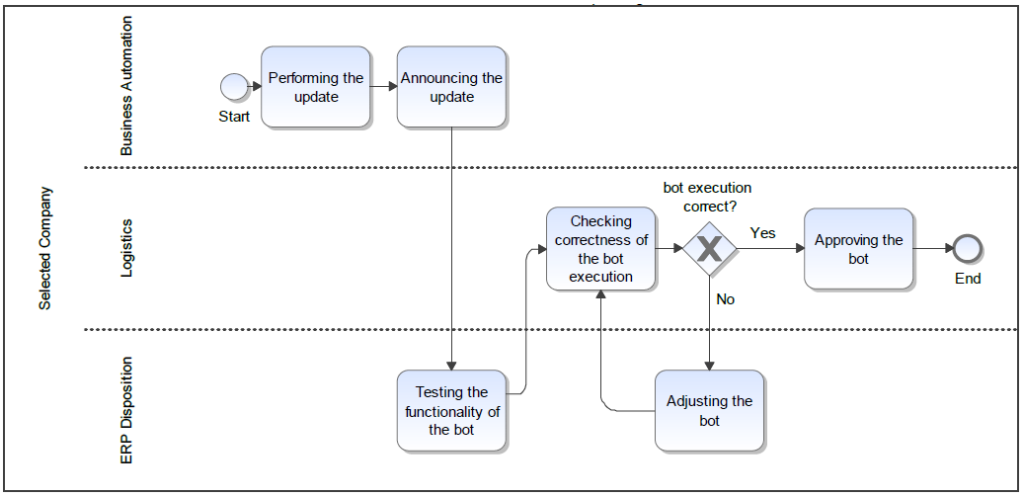
There are several benefits of introducing the questionnaire as a first step in gathering new use cases. One is, that every employee has access to the questionnaire and receives a first orientation on whether RPA could be a suitable solution or not and who to contact. Consequently, the questionnaire is not only valuable for the collaboration between ERP Disposition and Logistics but company-wide. Furthermore, the questionnaire can be extended continuously as the possibilities to automate processes increase. Therefore, the results in the Adaptive Cards can be extended in the future with additional solutions like Power Automate or others. Finally, the MS Forms supports one of the goals which has been defined for the thesis which was to provide a frame of how to find suiting processes for the

usage of RPA. Also, the questionnaire increases awareness about the topic process automation (Cimperman et. al. 2013).

The next step after filling out the MS Forms and receiving the information that the given process is a candidate for RPA, the employee contacts his head of the department first, in the given case the head of the Logistics team. The employee sends the Excel evaluation of the given process to the head of Logistics. The head of the Logistics team gathers all RPA cases and initiates the monthly jour fix with ERP Disposition which use cases should be implemented next and which status the current developments have. For new use cases the ERP Disposition working student arranges a meeting with the process owner from Logistics to talk about the process in detail and to understand the process flow, as well as all exceptions which can occur. Once, agreed on using RPA as the automation solution, ERP Disposition takes up the process as a use case. The next step is the development of the bot. Therefore, the process documentation in form of a video and an MS Teams room for the process is created. Afterward, the programing can take place. Also, the working student from ERP Disposition requests the SAP user roles, arranges meetings for testing and the final "customer approval" by Logistics. For the final approval, I created a facts sheet of the process with a checklist that should be used. The facts sheet contains all relevant information about the process, like a rough process description, the user name and user rights, where to find process documentation, how to proceed in case of a bot crash, and who approved the bot's functionality and content correctness. Once, the bot is approved by Logistics, Business Automation transports the bot to the Orchestrator. Afterward, I can set up the trigger in the Orchestrator to determine when the process should run. The first run will reveal whether additional adjustments are required, or not. If adjustments are needed, these are performed by ERP Disposition. If no adjustments are needed, the bot can run from thereon.

Besides agreeing on how to proceed with new use cases, also the question of how to cope with virtual machine updates needs to be addressed. Therefore, another BPMN model has been created as shown in Figure 20.

Figure 20: Collaboration Concept for virtual machine updates BPMN model

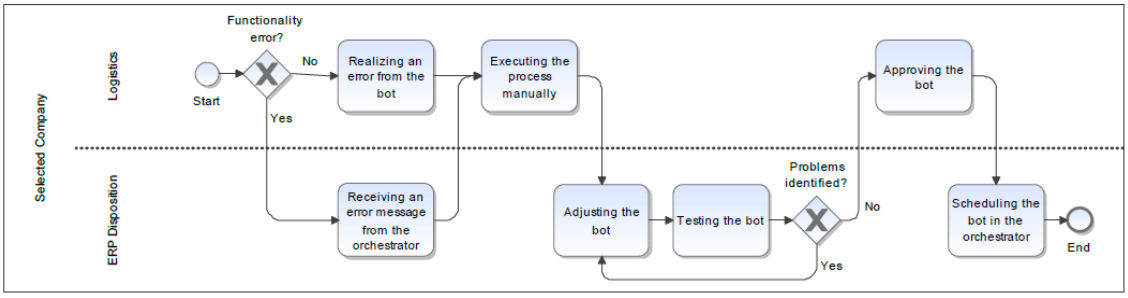


Source: Own work.

The virtual machine updates are triggered by the Business Automation department. After announcing the update, ERP Disposition tests the functionality of the bots, meaning whether any error messages occur while triggering the execution or not. Next, Logistics needs to identify whether e.g., the data generated by the bots is still correct or not. If adjustment is needed, ERP Disposition changes the bot's code before Logistics approves the bot and the process ends.

The last important BPMN model which has been created within the project regarding the collaboration concept tackles the situation of bot errors. Bot errors can occur due to different reasons. The error may be a functionality error, meaning that the bot could not execute the process as desired or a content-wise error. Content-related errors occur when the bot executed the process successfully but generated wrong data due to a specific reason. The BPMN model can be found in Figure 21.

Figure 21: Collaboration Concept bot errors BPMN model



Source: Own work.

Depending on what kind of error occurs, the first activity takes place in the Logistics swim lane or the ERP Disposition swim lane. Errors within the functionality of the bot will be sent from the Orchestrator to ERP Disposition and Logistics, via email. If the bot executes the process successfully but generates wrong data, this will rather be realized by the Logistics department since they have more knowledge about the data and are more likely to recognize mistakes. No matter what kind of error occurs, Logistics needs to execute the process manually until ERP Disposition found the problem and fixed it. After fixing the problem, the bot needs to be tested, approved, and rescheduled in the Orchestrator.

Another relevant aspect about controlling the bots is the companywide agreement of assigning a lifecycle of six months only for each bot. After six months Logistics and ERP Disposition must reevaluate whether RPA is still the best solution for process automation or if another solution would work better. Also, the SAP user roles are limited to six months. The responsibility of adapting the bots if problems arise lies with ERP Disposition. However, Logistics must ensure, that whenever a bot crashes, an employee is still able to execute a

process manually. This is achieved by having a detailed process description that is accessible for all involved employees in the MS Teams channel for each bot.

The last goal within the project is to document all knowledge about RPA and UiPath. All learnings from the project itself have been documented in a Word file and uploaded in the MS Teams room which is accessible for all employees. Also, the MS Teams room contains tutorials for UiPath and all PowerPoint presentations which I created for all the meetings with Logistics. One PowerPoint presentation also contains a summary of the most important facts about RPA and some basics for the usage with UiPath. This PowerPoint presentation has been used as an introductory training which I conducted together with the second working student for another department.

4.6 Project Completion

The project has been completed with a slight delay at the beginning of June 2021. The goals which have been achieved are:

- Automation of two Logistics processes with UiPath.
- Onboarding of the two automated processes on the RPA platform to make them run non-attended.
- Creation of a collaboration concept between Logistics and ERP Disposition for upcoming RPA use cases.
- Filing of relevant documentation in an accessible place.

I wrote a summary of the project completion and distributed the file in the company via email.

To evaluate how successful the project was, the future time savings and amortization period have been calculated. The main goal of the project was not to generate high savings or create the biggest savings possible. It is more about gathering knowledge about a new technology and creating competencies for upcoming automation projects. Still, I estimated the time effort of both processes for the manual execution and compared them with the implementation effort. Assuming, that the "Gross Load Preview" process takes up 10 minutes per day, the monthly time effort for the manual execution equals 3.33 hours, which causes almost 40 hours of time effort per year. The "Availability Maintenance" process takes up to 10-30 minutes. Calculating the monthly time effort by using the arithmetic mean of 20 minutes per process execution, the yearly time effort equals 80 hours. Since the hourly rate for a permanent employee is 90€, this equals personnel costs 10,800 € per year for both processes. Comparing the project costs with the potential savings, the project amortizes after about 7.5 months, so the project is perceived as successful. The calculation can be found in Table 2.

Table 2: Amortization Calculation

	Gross Load Preview	Availability Maintenance	Effort
Time effort per year in hours	40	80	120
Time effort per month in hours	3.33	6.67	10
Personel costs per year in EUR	3,600.00	7,200.00	10,800
Project costs in EUR			6,812.50
Amortization period in years and months			0,63 years/ 7.57 months

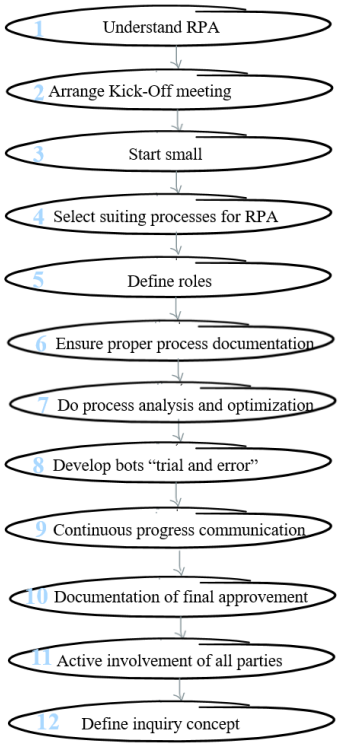
Source: Own work.

5 DISCUSSION

In the discussion, I focus on answering the research questions I posed at the beginning of the thesis based on the theoretical overview and the practical case. The first research question was “How can RPA be introduced in a department?”.

By conducting the case study, I identified several important CSF for the introduction of RPA. The RPA roadmap introduced in chapter 2.2 provides most of these factors. A summary with all the relevant factors I additionally identified can be retrieved from Figure 22.

Figure 22: Adjusted RPA Roadmap



Source: Own work.

The order of these CSF is not obligatory and may differ or some factors need a second iteration depending on the use case. When introducing RPA, the first thing which needs to be done is to understand the technology with all its strengths and weaknesses. This is important to identify suitable use cases and to prevent from seeing RPA as an all-encompassing solution for every process. To achieve this knowledge, I did a lot of research about RPA through the consultation of various literature. Next, I summarized all findings in PowerPoint slides and presented these to the Logistics department. The PowerPoint slides contained a definition of RPA, benefits, and limitations of RPA and the first version of the questionnaire for identifying suitable use cases. The meeting was crucial to give Logistics a first orientation about what the technology can do, to get to know each other, and to motivate the department for the topic. Since I read in different literature sources, that employees may feel like they would lose their job once, RPA is introduced, I tried to focus on showing the benefits of RPA also for employees like e.g., more time for other tasks, better reports due to fewer mistakes, etc. However, in the given case the employees were motivated to introduce RPA from the beginning and no employee mentioned the fear of being replaced by bots. One quote of a colleague about RPA at the beginning of the project was "Let's build bots, so we don't have to be bots". A similar quote can also be found on the UiPath website and serves as the perfect example of the motivation why companies even decide on introducing RPA in the company.

Another important aspect that should be considered when introducing RPA is to start small. In our case, we defined the project goals in the first meetings and the first goal was to automate two processes only, which are also not too complex, and make these two processes run non-attended on the Orchestrator. The two processes which have been selected in the case meet all the requirements for a suitable RPA case but are still slightly different. The "Gross Load Preview"-process copies data from SAP and the "Availability Maintenance"-process also changes data in the system. The differences between the processes helped to prove that RPA can be a good solution for different processes. The amount of two rather simple processes turned out to be a good choice. On one hand, the simplicity of the processes helped that the programming of the bots did not require too much time. Also, the experience which has been generated through the development of the first bot helped to develop the second bot faster.

For developing the bots, an RPA provider is needed, which is another aspect for a successful introduction of RPA. In our case, the provider UiPath has already been selected as the programming software, and as the provider of the Orchestrator for making the processes run non-attended. Consequently, the selection was not in the scope of the project. However, for other cases in other companies, this might be a relevant topic, so the different providers on the market need to be compared.

However, before starting to program the bots, another relevant aspect for the introduction of RPA is to define roles for all employees being involved in the project. In our case, the Logistics employees expressed no interest in programming the bots themselves, so this responsibility was assigned to the second working student from ERP Disposition and me. This required us to deep-dive into understanding how the programming with UiPath works through consulting various online tutorials. Our experience showed that it works best to use the "trial and error"-method when programming with UiPath. The first activities which are e.g., needed to log into SAP are simple click-activities, so even without a programming background, the first steps in UiPath can be taken very quickly. Whenever more complex problems came up, googling the error message and consulting different online communities or video tutorials helped since the UiPath community is very strong. An aspect that has been given little consideration only in our case but should not be neglected is the process analysis and optimization. The added value of automating inefficient processes is a lot smaller than when automating optimized processes.

Also, very detailed process documentation is needed. In our case, this documentation must be provided by the employees from Logistics. The process documentation is another crucial aspect when introducing RPA due to various reasons. On the one hand, process documentation is needed as a basis for the programming. In our case, we decided that a video where an employee executes the process manually works best since RPA is surface automation. Consequently, having a video demonstration of what must happen on the surface served as a perfect basis for the programming. Also, it was useful to record the process execution in a meeting so whenever I or the second working student had questions about the process or asked about exceptions within the process, these aspects were clarified in the meeting and were also part of the recording. On the other hand, the process documentation is also crucial to have a backup whenever the bot may crash due to unforeseen reasons. Therefore, the process documentation must be accessible for the Logistics employees, so they know what to do if a bot crashes. In our case, I created an MS Teams channel for each bot, uploaded all relevant process documentation, and added the process owners. Besides the video recording, I also asked for already existing process documentation in the form of e.g., Word files and uploaded these too. Consequently, the detail level of the process documentation increased due to the introduction of RPA which is considered as a positive aspect of introducing the technology.

Another aspect that helped within the project was to continuously communicate the progress and define the next steps in regular appointments. In our case, we had regular appointments within ERP Disposition which were very helpful. On the one hand, it was motivating to have one day where the progress of one week is presented to the colleagues. On the other hand, it was also often very helpful because when problems came up, colleagues might have an idea for a solution. Also, we always used this regular meeting to define the next steps and clarify who will fulfill which task until when. With Logistics, I scheduled meetings whenever we

achieved a certain milestone like finishing the development of one bot, but we did not have regular meetings.

Whenever a bot is programmed successfully, the next step is to get the final approval of the process owners from Logistics for the bot. In our case, we decided to do this in a meeting, showed the attended version of the bot to the Logistics employee, and afterward write in a created bot facts sheet who approved the bot on what day.

Also, our case showed how important it is to actively involve the department which plans to introduce RPA. This involvement can be described as eye-opening for Logistics in terms of what needs to be done to run non-attended bots. One potential advantage could be that inquiries for bot implementation will be done more consciously. Also, it helped to create an understanding of why the bot implementation may take more time than initially estimated.

The management of inquiries is another aspect that is important for the successful and especially sustainable introduction of RPA in a department. In our case, we created a collaboration concept that defines clear roles. The employees from Logistics are responsible for identifying new cases, filling out the MS Forms, and delivering them to the head of the Logistics team. The head of the Logistics team communicates the new inquiries to ERP Disposition. ERP Disposition arranges an initial meeting with each process owner to find about the process, develops the automation, is responsible for the bot users, requests the user rights, tests, and adjusts the bots. Logistics is responsible for the final approval and Business Automation transports the bots to run productively.

The second research question was “Which are the factors that increase the likelihood that seamless interaction between RPA bots and people can be achieved?”.

One aspect which helps to support the seamless interaction between the bots and the employees is the Orchestrator. In our case, the Orchestrator is managed by the department Business Automation. Within the Orchestrator we have an overview of which bots are scheduled for which time slot, which virtual machine is used for which bot, which bot version is currently used, which bots run successfully, which executions lead to error messages, how the error messages look like etc. The Orchestrator is an important aspect for the seamless interaction between the bots and the employees since it can be seen as the virtual bot manager.

Another aspect that helps to support seamless interaction between bots and employees is to think about possible file merging conflicts due to bots and employees operating in the same files in advance and develop suiting solutions. In our case this became relevant for the “Gross Load Preview”-process since in this process, SAP data is copied and written into an Excel file which is used by the entire department. Before considering RPA, the Logistics department used their internal department drive for all shared files and no SharePoint. This is a rather outdated approach anyways since if one person has opened a file, the file is blocked for others to do changes. In our case, the solution was to switch the Excel file to

SharePoint. Consequently, the introduction of RPA helped in this case to modernize the process in general which is another interesting aspect. RPA can also be a chance to rethink processes and chance them partly to ease automation.

Furthermore, seamless interaction can be achieved by exchanging information between bots and employees. In our case, we developed a sequence in both bots which sends emails to an email distribution list in case of successful execution. Additionally, the Orchestrator triggers emails that are sent to the employees from Logistics, as well as me and the second working student whenever a bot does not run successfully. Receiving this email is a sign for the employee to execute the process manually and for me and the second working student as developers a sign to check whether the bot's code needs to be fixed or to find out which other problems could have led to a bot crash.

The last research question was "How can RPA bots be controlled to avoid security, compliance, and economic risks?".

For the aspect of security and compliance, it is of high importance to establish a user rights concept for RPA. What needs to be avoided is, that the bots would have more user sights in systems like SAP than the employees. This would lead to mighty bot super users which could potentially lead to a shadow-IT in a company. Such a shadow-IT is problematic due to different reasons like e.g., loss of control about what the bots can do in the systems. This will be problematic to justify in case of potential visits of auditors. In our case, we and the user rights department decided that for all bots operating in SAP, they create a new role. The role is created by recording a trace while an employee executes the process manually. The role is assigned to the bot user and does only contain the rights to execute the process and nothing more.

Another aspect to avoid security and compliance problems is to define responsible people for the bots and their mistakes. In our case, we initially defined that the head of the Logistics team is responsible for the bot users. The reason was that the bots are handled as new employees, so the head of the team is responsible for his or her new virtual employee. However, due to e.g., testing purposes, it happened several times that I and the second working student needed to log onto the virtual machine to check what the bot does. For the login, we needed to schedule a meeting with the responsible person from Logistics, so that he enters the password into the login screen. This was considered rather unpractical and inefficient. Therefore, the concept was changed, and ERP Disposition took over the user responsibility. Also, ERP Disposition is responsible for the SAP roles and the programming of the bots. These responsibilities are documented for each process in the facts sheet which I created and uploaded in the MS Teams of each bot. The transparent documentation of the process execution, bot characteristics, etc. is another important aspect.

Considering the economic risks of RPA, several aspects that are important. To reduce the economic risk of bots doing mistakes in the system, we agreed to automate non-critical

processes only which do not lead to sales slumps when they are not executed correctly. Also, it helped to have testing systems to ensure that no actual data in the system was changed. For more critical processes other process automation solutions like back-end automation may be a safer solution. The implementation of the MS Forms which provides the user with a recommendation for action will support choosing the most suitable automation solution.

Another important economic aspect of RPA is the calculation of whether the automation of processes leads to savings or not. In our case the focus was not to generate high savings through introducing RPA in Logistics since the project goal was rather to do onboarding and to get familiar with programming in UiPath, understanding how to make processes run non-attended, etc. For the future, economic consideration will become more important since long-term the usage of RPA needs to pay off. When deciding on whether RPA pays off or not it is important to not only consider the programming time effort and compare it to the manual execution time. Our case showed that the effort for programming is only one aspect that consumes time. Getting the necessary user rights, setting up the virtual machines, testing the bots, adjusting them, getting the final approval, uploading the bot in the Orchestrator, updating the assets in the Orchestrator, etc. Consequently, using RPA often takes more time than initially planned. Additionally, also license costs for the bot users cause additional costs.

Besides the answers to all research questions, the project also helped to reveal other interesting aspects about introducing RPA which will be explained in the following:

Overall, the topic of RPA is “hot” in the company. Lots of departments identified different use cases for RPA and started to automate processes. The Finance department, for instance, managed to automate about 10 processes with RPA which run productively. For them, RPA currently serves as a perfect solution for process automation whenever APIs are missing. Also, the marketing department got interested in automating processes with RPA and started their onboarding project. I was part of their kick-off meeting to share the learnings we had in our onboarding project with Logistics. Especially the Finance department proves with 10 processes which run successfully that RPA can be an efficient automation solution.

However, RPA is rather a short to a middle-term solution. A colleague described RPA as “the first step of the automation journey” RPA is a chance not only to automate processes and to make progress in terms of digital transformation. RPA is also a chance to rethink the processes, start to harmonize processes, document processes in a detailed way which is a major improvement for the processes in the company in general. One example of this from the case study is the following.

When automating the process “Availability Maintenance”, the question came up why the Logistics department even needed to manually change the status of inactive data entries in SAP. A better solution would be a development within SAP that whenever a store changes their availability time and the time difference is below 0.75 days, the status in SAP will automatically be set to “active” and not initially always to “inactive”. The discussion would

probably not have been started without the idea of automating the process with RPA and consequently discussing the process activities. However, until the development within SAP has been implemented, RPA serves as a good "quick fix". Another colleague described RPA as "the quick and dirty solution". I agree with this description. RPA is quick since the implementation of bots with UiPath can be done in a few hours to a few days, depending on the process. It can also be described as "dirty" because it has the potential to cover inefficient processes or outdated IT in a company. The idea of assigning a lifecycle of six months only for each bot before it should be reevaluated whether RPA is a solution to face the issue.

With the process "Gross Load Preview" the discussion came up whether the other countries should be contacted to harmonize the process and maximize the time savings generated through RPA. Harmonized processes also pave the way for process automation with other automation solutions. This harmonization of processes could bring major benefits for the company in general. The company currently operates in 14 different countries so if processes are harmonized internationally the time savings created through RPA larger. Due to the limited time frame of the thesis, the international process harmonization has not been considered within the thesis but serves as a potential for future considerations.

One negative aspect of RPA which needs to be discussed is the volatility of bots. In our case, we had different reasons why bots just crashed. One time an MS Teams message randomly popped up, another time the SAP log-in mask showed up at a different place in the window than usual and the bot could not find the field to type in the correct SAP system, etc. An employee would just intuitively close the pop-up message or drag and drop the SAP window into another position. However, the RPA bots are – at least currently – not intelligent enough to do so. Also, whenever updates on the virtual machines are made, this causes additional testing effort and depending on the results of the tests also effort to adjust the bots.

Another example for the missing intelligence of RPA can be found in the "Gross Load Preview" process when considering selecting the correct picking date per distribution center. The colleagues from Logistics know the correct picking date because they are aware of regional holidays and adjust the picking date for the evaluation accordingly. However, the bots do not know it and need clear instructions. The programming sequence which has been implemented to find out the correct picking date is complex since it requires the bot to use additional transactions, iterate over all distribution centers, check whether the displayed picking date is unique, and find the correct picking date. This date searching sequence takes time for the bot since SAP transactions need time to load.

Furthermore, a negative aspect of RPA is related to the Orchestrator. Even though it is possible to assign triggers such as day times to a process, it cannot be guaranteed that the bot executes the process in the exact time needed. This is the case since all bots are stored in a queue. Consequently, if a bot is e.g., scheduled before the "Gross Load Preview" process and needs longer than expected, the "Gross Load Preview" starts later. For time-critical processes, this may cause problems.

Finally, a negative aspect of RPA is that currently, some employees have a lack of trust in the bots. In the first week of running the "Availability Maintenance" process productive, the bot did not send out any emails once. A colleague from Logistics explained, that she did the process already manually earlier that day. If employees do not trust the bot and still do the bot's work manually, the advantage of creating time savings does not happen. However, trust in bots may increase over time if the bots run stable and correctly.

To put the discussion in a nutshell, several aspects should be considered when introducing RPA. The given case revealed some of them but since e.g., the establishment of the infrastructure for RPA was not part of the project, not all relevant aspects are included. Also, the literature describes RPA as a quick solution. However, I only agree partly. The development of bots can indeed happen quickly but the sustainable introduction of a new technology like RPA in a department of a company requires time and money and should not be underestimated. The establishment of concepts such as collaboration concepts and user right concepts are crucial for the introduction of RPA and at least in the given case, this has not been done "quick and dirty" but rather thorough and detailed. Overall, the foundation for the successful introduction of RPA has been created within the project. The future will reveal whether RPA will remain part process automation portfolio in the selected company or not.

CONCLUSION

Within the thesis, three different goals have been defined. The first goal was the implementation of a non-attended automation for two defined Logistics processes in the selected company. This has been achieved by automating the "Gross Load Preview"-process and the "Availability Maintenance"-process with UiPath. Both processes run non-attended on the provided RPA infrastructure and save 120 hours of manual process execution per year if the bots run successfully the entire year.

The second goal was to provide a frame of how to find suiting fields of application and to create an understanding of the limitations of RPA within the targeted department in the selected company. This has been achieved by creating the MS Forms which is accessible for all employees who wish to automate a process. After filling out the MS Forms, the Flow which has been created gives suggestions for actions depending on the characteristics of a process in the form of an Adaptive Card.

Finally, the goal is to create a collaboration concept between RPA developers and users for upcoming RPA use cases. The collaboration concepts which have been created define clear roles for Logistics and ERP Disposition. The concepts help to organize new use cases, define what to do in case of virtual machine updates, as well if errors with the bots are found.

Also, the knowledge which has been generated throughout the project has been documented and accessibly stored in MS Teams. The introduction of RPA worked successfully since all

project goals have been achieved and the Logistics department is still motivated to automate new use cases.

The research limitations are the following: Within the project, I concentrated on the introduction of RPA in one department only. If other departments wish to start using RPA, they will probably still need to start their own onboarding project. However, other departments might be able to solve problems faster by adopting some aspects of the concepts we established in my project or asking me for support as e.g., the marketing department did with their onboarding project. Another limitation is, that the aspect of process redesign and harmonization with e.g., the same processes from other countries has been neglected in the project due to the limited time frame. However, harmonizing processes within the countries before automating them with RPA saves even more time and serves as an idea for future research.

The core future research question could target the mid-term governance of RPA in a company. The thesis' project endured three months only, so analyzing the long-term potentials, benefits and eventual drawbacks of an RPA introduction may reveal additional interesting insights. Additionally, one aspect which should be considered in the future targets the establishment of a center of competence in the company for RPA use cases. The urgency of creating such an instance depends on the number of inquiries for RPA implementations. A benefit of establishing such a center of competence may be higher efficiency in the bot development and increased bot quality. A potential drawback could be that adjustments would need more time due to limited resources in the center of competence.

Possible future research could also be to measure whether the benefits which are typically associated with RPA become reality in the selected company. As stated in the introduction, these benefits are e.g., fewer mistakes in process execution, higher process throughput, and employees having more time available for more complex problems in the company and feeling more valued.

Furthermore, another aspect of possible future research work could be to automate processes with different automation methods such as back-end automation and compare how much more time it would need to automate processes differently and also which quality differences another automation method would cause.

To conclude, RPA is a technology with a lot of potentials to generate savings but also with some drawbacks which need to be considered to successfully introduce the technology. The future will reveal how the technology develops. Interesting aspects will be whether AI will be successfully combined with RPA or not. Also, the collaboration of bots and humans in the future will be an interesting topic. Furthermore, the question if the technology RPA stays relevant will be answered in the future. Considering the findings within my case study, RPA will stay relevant. Probably, RPA will develop further by integrating other technologies such as artificial intelligence or machine learning to overcome the current drawbacks.

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APPENDICES

Appendix 1: Povzetek (Summary in Slovene language)

Glavna tema diplomske naloge je uvedba robotske avtomatizacije procesov v logističnem oddelku. RPA je krovni izraz za programska orodja za avtomatizacijo ponavljajočih se in preprostih procesov s programiranjem robotov, ki delujejo tako, kot bi delovali ljudje (Gartner, n.d.). Cilj RPA je, da naloge, ki so jih sprva opravljali ljudje, v razmerju 1 : 1 oprvijo roboti. Z uporabo površinske avtomatizacije je mogoče RPA uvesti brez večjih sprememb katerega koli aplikacijskega sistema, ki ga uporablja podjetje. Poleg tega lahko RPA privede do manjšega števila napak, ki jih delajo ljudje, večje prepustnosti procesov in posledično večje učinkovitosti (Santos, Pereira in Vasconcelos, 2020). Čeprav se avtomatizacija procesov pogosto dojema kot koristna, ima RPA tudi nekaj slabosti. Zato je pomembno razumeti, kako izbrati primerne procese za RPA (Santos et al., 2020).

Namen diplomske naloge je prispevati k razumevanju pomena, potencialov in koristi uvajanja RPA. Najprej je cilj diplomskega dela analiza možnosti avtomatizacije za dva opredeljena logistična procesa v maloprodajnem podjetju. Drugič, namen diplomskega dela je zagotoviti okvir, kako najti ustrezna področja uporabe, in oblikovati oceno o omejitvah RPA za določene primere uporabe v proučevanem podjetju. Ta okvir bo pomagal povečati verjetnost trajnostne uvedbe RPA v oddelku. Tretji cilj je ustvariti koncept sodelovanja med razvijalci in uporabniki RPA za prihajajoče primere uporabe RPA. Diplomsko delo odgovarja na naslednja raziskovalna vprašanja:

- Raziskovalno vprašanje 1: "Kako je mogoče uvesti RPA v oddelek?"
- Raziskovalno vprašanje 2: "Kateri so dejavniki, ki povečujejo verjetnost, da bo mogoče doseči nemoteno interakcijo med roboti RPA in ljudmi?"
- Raziskovalno vprašanje 3: "Kako je mogoče nadzirati RPA-boote, da se izognemo varnostnim in ekonomskim tveganjem ter tveganjem glede skladnosti?".

Diplomsko delo je nastalo v sodelovanju s hčerinsko družbo maloprodajnega podjetja. Zaradi zaupnosti imena podjetja v celotnem diplomskem delu ne bom navajala. Za zbiranje podatkov uporabljam tako primarne kot sekundarne podatke. V prvem delu magistrskega dela opravim podroben pregled literature, vključno s knjigami, novejšimi raziskovalnimi članki, članki in študijami primerov. V drugem delu diplomskega dela izvajam polstrukturirane intervjuje z lastniki logističnih procesov v izbranem podjetju, da bi pridobil vpogled v procese. Posnamem videoposnetke ročnega izvajanja procesa kot podlago za programiranje in kot rezervno rešitev za morebitne težave z roboti. Poleg tega pregledam notranjo dokumentacijo procesov, kot so npr. navodila za uporabo v datoteki MS Word. Nato ustvarim procesne modele obeh procesov in koncepta sodelovanja z uporabo zapisa za management poslovnih procesov (BPMN 2.0).

Appendix 2: MS Forms

The questionnaire serves as an orientation aid for every employee who wants to automate a process. It is accessible for all employees within the company. For all questions marked with a »*« an answer is required. The goal of the questionnaire is to clarify relevant questions about the feasibility of process automation for a given process in advance. Also, it provides a tendency which automation option is suitable. Finally, the questionnaire increases awareness for RPA in the company. After completing the questionnaire, the result and the evaluation is displayed to the respondent. Filling out this questionnaire is the first step in the collaboration concept.

Decision Matrix Process Automation

The questionnaire serves as an orientation aid for every employee who wants to automate a process. The goal is to clarify relevant questions in advance and to convey a tendency whether or which automation option is suitable.
After completing the questionnaire, a team room can be called up via the displayed link in which an adaptive card with the result and the evaluation is displayed.

* Erforderlich

1. Are all process steps known? *

- ◯ Yes, all regular process steps and exceptions are known.
- ◯ No, the process steps are not yet clearly definable.

2. How stable is the process? *

- ◯ Very stable - no changes for over a year.
- ◯ Stable - the process changes possibly within a year.
- ◯ Not very stable - the process could change several times within a year.
- ◯ Unstable - the process is constantly changing.

3. Does the process require human intervention ? e.g. confirmations, signatures, etc.? *

- ◯ Yes
- ◯ No

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4. Which data types are used in the process? *

- ◯ Exclusively structured data (e.g. date, article numbers).
- ◯ Exclusively structured data (e.g. date, article numbers).
- ◯ Structured and unstructured data.

5. Are there system breaks in the process (e.g. SAP, Excel & emails are used)? *

- ◯ Yes, I use multiple applications.
- ◯ No, I work exclusively in one application.

6. Which application is used? *

- ◯ SAP
- ◯ Office365
- ◯ Web Browser
- ◯ Other

7. Is SAP used in the process? *

- ◯ Yes
- ◯ No

8. Does the process use Microsoft Office 365? *

- ◯ Yes
- ◯ No

9. Which Office365 tools are used? *

- [ ] Excel
- [ ] PowerPoint
- [ ] Teams
- [ ] Forms
- [ ] Word
- [ ] OneNote
- [ ] OneDrive
- [ ] Other

10. Is Outlook used in the process? *

- ◯ Yes
- ◯ No

11. Does a systemic interface exist between the applications used? *

- ◯ Yes
- ◯ No
- ◯ I am not sure.

12. Is the process mission critical? *

- ◯ Yes - A faulty run has an immediate impact on presence gaps, loss of sales, production problems, etc.
- ◯ No - If the process cannot be automated for up to five days, it is bearable.

13. How rule-based is the process? *

- ◯ Complete - It is known exactly when which process step has to take place.
- ◯ Moderate - If the process runs as desired, the steps are defined and rule-based, but if there are exceptions, they are not.
- ◯ Not at all - The process regularly requires individual decisions.

14. Can decisions be mapped via ML or AI in the future? *

- ◯ Yes, could be.
- ◯ No, rather not.

15. Is the process internationally relevant? *

- ◯ Yes
- ◯ No

16. In how many countries is the process relevant? (Please enter number) *

17. Is the process already internationally harmonized (e.g. excels used have the same layout)? *

- ◯ Yes
- ◯ No

18. How is the complexity of the process assessed? *

- ◯ High - more than 10 process activites
- ◯ Medium - from 5 up to 10 process activites
- ◯ Low - less than 5 process activites

19. How often does the process run through? *

- ◯ Yearly
- ◯ Monthly
- ◯ Weekly
- ◯ More than once a week
- ◯ Daily

20. How much time does the process take per run? *

- ◯ <5 minutes
- ◯ 5-10 minutes
- ◯ 10-30 minutes
- ◯ 30-60 minutes
- ◯ >1 hour

21. How high a priority is automation rated? *

- ◯ 1 - very high
- ◯ 2 - moderate
- ◯ 3 - low

22. Assign a short title for the process including area (e.g. Logistics Availability Maintenance). NOTE: Please do not use any special characters! *

23. Describe the process roughly in max. 3 sentences. *

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Source: Own work.

Appendix 3: Excel Mapping File

The Excel mapping file includes the different questions in the first column. The second column inlcudes the different response options for each question. The third column includes the rating per answer for UiPath, whereas the fourth column includes the rating for Automic with the values -1, 0, 1, 2. Depending on the answers of the respondent, the user receives a rating. The second table below the mapping defines what the rating implies regarding the different automation possibilities UiPath and Automic.

Figure 1: Overview Excel Mapping File

Question	Option	UiPath RPA	Automic
Are the process steps known?	Yes, all regular process steps and exceptions are known.	2	2
Are the process steps known?	No, the process steps are not yet clearly definable.	-1	-1
How stable is the process?	Very stable - no changes for more than a year.	2	2
How stable is the process?	Stable - the process might change within a year.	1	1
How stable is the process?	Not very stable - the process could change several times within a year.	1	0
How stable is the process?	Unstable - the process changes continuously	0	-1
Does the process require human intervention ? e.g. confirmations, signatures, etc.?	Yes	0	0
Does the process require human intervention ? e.g. confirmations, signatures, etc.?	No	2	2
Which data types are used in the process?	Exclusively structured data (e.g., date, part numbers).	2	2
Which data types are used in the process?	Exclusively unstructured data (e.g., images, undefinable data types).	0	-1
Which data types are used in the process?	Structured and unstructured data.	-1	-1
Are there system breaks in the process (e.g. SAP, Excel & emails are used)?	Yes, I use multiple applications.	2	2
Are there system breaks in the process (e.g. SAP, Excel & Emails are used)?	No, I work exclusively in one application.	0	1
Which application is used?	SAP	2	2
Which application is used?	Office365	2	0
Which application is used?	Web Browser	2	-1
Which application is used?	Other	2	0
Is SAP used in the process?	Yes	2	2
Is SAP used in the process?	No	1	1
Is Microsoft Office 365 used in the process?	Yes	2	0
Is Microsoft Office 365 used in the process?	No	1	1
Which Office365 tools are used?	Excel	2	0
Which Office365 tools are used?	PowerPoint	1	0
Which Office365 tools are used?	Teams	2	0
Which Office365 tools are used?	Forms	1	0
Which Office365 tools are used?	Word	1	0
Which Office365 tools are in use?	OneNote	1	0
Which Office365 tools are in use?	OneDrive	2	0
Which Office365 tools are used?	Other	1	0
Is Outlook used in the process?	Yes	2	0
Is Outlook used in the process?	No	0	1
Is there a systemic interface between the applications used?	Yes	0	2
Is there a systemic interface between the applications used?	No	2	0
Is there a systemic interface between the applications used?	I am not sure	1	1
Is the process mission critical?	Yes - An incorrect run will have an immediate impact on attendance gaps, l	0	2
Is the process mission critical?	No - If the process cannot be run automatically for up to five days, it is tole	2	2
How rule-based is the process?	Complete - It is known exactly when which process step has to take place.	2	2
How rule-based is the process?	Moderate - If the process runs as desired, the steps are defined and rule-ba	0	0
How rule-based is the process?	Not at all - The process regularly requires individual decisions	-1	-1
Can decisions be mapped via ML or AI in the future?	Yes, could be.	1	0
Can decisions be mapped in perspective via ML or AI?	No, rather not.	0	0
Is the process internationally relevant?	Yes	1	2
Is the process internationally relevant?	No	0	1
Is the process already internationally harmonized (e.g. used Excel's have the same layo	Yes	2	2
Is the process already internationally harmonized (e.g., used excels have the same layo	No	1	1
How is the complexity of the process estimated?	High - more than 10 substeps	0	2
How is the complexity of the process estimated?	Medium - from 5 to 10 steps	1	2
How is the complexity of the process estimated?	Low - less than 5 steps	2	2
How often does the process run?	Annual	0	2
How often does the process run?	Monthly	0	2
How often does the process run?	Weekly	1	2
How often does the process run?	Several times a week	1	2
How often does the process run?	Daily	2	2
How much time does the process take per run?	<5 minutes	0	2
How much time does the process take per run?	5-10 minutes	1	2
How much time does the process take per run?	10-30 minutes	2	2
How much time does the process take per run?	30-60 minutes	2	2
How much time does the process take per run?	>1 h	2	2
How high is the priority of the automation estimated?	1 - very high		
How high is the priority of the automation estimated?	2 - medium		
How high is the priority of automation rated?	3 - low		
In how many countries is the process relevant?	Numbers from 1-14		

Source: Own work.

Table 1: Rating Overview

	UiPath	**Automic**
Suitable	>20	>20
Rather unsuitable, but ask for consultation	20-15	20-15
Unsuitable	0-15	0-15
KO criterion met	-1	-1

Source: Own work.