Implementation of Robotic Process Automation in a Retail Company

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KEYWORDS

Business Process Management, Robotic Process Automation, Critical Success Factors

ABSTRACT

In recent years, Robotic Process Automation (RPA) has emerged as a tool to automate processes to bring higher productivity, process speed, lower costs, and errors in process execution. However, many companies are uncertain on if, how, and when to use RPA. Therefore, the purpose of this paper is to explain what RPA is and to provide core messages for companies on:
1. How to choose suitable processes for RPA,
2. What to look out for during implementation, and
3. Which factors can influence the successful introduction of the technology.
The conduction of a case study in a German retail company helped to reveal this information.

INTRODUCTION

Every company has business processes that need to be done regularly. Depending on the process, the activities within a process can be complex or relatively simple and repetitive. Especially for those simple, structured, non-critical processes, human intervention is not necessarily needed (Power et al., 2017). Extracting data from an Enterprise Resource Planning (ERP) system, export it to Excel, and process the data to create a weekly or daily report is a typical example. Since continuous improvement is crucial for companies, 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 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 quickly without major changes to any application systems used by the company. Furthermore, RPA may lead to fewer mistakes made by humans, higher process throughput, and consequently increased efficiency (Santos et al., 2020).

RPA bots can either run attended or non-attended. Attended bots run on the desktop of an employee. Usually, the employee develops the bot himself, triggers it when needed, and watches the bot execute the process steps. Non-attended bots run on virtual machines. The orchestration is organized centrally by using a cockpit (Langmann and Turi, 2020). The cockpit triggers the process execution. One main benefit of non-attended bots is that employees can fulfil other tasks while the bots execute the processes (Koch and Fedtke, 2020).

The importance of RPA is illustrated by the Gartner report that current spending by companies on RPA software was above $1.5 billion in 2020 and is predicted to expand to $2.9 billion in 2021 (Rauch, 2020). Further, Deloitte estimated that RPA will hit almost universal adoption in companies by 2023 (Casey, 2020). The COVID-19 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 (APIs) through the usage of surface automation (Koch and 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 can influence the success of RPA projects are not well identified yet. The main research question of this paper is "Which factors should be considered when aiming to introduce RPA in a company or a department of a company?".

A case study conducted in a German retail company provides an analysis of the possibilities and outcome of RPA

by implementing non-attended automation for two defined logistics processes. Conducting the case study in the selected company, led to some lessons learned. These lessons learned may help other companies trying to implement RPA too. Therefore, these lessons learned are summarized in this paper as well as the benefits and drawbacks of an introduction to RPA. Finally, possible future developments of the technology are presented.

CASE STUDY

Methodology

The research strategy of this work is a case study. A case study is a deep analysis of a research object and its environmental conditions (Oehlrich, 2019). The research objects for this work are the logistics processes of the selected retail company.

For the discovery of the relevant processes in the logistics department, semi-structured interviews with one to two responsible employees of the department for each process were conducted. Depending on the complexity of the process, additional questions were asked. The goal of the interviews was 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 was to enable the evaluation of whether RPA is a suitable automation method for the given process or not. Lastly, the manual execution of the process was 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.

Existing process documentation within the department was used for process automation. Both processes were modelled with BPMN 2.0 notation which is generally understood by business users. BPMN 2.0 notation allows the creation and visualization of end-to-end processes by providing a set of rules and conventions for the model (vom Brocke and Rosemann, 2010).

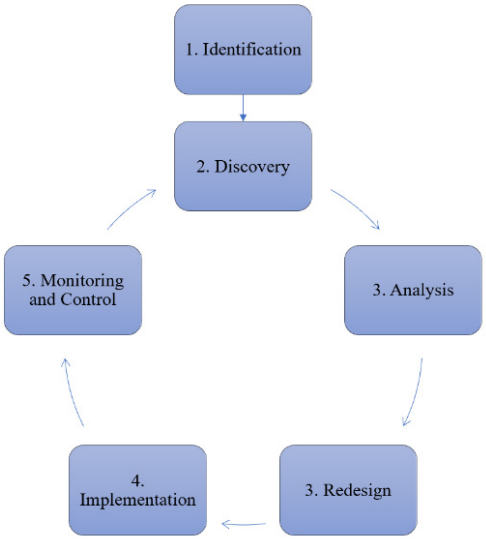
AS-IS Situation

Firstly, a suitable RPA software provider (in this case UiPath) needed to be found. UiPath is the current market leader in RPA software solutions (Gartner, 2020). They gave a strong partner ecosystem with more than 250 technology partners, a strong development community, and many learning resources like online training (Ray et al., 2020). UiPath can also be used for other purposes like e.g., process mining or testing automation. Also, the RPA infrastructure, including the setup of virtual machines, purchase of licenses, etc. and the assignment of responsible employees for the RPA infrastructure, was done.

For attended bots, each employee in the company 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.

Project Execution

The BPM lifecycle is often used to structure and manage business processes (Bergener, et. al., 2019). It also improves the understanding of the role of technology within BPM (Dumas et al., 2013). Since RPA is a new technology, the BPM lifecycle provides a suitable structure for the different phases of the case study's project execution. The BPM lifecycle consists out of the following phases: process identification, discovery, analysis, redesign, implementation, monitoring, and control (Flechsig et al., 2019).



Identification

The first phase in the BPM lifecycle is the identification phase. However, the technology of RPA needs to be understood first. An initial kick-off meeting with the logistics employees introduced the idea of RPA in the department. Within the meeting, the definition of RPA has been introduced, as well as important characteristics for processes that can be automated with RPA, and the benefits of introducing RPA. Next, it was necessary to find suiting processes for RPA.

For the actual identification of RPA candidates, eight questions that should be answered with "yes" and two questions requesting additional information about a process have been defined. The questions aim to cover all must-criteria for RPA. The goal of the questionnaire was to identify two use cases where RPA can be a good solution. The questions are the following:

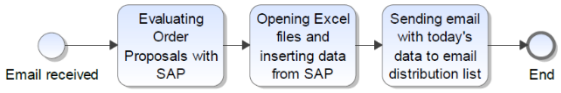
- Is the process rule-based? (It is possible to create a process model without too many exceptions.)
- Does the process include structured data only? (The input data is electronic and has a defined format, e.g., item number, prices, etc.?)
- Is the process repetitive? (The process is executed regularly, e.g., weekly or daily.)
- Is the process stable? (The process is not new and will not change soon.)
- Are no activities included which need to be done manually? (The process does not require any non-digital activities, e.g., signatures.)
- Is the process itself non-critical for the company? (If the bot crashes, this has no immediate impact.)
- Is it possible to provide a timeframe when the bot can run the process without interruptions?
- Does the process contain system breaks? (Are different tools and systems like, e.g., SAP, Excel and Email used in the process?)

Additional information:
- How complex is the process? (Low, middle, high)
- How long does the process execution need? (In hours per week)

The logistics department was asked 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.

Discovery
The next phase in the BPM lifecycle is the discovery phase. This phase thematizes understanding the processes in detail and create the AS-IS models. Therefore, one meeting per process has been scheduled to conduct semi-structured interviews. In the meetings, the manual execution of the processes has been recorded in a video. Also, any existing process documentation has been gathered, all questions about the processes have been clarified and eventual exceptions in the process execution have been documented.

The first process is called “Gross Load Preview”. Figure 2 shows the BPMN model of the process. Since it contains three activities only, the process complexity is rather low. The entire process is executed in the logistics department.



The process is executed daily by any employee from logistics, so it meets the requirement of repetitiveness. 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. 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 to an email distribution list.

Each morning, at around 7:30 AM, the logistics department receives an automated email informing the employees about 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, the picking date can vary 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 manually. For the bot implementation, clear rules are needed. 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 needs to be exported in an Excel file. Usually, the process needs to be executed from Monday to Friday. On the weekends, no data would be found in the relevant SAP transactions. However, it may happen that the bot needs to run on a Saturday. The company has some “logistics Saturdays” especially in November and December before Christmas. To integrate the “logictics Saturdays”, the bot has been scheduled to run from Monday to Saturday. If the bot does not find any data, it is not supposed to crash but writes an email that it did not find any data due to holidays or no “logistics Saturday”.

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 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.

The last step in the process is to send an email to a defined list with an excerpt of the two Excel files showing the picking units for the most recent picking date for all distribution and pre-distribution centers. After that, 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 are 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 “Availability Maintenance”. Figure 3 explains the process flow in the form of a BPMN model.

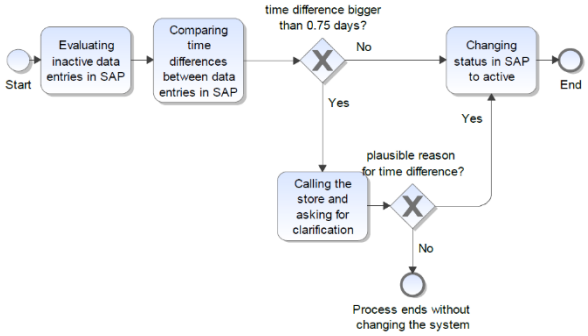


Figure 3: BPMN model "Availability Maintenance", own representation

Each store can change its availability times for delivery whenever needed. Any changes to the availability times cause inactive data entries which need to be changed to active within the process. The process is also executed daily and needs about 10-30 minutes for an employee. The process needs to be executed before 3 PM. The process looks as follows:
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. The store identification numbers need to be copied and pasted into another transaction. Also, the most recent date indicated needs to be copied for the second transaction.

The next SAP transaction changes the availability entries. The employee enters the store identification numbers, the most recent date from the previous transaction minus one day and executes. The employee sees a table with different data entries. 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. 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. However, there is still one interesting difference compared to the first process. The “Availability Maintenance” 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 reason why RPA is beneficial for this process is that it has to run on the weekends. Stores may change their availability times 24/7, so even on e.g., Saturdays. Since no office employees are available to adjust the status in SAP, the request would have the status “inactive” until Monday. By implementing the process with RPA, this problem would be solved.

Analysis and Redesign
The next two phases in the BPM lifecycle are the analysis and process redesign phases.

The “Gross Load Preview” process has been slightly redesigned before developing the automation. 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 on a table was sent instead of the screenshot.

Another aspect that has been redesigned in the “Gross Load Preview” process is the location of the Excel files. Beforehand, the employees used an internal drive to save their Excel files which meant that only one person at a time could work on a file. Consequently, if the bot aims to write in an Excel file that is locked by another user, the bot will crash. Informing the employees in the department that, e.g., 6-7 AM, no one should access the Excel files was not 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. 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. Due to bad experiences with the VLOOKUP solution in the past, also this idea was discarded. Since the company plans to switch to SharePoint during 2021 anyway, the traditional drives will not be used anymore. These circumstances led to the decision to create a SharePoint where the bot saves the updated Excel file daily. This can be seen as process optimization.

Also, the “Availability Maintenance” process has been redesigned. The employees need the information 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. 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.

Implementation
The next step in the BPM lifecycle is the implementation of process automation. In this case, the phase includes primarily the programming with UiPath. 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 easy to implement since it consists of click and write activities only.

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 decide whether it can change the status by itself or should write the information of the entry in an email.

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. The passwords are encrypted as credentials in the Orchestrator. Through using the activity "Get-Credential", the bot gets the password and username without anyone knowing the password. This solves 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 more experience with programming in UiPath. Also, some sequences could be reused like the "log into SAP" sequence. Consequently, the initial programming did not take a lot of time.

After the bot development, the bots needed to be tested. The tests showed how volatile the implementation with RPA is. Differing language settings within, e.g., Excel or SAP or different GUI settings in SAP cause bots to crash. However, the goal was to run the bots on virtual machines whose settings would not be changed without an announcement by the Orchestrator administrators. Another problem that came up during the testing was that the bot always crashed 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. 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 was to block any automated program starts in the task manager of the virtual machine. Furthermore, bots crashed because the bot tried 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 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, but one distribution center did not pick in the selected time interval. These exceptions were intercepted by adding a sequence that causes the bot to skip the distribution center when the table is empty.

The bot needs about three minutes for the execution of each process. The reason why the bot is not faster than three 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. However, the bot is about 30 minutes faster than manual execution. After two weeks of testing the attended bots and fixing all issues, the bots ran stable.

To let the bots run non-attended on the provided infrastructure different steps need to be considered too. The first step required is to request a service user in the identity management system of the company for the bot.

Next, it is important to assign different Active Directory (AD) groups to the user. These AD groups control which access 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, e.g., Excel as well as an SAP user with appropriate SAP roles. Since a lot of damage can be done by mistakenly changing data in the productive system, the SAP user rights management is very strict. The company has an entire department being responsible for user rights management. The idea of assigning user rights to bots was initially seen as a high risk. A solution is to strictly define a role per process. In a meeting between the user rights department, 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 needs read- or also write rights per transaction. Next, the user rights department created the role per process by using a predefined name. The role has been tested by executing the processes once manually with the bot user.

Another step is to set up the virtual machine. This is done after all user rights have been received. The internet connection, SAP GUI settings, and user rights, Office365, SharePoint etc., needs to be set up and tested.

Also, the two bots need to be uploaded to the Orchestrator. Furthermore, the process triggers needed to be set up in the Orchestrator. The "Gross Load Preview" process needs to be executed before 8 AM and the "Availability Maintenance" before 3 PM. Therefore, the daily execution time for the "Gross Load Preview" process is set 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. After all the mentioned steps, the bots can run non-attended.

When both bots started running productive, daily checkups were made for one week to verify whether the data generated by the bot matches the data of the manual process execution. Some further exceptions were found, so the bots needed additional adjustments. One example is that within the "Availability Maintenance" the bot will not send out an email if no data needs to be changed for this day. A sequence has been added in the bot's code so that the logistics department receives an email that informs them that no changes were made.

Monitoring and Control
The last phase in the BPM lifecycle is the monitoring and control phase. The Orchestrator is the tool to monitor and control the non-attended bots. One important tab is the "Automations"-tab. This tab includes the function to trigger the processes. Consequently, the employees can trigger the processes manually. 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 and the screenshots about process execution.

DISCUSSION

The research question was "Which factors should be considered when aiming to introduce RPA in a company or a department of a company?".
Although RPA is sometimes portrayed as a quick fix of the processes, it can be challenging to achieve the business benefits. The case study revealed 20 different lessons learned which can increase the likelihood of a successful RPA introduction in a company:

Lesson Learned 1 - Understanding the technology: Understanding the technology with all its strengths and weaknesses is important to identify suitable use cases and to prevent from seeing RPA as an all-encompassing solution for every process. A lot of research about RPA with the use of various literature must be done by the employees aiming to introduce RPA in a company.

Lesson Learned 2 – Communicate RPA knowledge: The findings about RPA need to be communicated in the company to ensure that the knowledge is accessible for all. The benefits of RPA need to be communicated transparently and understandable. These benefits are, e.g., more time for other tasks, better reports due to fewer mistakes, etc.

Lesson Learned 3 – Define suitable RPA cases: The questionnaire introduced in the "identification" section of the paper provides an orientation which questions may help identifying suitable RPA cases.

Lesson Learned 4 – Start small: Within the case study, two simple processes have been automated. The two processes meet all the requirements for a suitable RPA case. The differences between the processes helped to prove that RPA can be a good solution for different processes. 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.

Lesson Learned 5 - Choose an appropriate RPA provider: The software vendor market should be analyzed to find an RPA vendor which fulfills the specific requirements of the company.

Lesson Learned 6 – Role definition: All involved employees should have defined roles. This means it needs to be documented who is the process expert, who is responsible for the bot development, for the bot users, for the RPA infrastructure, etc.

Lesson Learned 7 - Process analysis and optimization: The added value of automating inefficient processes is a lot smaller than when automating optimized processes. RPA can also be a chance to rethink processes and change them partly to ease automation. Consequently, the introduction of RPA can help to modernize processes in general.

Lesson Learned 8 - Process documentation: A very detailed process documentation is needed e.g., as the basis for the programming. In the given cases, a video where an employee executes the process manually was the best solution since RPA is surface automation. Also, it was useful to record the process execution in a meeting so the questions about the process and its exceptions were clarified as part of the recording. The process documentation is also crucial to have a backup whenever the bot may crash due to unforeseen reasons.

Lesson Learned 9 – Consider User-Bot interaction: The interaction between bots and users should be a seamless as possible. Therefore, e.g., possible file merging conflicts due to bots and employees operating in the same files should be avoided. The usage of SharePoint instead of internal department drives can be a possible solution.

Also, adding a sequence in the bot's code where the bot saves the current file before changing anything can prevent issues with files. Furthermore, seamless interaction can be achieved by exchanging information between bots and employees. In the case study, both bots send emails to an email distribution list in case of successful execution. Additionally, the Orchestrator triggers emails that are sent to the employees whenever a bot does not run successfully. Receiving this email is a sign for the employee to execute the process manually and for the 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.

Lesson Learned 10 – Communication of progress: Continuously communicate the progress and define the next steps in regular appointments to keep up the motivation. Also, regular meetings help to define the next steps and clarify who will fulfill which task until when.

Lesson Learned 11 – Document final approval: After a bot is programmed successfully, get the final approval of the process owners for the bot. In the given cases, this has been done in a meeting, where the attended version of the bot has been shown to the process experts. The approval made by the process owners has been documented.

However, RPA should not be limited to one-time bot implementation but should provide long-term benefits of the RPA program. For that, the following is needed:

Lesson Learned 12 –Involve the department which plans to introduce RPA: This involvement can be eye-opening for a department in terms of what needs to be done to run non-attended bots. One potential advantage could be that inquiries for a bot implementation will be done more consciously. Also, it helps to create an understanding of why the bot implementation may take more time than initially estimated.

Lesson Learned 13 - Proper Orchestrator: Orchestration provides 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 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.

Lesson Learned 14 - Establish a user rights concept for RPA: What needs to be avoided is, that the bots would have more user rights in systems like SAP than the employees. This would lead to bot super users which could potentially lead to a shadow-IT in a company.

Lesson Learned 15 - Reduce the risk of bots doing mistakes: A solution approach could be to automate non-critical processes only. Also, it may help 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.

Lesson Learned 16 - Calculation of potential cost savings: The case study's focus was not to generate high savings through introducing RPA since the project goal was to understand the technology RPA, 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. It is important to not only consider the programming time effort and compare it to the manual execution time. The case study 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. Additionally, also license costs for the bot users cause additional costs.

Lesson Learned 17 - Understanding that RPA is rather a short to a middle-term solution: RPA can be described as "the first step of the automation journey". However, RPA is also "the quick and dirty solution". RPA is quick since the implementation of bots with UiPath can be done in a few days. It can also be described as "dirty" because it has the potential to cover inefficient processes or outdated IT. To prevent hiding an outdated IT, it may help to assign a lifecycle of six months for each bot before it should be reevaluated.

Lesson Learned 18 – International roll-out of RPA: If a company is operating internationally, the plants in all countries should be either encouraged or even required to harmonize the processes. This leads to maximized time savings generated through RPA. Harmonized processes also pave the way for process automation with other automation solutions. The company analyzed in the case study, currently operates in 14 different countries so if processes are harmonized internationally the time savings created through RPA are larger.

Lesson Learned 19 - Manage the volatility of bots: There are several unforeseen reasons why bots may crash like e.g., MS Teams messages randomly popping up or SAP log-in mask showing up at a different place and the bot could not find the field to type in the correct SAP system. 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 able to do so. Also, whenever updates on the virtual machines are made, additional testing and possible adjustments of the bots are needed.

Lesson Learned 20 - Gain employees' trust in the bots: In the first week of running the "Availability Maintenance" process productive, the bot did not send out any emails

since an employee did the process already manually earlier that day. If the employees still do the bot's work manually, time savings do not happen. However, trust in bots may increase over time if the bots run stable and correctly.

Considering these 20 aspects helped in the company of the case study to achieve a successful introduction of RPA. The number of non-attended automations is constantly increasing, new licenses are bought to run more bots simultaneously, and more departments expressed interest in introducing RPA too. However, it needs to be mentioned, that this list of lessons learned focuses on RPA related aspects only. Also, since only one company has been analyzed within the case study, there may be more relevant aspects.

OUTLOOK

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

If a company aims to combine RPA with Artificial Intelligence (AI), this step is also called Smart Process Automation (SPA) or Intelligent Process Automation (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 (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, et. al. 2021).

Another new term in the field of automation is hyperautomation. Hyperautomation integrates different new technologies such as natural language processing (NLP), intelligent optical character recognition (OCR), communication analytics, process optimization, machine learning deployments, and AI into the route of process automation (Walker, 2020). Intelligent OCR 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. This 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).

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.

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