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Managing the Robotic Process Automation Life Cycle: A Case Study for a Thesis

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Abstract

The central proposition inherited from the Business Process Redesign doctrine, is that business process automation should always be preceded by a fundamental rethinking and restructuring of the business processes that are involved. In practice, however, this may be a difficult and costly endeavour, in particular when these processes are intertwined with legacy information systems. For many small and medium sized organisations, the resources needed to finance and manage such an effort may simply not be available. Robotic Process Automation (RPA), is an emerging technology with the potential to lighten the burden in such cases. The problem however, is that much is still unclear about when, where and how this technology should be applied in practice. This thesis addresses this problem by providing a detailed analysis of the entire life cycle of an RPA-project. First of all, several documented approaches to managing this life cycle are evaluated by means of a literature review. Subsequently, a detailed analysis is provided of the life cycle of an RPA project, conducted at a medium sized organization in the period 2020 – 2021. This includes the preliminary stages where the financial viability of the project is established and the organization and governance structure of the project is decided, but also the subsequent development, testing and maintenance phases. The analysis is based on a significant amount of empirical data gathered by observing the execution of the project up close, interviewing project members and scrutinizing project documentation made available by the organization. The detailed account of the execution of the RPA project in itself provides an interesting reality check on popular beliefs with respect to RPA. The results of the analysis include several useful lessons learnt for managing the life cycle of an RPA project in a medium sized organization.

Contents

1 Introduction

1.1 Background

A lot of companies are looking for ways to automate their processes to make them more efficient. There are several ways to automate. An emerging technology is Robotic Process Automation (RPA). It is a software-based solution for the automation of repetitive and standardized human tasks. It is a new form of business process automation, where it automates simple actions of people through the interface instead of improving information system on its backhand (source code). RPA aims to build "software-robots" that emulate the role of humans in human-computer interactions. Like a human, a software robot can "understand" what is happening on the screen and take actions accordingly, such as complete the right keystrokes, navigate systems, identify and extract data, and perform a wide range of defined actions. It is an approach to business process automation where human activity is simply copied by a piece of software. In literature this often referred to as an "outside-in-approach". The motivation for choosing this approach lies in the consideration that robots can work faster, more consistently and without pauses. This allows humans to focus on non-routine tasks[1][2][3].

1.2 Problem Statement

Many organizations have to deal with legacy systems. Legacy systems are computer systems/applications that are still running in the organization and are at the end of their life cycle. They are typically difficult and costly to maintain. Some well-known problems with these systems are that they are outdated, which can cause certain other problems. Problems are brittleness, inflexibility, isolation, non-extensibility, lack of openness. A solutions could be the migration to new environments which allow the information system to more easily adapt to new business requirements. Or another solution is redevelopment of the legacy system. But both, migration and redevelopment of the legacy system are dealing with issues. Automation projects are becoming more and more complicated as the processes to be automated become more and more extensive and complex. This makes automation projects very expensive or time-consuming and have a greater risk of failure.[4][5].

Large-scale and expensive solutions are not always necessary. RPA can be significant when certain types of clearly defined processes need to be defined. For those processes RPA could be a solution. RPA is growing in popularity. RPA is being introduced in organizations for repetitive work processes, with the aim of being able to work faster and cheaper. One of the reasons for that is that RPA allows to be improved and further automated, current operations to be improved and further automated, without the need for a costly overhaul of existing legacy systems.
But before organizations start using RPA, it is important to assess in advance whether RPA is the right solution for the organization. As a result of lack of knowledge of and experience with RPA among decision makers, there is a risk that RPA will be improperly designed and applied to processes in an organization, resulting in unfavorable license purchases and additional costs of the RPA project. That's why many business analysts like to assess the capabilities and the weaknesses of the technology. They hear a lot about the benefits, but not every process or organization is suitable for deploying RPA. It is important for business decision makers to learn more about the

requirements and characteristics of a process or organization in order to make additional decisions for deploying RPA[2]. Furthermore, the approach to implementation is also an important factor that determines the success of the project. There are requirements, pitfalls and other things that are relevant to know before implementing RPA. Sigurõardóttir et al.[6] researched a method for successfully implementing RPA. According to this study, there still is insufficient knowledge and experience with respect to implementation methods and a lack of case studies to fill this gap. Furthermore, RPA is still a relatively new technology, which creates a rapidly changing environment. Therefore, more experiences regarding the implementation of RPA is relevant for gaining knowledge about RPA.
So, a second problem is that decision makers often don't have enough information about how and when to implement RPA to make an informed decision about starting a project. They do not know what crucial factors are or what can go wrong during the implementation phase. Implementation is a critical part of RPA and a lot can go wrong during this stage. The lack of knowledge about the experiences with implementing RPA and pitfalls in the implementation phase could lead to failure of project. The lack of information about the RPA project and its life cycle also creates a gap in the information needed to make the decision of starting an RPA project.

The above can be translated into the following problem statement, which has been further elaborated.

Problem statement:
Improving and/or automating business processes running on top of legacy computer systems using traditional business process automation methods is difficult, costly and time consuming, in particular for small and medium sized organizations. RPA is an emerging technology with the potential to address some of these issues, but much is still unclear about when, where and how this technology should be applied.

1.3 Research Questions

This research aims to contribute to solving the problem statement, by answering questions, regarding the application of RPA to legacy systems. The focus here is on the RPA technology and the effects it has on the success of the application. This contributes to knowledge that may be relevant to decision makers in choosing to start an RPA/automation project. In order to get more information about the conditions in which RPA is a suitable or even best alternative, it is important to know more about RPA as a technology itself and the process to be automated.
To conduct research on this problem issue, two main questions were developed. The first main question highlights the opportunities, suitability and potential that RPA offers in the area of process automation. The second main question will look at how a successful RPA project can be set up and introduced within an organization. Below, the two main questions with their sub-questions are named and then explained.

Research Question 1:
Under which conditions is RPA an attractive/superior alternative to traditional business process automation?

- 1a. What are suitable criteria for deciding between RPA or traditional business process automation?
- 1b. What are suitable criteria for identifying business processes that can successfully be automated with RPA?

The first main question is divided into two sub questions, 1a and 1b.
As mentioned in the first problem statement, companies are currently running into outdated systems that they would like to automate. Current traditional automation techniques fall short. RPA seems to be a technique that can offer a solution. To explore the potential, suitability and opportunities of RPA regarding legacy systems, it is interesting to look at the advantages RPA offers as a suitable alternative to traditional automation techniques. Here, it focuses on RPA itself and the potential it holds. Therefore, the first sub-question (1a) of research question 1 is: what are suitable criteria for deciding between RPA or traditional business process automation?
In addition to looking at the potential that RPA can offer, it is also relevant to examine exactly which processes are suitable for RPA. Not every process seems to be suitable for RPA. In order to determine which processes are then suitable for RPA, it is necessary to identify conditions and characteristics of processes. Therefore, the second sub-question 1b is: what are suitable criteria for identifying business processes that can successfully be automated with RPA?

The second main question focuses on the planning and implementation of RPA. The question addresses how RPA can be successfully implemented within an organization.

Research Question 2:
How can RPA-technology be successfully introduced into an existing IT-organization?

- 2a. What are important components in a planning process for an RPA project?
- 2b. What guidelines can be given for the optimal organization and execution of an RPA project?

Success is not guaranteed when it is found that RPA is a good alternative to automating a legacy system and when suitable processes are in place. In particular, the implementation of RPA also determines the success of an RPA project. Although RPA is an emerging technology with great potential, little is known about when, where and how to implement it properly. The second main question, looks at how RPA-technology can be successfully introduced into an existing organization. It is therefore important to know what a proper life cycle of an RPA project is and which factors play a role. The implementation starts with planning an RPA project. Hence question 2a: what are important components in a planning process for an RPA project?
Another important aspect of the introduction of RPA into an organization is the organization and execution of a RPA project itself. As said before, the implementation of RPA is a crucial factor that determines the success of the automation project. For decision makers it is therefore relevant to know the crucial factors in order to prevent failure and increase success. To investigate this, it is interesting to know what those crucial factors are and why. It will help decision makers in making their decision. Hence question 2b: what guidelines can be given for the optimal organization and execution of an RPA project?

1.4 About the Case Study at Flanderijn

To answer the question of how to successfully introduce RPA technology into an existing IT organization, a case study was conducted at Flanderijn. Flanderijn is a bailiffs office located in Rotterdam. Its core business is collecting receivables from clients. In 2019, Flanderijn started a program called "Flanderijn vernieuwt (Flanderijn renews)". The goal of this program was to make business processes more efficient by making them more uniform and consistent. By automating a number of processes, it was intended to give substance to this. This would contribute to the three main goals of the organization: increasing employee satisfaction, reducing costs and improving service. This project at Flanderijn provided the opportunity to follow the entire process to investigate how this project went, using a case study.

1.5 Research Approach

In order to answer the research questions, this study will conduct a literature review in combination with the aforementioned case study.

To answer question 1a, a literature review was first conducted. A search was conducted to determine what factors and criteria are important in making the decision for RPA over traditional automation techniques. First, the study examined what a general investment analysis for automation projects looks like. This involved looking at how an automation project is defined, what structure an automation project has, and what criteria are important in choosing an automation method. It also examined what capital decision methods apply to automation methodology as part of investment analysis. The literature was searched for terms such as, "Investment Analysis RPA" and "Criteria project selection ". The first search term gave no results. The second found an article by Coffin et al.[7] with an approach to project selection and an article by Liang et al.[8] with financial criteria. Subsequently, it was investigated what exactly RPA entails. The literature was searched with the search term "Robotic Process Automation" plus additions such as: "Advantages and disadvantages", "Benefits and costs", "Performance", "Legacy systems" "Case study". This yielded articles by Van der Aalst et al.[3], Willcocks et al.[2], Lacity et al.[9] and Geyer-Klingeberg et al.[10]. Among other things, these articles highlight the operation of RPA, the method of RPA and characteristics of RPA. Next, the advantages and disadvantages of RPA were examined in more detail, focusing on the motivation to use RPA, its capabilities, and its weaknesses. Subsequently, the literature was specifically searched for information about the costs and benefits, examples of RPA projects, experiences with implementing projects and with the use of RPA.
In addition to the literature review, a case study was also conducted. Using the findings of literature review, the case study examined what criteria were actually used. The case study investigated Flanderijn's reasons for choosing an RPA project. In doing so, the challenges and motivations of Flanderijn were examined. Furthermore, in the investment analysis, Flanderijn made an expectation of what the effects would be of the implementation of RPA. The indicators that are used in the investment analysis also reflects their criteria.

Question 1b is about conditions/requirements of processes, which makes them suitable for the application of RPA. This research used a literature review to examine what criteria for processes

are crucial for the application of RPA. Search criteria were: "Characteristics of RPA", "Process selection RPA" and "RPA process criteria". During the study, articles by Schuler et al.[11], Wanner et al.[12] and Osman et al.[13] came up. The selection procedure was first looked at. Subsequently, the literature was reviewed to see what was said about characteristics of processes and the criteria, for selecting and prioritizing the processes that need to be automated.
In the case study, the sections Identifying Candidate Processes and Process Selection go in detail about the steps and characterizations of processes that Flanderijn used to automate. This includes a discussion of Flanderijn's approach and requirements for process characteristics. It also looks at how this ultimately worked out.

Question 2a looks at key components of planning an RPA project. On the basis of a literature study the life cycle of an RPA project and the steps involved were examined. Also the crucial components in the life cycle of RPA were examined. The search criteria that are used are: " The life Cycle of RPA", "RPA implementation" and "RPA Framework". This revealed articles by Jimenez et al.[14], Cernat et al.[15] and Huang et al.[16].
The case study was used to see what the life cycle looks like in practice. First, the planned life cycle of Flanderijn is examined. Then the actual course of the life cycle of Flanderijn is explained. This involved examining how the project ultimately ran and what it had to deal with. The paragraph 'Issues' discusses what stood out during the life cycle and what the project encountered.

Finally, to answer question 2b, a literature study was conducted on the design and implementation of RPA within an organization. For this, the same items were used to determine the life cycle as those for question 2a. In addition, an article by Schuler et al.[11] came up via the search term "Organization of RPA". This article discussed the organizational setup of RPA and roles and responsibilities of an RPA project team. Appropriate performance indicators that help determine the success of an RPA project are also examined. Finally, how maintenance can be organized was examined.
The case study explored the overall organization for implementing RPA within Flanderijn in practice. Subsection 3.2.2 discussed the actual setup. It looked at how Flanderijn arranged the maintenance and discusses issues that address aspects that Flanderijn eventually ran into. This provides insight into what the actual approach and rollout was like and what was crucial during implementation.

The following is a description of how the case study was conducted and for what purpose.
The case study was done at Flanderijn, which started with setting up an RPA project. Flanderijn is a bailiff's office in Rotterdam. At Flanderijn, the RPA implementation is in the initial phase.
The case study describes the background situation, addresses Flanderijn's planning, describes and analyzes the processes selection for automation and describes the project design and implementation. The case study includes the description of the starting point, the analysis of the development and implementation process of 3 to 5 RPA robots at this office. The case study is based on interviews, documentation of project expectations and measured data, observation of meetings and delivered work, such as the software of the robots. Before and after implementation, data were collected to measure performance. Interviews were with a board member, to find out information about the motivations of RPA and automation, the set up of the organization and the project's costs. Several interviews were done with the program manager of the RPA project. The purpose of these interviews was to find information/details about the setup of the project, the motivations of choosing RPA, the

planning of the project and the implementation of RPA. Furthermore, two members of the project team were interviewed. These persons were the developer of the robots and the member who is responsible for identifying suitable processes for RPA. These interviews answer the questions about the motivation of using RPA, providing information in their project selection process. Furthermore, the indicators of process characteristics that Flanderijn uses to select processes, which will be automated. It also gives insight in the method of implementation Flanderijn uses to integrate RPA bots in their organization and operational processes. Information such as the planning, setup of the project organization, costs, process of implementation, pitfalls and results of the project have been collected.

2 Theoretical Framework

In this chapter, a literature review was conducted to answer the research questions. The literature review begins with an examination of the appropriate criteria for the use of RPA referred to in question 1a. Subsection 2.1 explains the research on what the literature says the investment analysis and project selection method of an automation project in general. Subsection 2.2 then focuses more on RPA. It looks at how it differs from other automation methods and what possibilities it can offer. Subsection 2.2 starts with an explanation of what RPA is, what advantages and disadvantages it offers, and what costs and benefits can be expected.
Question 1b, which is about finding appropriate criteria for identifying processes for the use of RPA, is discussed in subsection 2.3.2 "Process Selection". Subsection 2.3.2 is part of subsection 2.3, which deals with the lifecycle of RPA. It reviews the literature that deals with the different steps of the implementation of RPA. Subsection 2.3 thus answers question 2a, which focuses on the key components of RPA implementation planning. Finally, question 2b is answered in the different steps of the life cycle 2.3. These subsections contribute to finding relevant guidelines for the implementation of RPA. This applies in particular subsection 2.3.1, which deals with the organization of RPA and 2.3.5, which focuses on guidelines for making RPA maintainable within the organization.

2.1 Investment Analysis & Project Selection

Selecting the right project for the desired goals requires an investment analysis. A project is defined as a specific, finite activity that produces an observable and measurable result under certain predefined requirements[17].

Each project has a trigger or reason for being started. This also applies to an RPA project. But before choosing RPA, a broader consideration is made beforehand. This subsection discusses the aspects investment analysis and project selection, as part of the process of decision-making, which ultimately leads to the choice of RPA as a solution. It starts with investment analysis and project selection. First, a brief definition of a project is given. Then, RPA as a Research and Development (R&D) project, is examined in more detail. In doing so, the steps of an R&D project are examined. Finally, methods are discussed that may be applicable to support decision making for automation projects, for which RPA may be a solution.

R&D projects, are aimed at the (further) development or improvement of service or products. Companies often invest in R&D projects when they are dealing with an obsolete product or service.[18] In this research we look at the problem of having a legacy system, which needs to be automated and thus improved. Therefore, this research looks at R&D projects rather than normal projects.
The process for selecting R&D projects, according to Coffin et al.[7], has the following structure. The first stage is about the definition of the goal. Typically, the projects can be split into three main goals: maximizing the project portfolio's expected return, maximizing the portfolio's average probability of success, and minimizing the portfolio's overall turnaround. Two assumptions are made here. The first assumption is that it is believed that all possible R&D projects and (supporting) facilities (technical, economical, etc.) for these project are equally important. This means that there is no preference in a way for an R&D project. The other assumption is that it is assumed that all supporting facilities are available to start a R&D project. So that there is no doubt that a R&D projects can be executed.
The second stage of R&D project selection looks at the resources available to carry out the project. In this phase, the different resources are identified, as well as the opportunities and constraints of the project. In the overall structure, the main constrains are the budget resources and the human resources. Furthermore, some other resources are: other manpower constraints, computer resources and equipment resources.
After these two stages, the decision-making follows. An important part of this is the costs and financial benefits of the project. The capital investment decision-making has several methods for comparing projects or to estimate the risk of projects. Methods according to Ye & Tiong and Lianf & Li[19][8] are the determination of the payback period, the average accounting rate of return, the net present value(NPV), the internal rate of return(IRR) and return on investment(ROI). All these methods have no risk factor in their method. Thus, the cash flows of the projects are assumed to be certain even though they are forecasts. But the actual cash flows may differ substantially from the predicted cash flows.
In this research these methods are used to select the most promising robots.
ROI and payback period are interesting performance measures to be used to measure the long term economic value of automation and robotic projects[20]. ROI helps in making the decisions regarding the implementation of the process by determining expectations, which can be compared with the desired results. Like any other method, this method is used to determine whether the investment meets its criteria before making the decision. The formula of the ROI is: $ROI = \frac{(S-E)X100}{I}$. Where ROI = return on investment, S = annual savings when implementing robots, E = total annual expenses of the robots, I = total invested capital in the project. The formula for the payback period is $P = \frac{I}{L-E}$. Where P = Payback period, I = total capital investment, L = annual labor savings by the robots, E = total annual expenses by the robots[21].
Other interesting methods to determine the value of a project are the NPV and IRR. The NPV is the present value of future expected cash-flows less the costs of the investment of a project. A positive present value means a increase in value of the invested capital. The IRR is the discount rate that makes the present value zero. An IRR makes it easier to compare projects with each other. Multiple projects could be ranked to find the optimal portfolio[22].

2.2 RPA Technology

This subsection discusses RPA technology. Here the technology is explained and as well as the advantages and disadvantages described. The costs and benefits of RPA are discussed separately in the final part of this section, where attention is only given to the financial aspects of RPA.

2.2.1 What is RPA?

Robotic Process Automation is a way of automation that replaces people's actions on a user interface. This can lead to people no longer being needed in a process. RPA operates on the user interface of computer applications as a human would. Unlike traditional methods of business process automation, RPA can automate labor intensive tasks within an organization, perceiving the its existing application landscape[23]. RPA is easy to use in switching between multiple applications/computer systems. Additionally, it is possible to connect APIs to drive client servers, mainframes and HTML codes. The configuration is based on simple rules and logics, such as if, then and else, statements. It works with a software script that can be executed by a control dashboard[3][10]. The robot takes over simple and repetitive human actions. This improves the speed, reliability, error reduction, process efficiency accuracy and costs reduction[2].

A software robot is very similar to a macro, which has been around for some time. But there is a difference between the two. Macros are useful for single tasks that are repetitive and standardized. It is pre-programmed and executes the "script". For so far RPA is the same. But RPA is the next generation of macros. The difference is that RPA is a robot that can respond on stimuli. So, it can decide when it will execute the script/macro. Moreover, RPA can gather knowledge, that can be stored for future use[24].

Algorithm 1 presents an example of a simple robot. The example is about getting information of a customer from an external database via a website and copying it to an internal system. The purpose of this process is to enrich customer records with additional information about the individuals, such as contact information, etc. This found contact information is ultimately used to reach the debtor. In this example personal data from the Chamber of Commerce(KVK) (the external system) are transferred to an internal CRM system (internal system). See Figure 1 and 2. Figure 1 shows the process before using RPA. The process is about transporting information from an external system to the internal system. First, a file name is retrieved from the internal system, and then used as a search term in the external system. Then the information such as the phone number and email address is stored with the corresponding name and entered into the internal system. This process repeats for each name in the internal system. Figure 2 shows that actions are taken over by robots, which were first performed by humans.

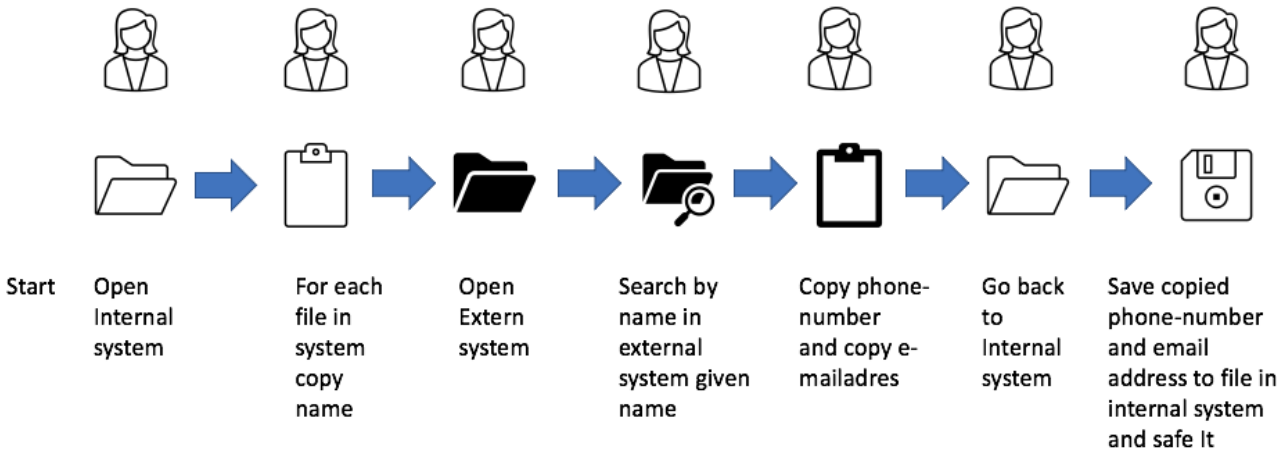

Figure 1: Example with Employee
(In this case: KVK is external system and CRM the internal system)

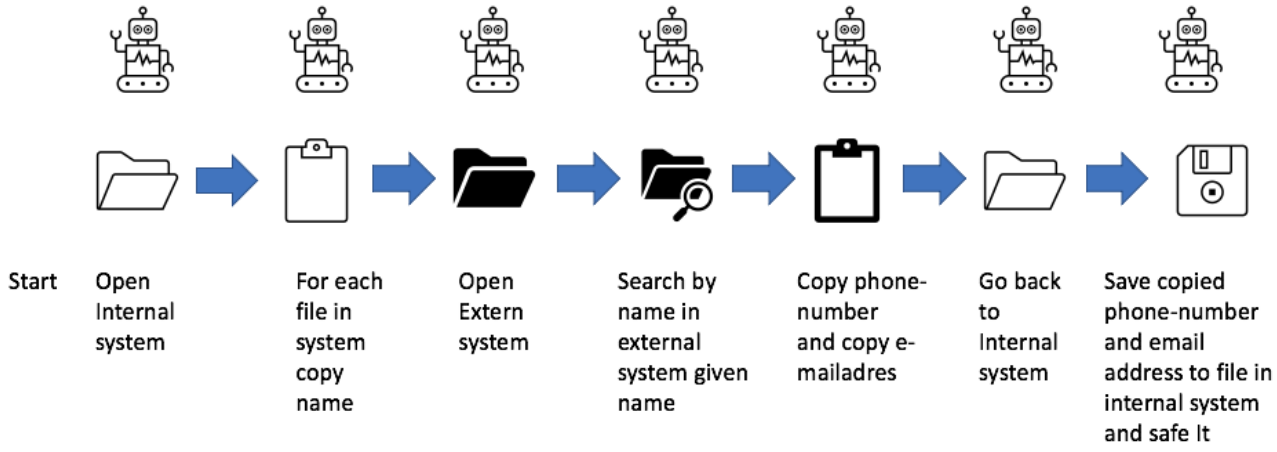

Figure 2: Example with RPA Robot
(In this case: KVK is external system and CRM the internal system)

Algorithm 1: Algorithm Example

```
Result: External information in internal system
Name ;
for new customer dossier in internal system do
    Name = name of customer;
    if Name in external database then
        phonenumber = phone number from ex. database;
        email = email from ex. database;
    else
        continue
    end
    input phonenumber into internal database
    input email into internal database
end
```

2.2.2 Pros and Cons of RPA

RPA has a number of well-known pros and cons[2][3][10][9]. The main advantages are improved use of assets, lower number of errors, increased cost-effectiveness and cash-flows, short implementation time and decoupling of IT and technology.
In this section will list and explain the advantages and disadvantages of RPA.
First, the improved use or efficiency of assets. One of the main benefits of RPA is the ability to improve the performance of existing processes. The robots perform the process much faster, more accurately, more consistently and with fewer errors compared to a human. In addition, it could work 24/7, without holidays and can respond quickly. This increases the quality of the workflow for a specific task and saves a lot of time[2].
The lower error rate and faster response also have another effect. It reduced "chase up" calls and reduces the error rate, leading to a shorter troubleshooting time.
Furthermore, the inflow of input for processes is not always consistent. For example, consider more processes (cases per process) on a Monday compared to a Friday. Robots can easily anticipate this by scaling up and down[10][9]. With employees this is much more difficult. An additional advantage is that the freed up employee capacity gives room to tackle more complex tasks[3].

RPA also has some technical advantages. A robot can easily switch between multiple systems. More heavy-weight IT approaches are more difficult to switch between multiple systems. These need an API to connect, while RPA uses the interface to switch[2][11]. Compared to more heavy-weight IT approaches, the development and implementation of a robot is less time consuming[11]. Because of the short implementation time productivity can increase rapidly[25]. Employees can also be trained to automate processes in a matter of weeks. No programming experience is required to learn how to develop the robots. Other automation methods often do require programming knowledge.[2].

Another potential benefit is that RPA could lead to higher customer satisfaction due to its fast response rate, lower error rate and consistent service[10]. RPA is still under development. There are new possibilities for the software, such as deep learning and artificial intelligence. New services and enterprises are becoming available. This increases the possibilities of RPA[26].

Besides advantages, RPA also has a number of shortcomings. RPA is only interesting for processes that are standardized and simple. Complex processes or those with a high exception rate are not suitable, because RPA is based on logic statements. Like probably almost every other automation method, a robot cannot handle judgment work the way a human can. The robot must be pre-programmed. Creating a route for each exception is time consuming and not viable. Moreover, RPA does not improve the process itself. It just accelerates the process. Being able to think about improving processes could be a better solution.
Another risk is the dissipation of knowledge about processes. By automating processes, the detailed knowledge (and workflow) that was present among the specialists can be lost and remain unknown[25]. Lack of knowledge about workflows or processes can be a handicap when making necessary changes or modifications.

There are also some ethical en security risks. When an error occurs in the process or the robot does something wrong, it is difficult to recognize or detect an error in the process. A human being has the ability to correct mistakes wisely. A robot does not have this and will not sound the alarm if necessary. Unless such a function is programmed.

Changes in the process can also lead to intensive maintenance of the robot. After all, the robot does not automatically do this itself: RPA does not improve the process itself. It only executes and accelerates it.

Benefits and Costs of an RPA Project
One benefit of RPA is greater cost effectiveness and cash flows. RPA can have a high Return on Investment (ROI). Compared to other automation techniques, it has low investment costs. Where as traditional automation techniques do not see their first returns until late (after a year or more), RPA can already produce high returns within the first year of starting the project[2][3]. Robots can replace workers, are faster, or help perform simple but labor-intensive tasks. The worker can then focus on other, more complex tasks. This saves time and costs. A case study at Telefonica O2 showed a Return on Investment of between 650% and 800% over 3 years. They deployed over 160 robots that processed between 400,000 and 500,000 transactions per month. The ROI was shown by an 80% reduction in the number of "Chase up" calls (because fewer customers over to inquire to the status of their service requests), the amount of work capacity doubled, the number of FTEs was significantly reduced by a few hundred and scalability was unsurpassed[9]. Furthermore, the Co-operative Banking Group achieved an 80% process cost reduction by automating 130 processes [25]. Finally, Xchanging reduced 30% of its cost per process[27].
Below are the various cost reductions/benefits and the costs of an RPA project:

- Reduction in the number of employees involved in the execution of processes: The number of FTE, reduces due to shorter processing time, higher number of transactions per unit time and higher quality assurance (recover failures). Overhead costs also decrease with having

fewer FTEs. Think about training or recruiting and hiring employees. This will be less if fewer employees are needed.

- Less office space required.
- Lower costs as a result of fewer incorrect processing. Customers can hold the organization liable due to defective processing. Higher quality reduces human errors and thus costs.
- New revenue. Higher speed, better quality and lower costs can lead to the acquisition of new customers and the expansion of the new revenue stream.

In addition to the benefits, the implementation of RPA also entails some costs. The costs of implementing RPA can be broken down into three categories[28][25]:

- Development costs/investments
- Maintenance costs
- Infrastructure costs

Types of development costs of/investments in RPA are:

- One-off investment costs for the robot's framework. For example decision-making, adjusting policies and costs for consultants, planning, opportunity assessment, design, development, testing, roll out.
- One-off investment costs per use case. For example technical implementation in the data center, the cost of robot providers, service provider, consultants for preparation and personnel costs.
- Consulting: organizations are often unfamiliar with RPA. Hiring a consultant will help the implementation of RPA. The costs are between 50 and 500 $/hour.
- Operating costs. An RPA solution requires validation by the company through user testing. In addition, Use of RPA may lead to changes in management.
- Training costs. Cost for developer and analyst training, skills training, enterprise standards and training guidelines.

Maintenance costs:

- Infrastructure maintenance. Changing environment systems, may lead to changes to the RPA infrastructure, such as upgrades of PC's.
- RPA robot services and maintenance. In the sense of robot software upgrades.

- Personnel costs for control and management of RPA. These costs depend on the frameworks of the RPA organization. For example, central or decentralized management teams.

Infrastructure costs:

- License fees. These licenses are for the use of the robots. This can be based on time units or per transaction. It could be around $5000.
- Robot hosting. The number of servers the robot is running on.
- Costs of disk storage and management console.

2.3 Life Cycle of an RPA Project

The literature is not unanimous on the definition of the different steps of an RPA implementation life cycle. On the other hand, much overlap in the steps of the RPA life cycle has been found in the literature. Below are the steps identified with this research in the literature.

The first step is the investment analysis. According to Sigurõardóttir et al.[6] the life cycle starts with identifying the business problem, challenges, obstacles and tasks needed for improvements within the organization. This includes identifying processes to be improved. Within this step possible solutions to the problem are inventoried. These are then weighed against each other. For example, traditional automation processes versus RPA. In this study, the assumption is made that RPA is the solution for optimizing processes, after previously broadly the candidate processes to be improved. The second step involves setting up the organization. After the decision has been made to opt for RPA, according to Sigurõardóttir et al.[6] it is then necessary to think about the setup of the organization of RPA. This should include the position and structure of the RPA organization, including the roles and responsibilities of teams. The third step is the selection of candidate processes. In the investment analysis, the suitability of RPA has already been broadly looked at. In step three it is examined in more detail. Criteria are used to determine whether the processes actually are suitable for the use of RPA. An important part of this step is to work out the processes step by step and to properly document, so that they can be used for the development of robots. In this step, the processes can also be modified to make them more suitable for RPA, to improve speed, error rate and standardization. In this step, the processes are also prioritized. The documented processes are used by the robot developer in the next step[16], [14], [6]. Step four involves developing the robot and on buying the license, for developing and building the robot with this software[16], [14], [6]. Step five consists of testing, verifying and implementing the robot. This includes quality testing and finally placement in its environment[16], [14], [6]. Finally, maintenance is required, to ensure the performance of the RPA, to ensure quality and to further improve the robot[14]. In Figure 3 the steps are shown. These are the different steps, which can be distinguished from the literature. The first step, which concerns the choice of RPA, has already been explained in the previous subsections of this study. In the following subsections, the life cycle steps identified above are further explained, starting with step 2, the design of the project.

Figure 3: Life Cycle according to the Literature

2.3.1 Organization Setup

This subsection explains relevant factors of the organization of a RPA project according to the literature. Implementation factors are introduced such as the position of RPA within the organization, the organizational set-up, and the roles and responsibilities.

Position in Organization
Successful implementation of RPA in organizations requires a good understanding of various aspects of the organization and the (working) environment of the RPA process. A leadership team will be necessary to manage the business and IT departments to carry out the implementation. The involvement of the business unit is important because of its knowledge of the processes and any bottlenecks, as well as for being able to advise on eligible RPA processes. The IT department is important to design the best automated solutions and to integrate the automation well and in an efficient and robust way with the underlying systems. One point of discussion is where responsibility for and support of RPA should be placed in the organization. According to Schuler[11], it is not important where this responsibility and support is placed in the organization, but it is symbolically best to locate it outside the IT division. The reason for this is that these roles should best be located as close as possible to the executive department(s). This allows for quick anticipation of constantly changing business conditions, which impacts business processes and thus the operation of RPA robots. Another reason for placing RPA support at a distance from an IT department is that RPA is distinguished from IT solutions by being easily and quickly adaptable and reusable. Often an IT department focuses more on the larger, stable and mature IT projects. A crucial part of this implementation is to involve and inform affected employees and IT personnel. To avoid deliberate sabotages or delays, their involvement helps to make their concerns negotiable.

Roles & Responsibilities
If the support and responsibility for RPA is placed at a distance from an IT department, the follow-up question is where RPA is positioned in the organization relative to the executing department(s). There are basically two options: the execution of RPA processes is centralized in an RPA center or the RPA processes are placed in the various small business units. To gain knowledge, identify best practices, and better set quality standards, centralizing expertise in one RPA center is a better option than housing RPA in multiple business units. Centralization will also lead to better knowledge transfer to keep development and maintenance costs low, for example. On the other hand, (the availability of) funding sources could become a bottleneck over time when an RPA center

is formed[11]. Schuler et al. also mentioned six roles that are important within an RPA centre. The first one is that of a sponsor, the person who finances the project and owns the automation technology. The second role is that of the Program Champion or Manager which is the person who coordinates the project and is responsible for communicating with the sponsor, team and other stakeholders of the RPA project. The third role is that of the Business Users, they are the experts of the process and are familiar with the workflow. They are also the ones who will analyze the input and output of the robot. The fourth role is that of the implementers of RPA. They are process analysts, solution architects and developers. The fifth is the Robotics Operational Team. They are responsible for the go-live of quality assurance, infrastructure management, robot change management, first-level RPA maintenance, development guidelines, coding standard and best practices, liaison with RPA software vendor, and other building blocks for implementers to build RPA solution in a standardized and well-managed way. The last role is IT infrastructure provider. Their role is to set up and maintain the servers of the software automation tools. In this step, the employees should be trained to be able to identify processes and develop robots. Furthermore, the supplier of the RPA software should be identified. It is possible that a role is fulfilled by several people or a business unit. It is also possible that some roles are done by several people or a sub-team[11].

2.3.2 Process Selection

This subsection discusses the selection of processes. In doing so, it looks at the methods of selecting/prioritizing the processes and the characteristics of processes that make them suitable for RPA.

Process Selection Method
Wanner et al.[12] have set up a method for the selection of processes. The method consists of three steps. The first step is the pre-selection/identification. In this phase the process of interest is first selected, so that special challenges such as legal compliance or objectives such as customer satisfaction are addressed before proceeding with the quantifiable selection. Furthermore, the processes must meet the requirements as mentioned in the previous section. The potential of all the processes that are selected is based on chracteristics identified as measurable indicators of organizational importance. This is further discussed in the next paragraph.
In the second step the processes are analyzed for their profitability. In this phase the processes are analyzed for, for example, cost reduction or quality improvement. Here the benefits and costs are calculated. The possible costs and benefits are named in subsection 2.1.
The third step involves decision-making by choosing a selection of processes which has the maximized economic value. The decision-making methods of capital investment can be used in this section to make decisions of interesting processes.

Identifying Candidate Processes
According to Schuler et al. there are six criteria that make a process suitable for RPA are: rule-based, predictable in terms of process scenarios and process exceptions, repetitive with limited exception handling and human intervention, a side priority to automate for IT or business owners of an application, often providing access to multiple systems and having medium-to-high transaction

volumes[26][11]. Osman et al.[13] collected nine criteria that decision makers should consider using RPA. These are: high volume of transactions, limited exception handling, manual IT processes prone to errors or rework, limited human intervention, stable environment, frequent access to multiple systems, high transaction value, ease of decomposition into clear IT processes and clear understanding of current manual costs.

Setting up a robot takes time and money. To make the trade-off to robotize a process, the gain in time and money must be taken into account. In general, a process with a robot has higher fixed, but lower variable costs compared to a process without a robot. Assuming that robots perform the process faster than a human, a large number of transactions to be performed will increase the benefits of using a robot. The fixed costs of developing and implementing a robot should not exceed the benefits it provides.
An RPA robot is based on if-and-else statements. If a process is too complex, the development of the robot will take more time and money. Therefore, a process with limited exception handling is more suitable than a process with many exceptions. Not only because of the costs, but also because it is more work than with many exceptions.
Another characteristic of a process, suitable for RPA, is its susceptibility to errors and rework. Robots are very consistent compared to people who make more mistakes. A robot can achieve a lower error rate than humans, so processes that are prone to errors are better performed by a robot to keep the error rate as low as possible.
Processes that require human intervention are less interesting for RPA. This can be a bottleneck for an automated process. Another characteristic of a process suitable for RPA is a stable environment. A changing environment requires a change in the robot structure, which is expensive. The more stable an environment, the better a robot can recoup its investment.
Yet another feature that could improve the match between RPA and a process is a process that spans multiple systems. An advantages of RPA is the ease of switching between multiple systems compared to other IT solutions, because it uses the interface, rather than creating an API between the systems. In addition, high-value transactions are much more costs-effective and important to execute properly.
The ease with which work-processes can be broken down into clear IT processes is another feature. The process must be clear, otherwise it will be too difficult to develop a robot. If too many processes are linked or integrated, then creating a robot will not result in an advantage.
Finally, a clear overview and understanding of the costs of the process is important when making the decision to use RPA for a process. If the costs are not clear, decision makers would not be able to decide to start with RPA. It is not a good idea to start a loss-making project and it could be a waste of time [13][11].
Interesting industries for RPA are the insurance sector and financial sector. Within a company, the human resources and finance departments often have processes that are suitable for RPA. These are commonly used processes that are common and use multiple systems[26].

2.3.3 Robot Development

This step is about developing the robot. Before a robot can be built, it is important to have good documentation of the process ready. This involves dividing the process into unloading steps. This makes it easier for the RPA developer to build the robot.

Building an RPA robot requires a license for the RPA software. Several RPA vendors offer RPA software. Some major vendors are Blue Prism, UIPath, Automation Anywhere. Many other companies, such as Pegasystems and Cognizant offer embedded functionality of RPA in their software.
It is very easy for companies to learn how to build this software. Furthermore, it helps if the builder of the robot knows every detail of the process. This increases the robot's chance of success and lowers the implementation risk. Another advantage is that the software can be created in-house. This gives the company itself full control over the construction of the robot and sensitive information is better protected[16].

2.3.4 Testing and Control

This step looks at getting the robot up and running, with testing and monitoring playing an important role. As with other automation methods, testing is also helpful for RPA. Nevertheless, Jimenez[14] says RPA is characterized by the lack of a test environment. But when a robot is ready, there will be a need to be verified that it actually works as intended. In the literature not much is said about the testing step of RPA. Cernat et al.[15] have a short paper that says something about this part. One method they discuss is about the coverage rate of potential scenarios. This method provides an input and checks if the output matches the expected outcome. Several scenarios must be completed to test the quality of the robot. The coverage rate, herein gives the percentage of successfully completed scenarios. Sigurõardóttir et al.[6] also state that testing is important. The use of test data helps in testing the robot. It also says that it is good to check all exceptions. It further adds that a soft launch is recommended. This means that the robot is slowly put into production. By doing this, the robot will be tested in the real environment. The robot will then step by step take a case into production. This allows one to follow what the robot is doing. If this goes well, the robot can be fully turned on.

It is also important to monitor the performance of an robot. Some performance indicators are discussed here.
The motivation for implementing RPA can vary per company. But in general some standard motives are common to most companies, such as cost reduction, staff savings or process quality improvement. To measure the performance of RPA, the following key performance indicators are mentioned in this section[10][23]:

- The number of transactions per time unit. This indicator tells the analyst about the speed of the robot compared to a human.
- The throughput time. During the process this indicator tells something about the course time of a case.
- The number of FTEs required for the process
- The number of error messages. Which says something about the quality of the process.
- The percentage of successful cases that have been completed.

- The Return on Investment. This is based on the investment costs and the revenues. The revenues are for example, savings from fewer employees, or from higher quality and a reductions in other costs.
- Employee satisfaction
- Customer satisfaction

2.3.5 Maintenance

The final step of the life cycle concerns the operation, maintenance and improvement of the robots. According to Jimenez et al.[14], this step is responsible for the robot's performance and error cases. The analysis of these should provide a design cycle that continues to improve the robots. Sigurõardóttir et al.[6] state that a person should take care of the maintenance of the robot. This person should be familiar with the RPA software and has an IT background.
Furthermore, Noppen et al.[29] compiled a list of 11 guidelines that should lead to making the robots maintainable. For example, it says that an organization should consider enabling business units to develop and maintain robots. The transition is then supported by a centralized RPA team. The second guideline says that the context and characteristics of the organization should be considered when choosing the RPA software vendor. For example, some companies are better in learning themselves how to use RPA, where others need more help and so another package deal, with more tutorials. So there is a difference in vendor and the organization is relevant when choosing the vendor. The third guideline says that the IT department within the organization should communicate clearly and openly about the capabilities and shortcomings of RPA. This is important to avoid resistance and to keep the organization running smoothly. The fourth guideline says that software architects should be consulted to maintain quality. The fifth guideline says that there should be development standards to create uniformity. This also makes maintenance easier. The sixth guideline states that there should be an automation library to avoid duplication of effort. This is where parts of fully automated processes are stored and can be reused. The seventh guideline says that during the development of the robots, checks should be performed to ensure the development standards. Guideline eight says that a central RPA team should do a technical review when the robot is created by a business unit. This should ensure that the robot is up of a certain standard. Guideline nine says that the organization muster enter to an agreement with the supplier of the RPA software to to keep abreast of any updates. The tenth guideline is about the organization sharing information with suppliers and customers about the use of RPA robots. This way they can take this fact into account and possibly respond accordingly. The last guideline is about a personal development plan based on the impact assessment. It should be examined whether the employee is still suitable and fits into the new work that has been created by implementing an RPA robot.

2.4 Conclusion

The literature review shows that the answer to question 1a is that RPA is a suitable automation technique for taking over simple tasks from an employee. The advantages of RPA are that it can speed up processes, reduce errors, is more consistent, optimize the use of current systems, deliver high cash flows and cost effectiveness in a short time, requires a short implementation times, can

easily switch between multiple systems/applications and requires minimal IT staffing. It also works 24/7 compared to an employee, saves time for employees, easily scale up and down and can respond fast, which could reduces chase up calls. Compared to other traditional automation methods, RPA has the advantage of being easy to implement, with low cost in a short period of time. However, it is not suitable for complex processes. Furthermore, it does not improve processes itself. It only executes the process. Finally, a robot may lead to losing detailed knowledge, when employees do not have to work with the process anymore.

On question 1b, regarding the criteria of processes suitable for RPA, it appears that not every process is suitable for the application of RPA. As mentioned in the paragraph above, RPA is especially suited to simple, non-complex processes. By this is meant that it should be a standard process, that does not require too much assessment work. In addition, scenarios must be predictable and with not to much exception handling, since each process flow must be thought out and programmed. So, the process should be rule based. Furthermore, appropriate characteristics of processes are that it has a high volume of transactions, manual IT processes prone to errors or rework, limited human intervention, stable environment, frequent access to multiple systems, high transaction value, ease of decomposition into clear IT processes and clear understanding of current manual costs. Finally, it should not be to important for the IT department, but just a side priority for them.

Question 2a, is about the planning of the RPA project. The literature talks about different stages, which an RPA project passes through. In this study six steps were identified from the literature. These steps are: the decision-making for RPA\investment analysis, the organization setup, process selection, robot development, testing and controlling, and maintenance. The first step is important to determine if RPA is indeed interesting for the project. This involves weighing whether RPA is the best alternative and that the benefits match the business objectives or that it provides a solution to the challenges an organization faces. In addition, the benefits must be weighed against the costs. The second step is to set up the organization. This should include the setup and position of the project within the organization, team roles and responsibilities, training and supplier of the software. The third step is the process selection. This involves selecting of candidate processes, determine whether they are suitable for RPA, document them, possibly modify them and calculate the value of each robotized process to prioritize them to maximize the value. The processes should be mapped out, by creating specifications, data flow and actions to prepare for the fourth step, namely the robot development. In this step, the license for the RPA software should be chosen and bought to start using the software and develop robots. Step 5 is testing and controlling the robot. It checks its performance to eliminate errors before it goes into production. Finally, step 6 is maintenance, where the performance is checked and the robot is improved, if necessary.

The final question, question 2b, deals with guidelines that provide the optimal organization and execution of the project.
Regarding the allocation of responsibility for RPA projects within an organization, the literature indicates that the preference is to place it outside the IT department. This provides a clear separation between the responsibility for heavy IT and RPA. In addition, it is important to communicate well and clearly within the organization about the implementation of RPA, to avoid resistance and delay, but also to increase commitment. Furthermore, the literature talks about 6 roles that are relevant for the success of an RPA project. These roles are sponsor, program manager, business users,

process analyst, RPA developer, Robotic operational/maintenance team and the IT infrastructure provider. Another observation is that a good documentation of the process is important for the development phase. This makes it easier for the developer to create robots for it. About testing, the literature does not say much. Only that it is important to test all steps and exceptions to determine the coverage rate. This prevents errors. In addition,the implementation should be done carefully with a soft launch, to test how the robot works with the first automated processes. If this goes well, it can be slowly scaled up. Measuring the performance is also important. Relevant performance indicators are: the number of transactions or cycle time, number of FTEs saved, cost, ROI, error rate and customer or employee satisfaction rate.
Finally, 11 guidelines were given that should make robots untenable. Examples are that consideration should be given to whether business units should remain involved in the development and maintenance of the robot, that there should be active open and clear communication about the capabilities and shortcomings of RPA from the RPA team. It further stated that there should be RPA development standards within the organization and that these should be monitored during development. It is also useful to keep a library of robots for reuse, to avoid duplication of effort. Finally, it is important to make agreements with the supplier of the RPA software to be able to take account of updates and it is also important to consider the characteristics of one's organization when choosing the supplier, because of the different products it offers, such as training.

3 Case Study

This chapter discusses the case study conducted at Flanderijn. Several aspects of the RPA project of Flanderijn are discussed. Among others the motivation, timeline, approach, course, organization and result of the project. The purpose of the case study is to answer the research questions on the basis of practical experiences with the preparation and implementation of an RPA project. is structured as follows. Subsection 3.1. answers research question 1a, by describing the criteria that Flanderijn used, in choosing RPA as automation method over other traditional automation methods. This subsection first provides a sketch of the organization. The situation of Flanderijn is described before the start of the RPA project and the challenges the company faced. It then explains the rationale of Flanderijn, for using RPA.
Subsection 3.2 then discusses Flanderijn's life cycle to answer research question 2a. This is aimed at finding the key components in a planning process of an RPA project. In doing so, the various steps that Flanderijn went through during the life cycle of the RPA project are discussed. Both the planned life cycle (subsection 3.2.1) and the actual executed life cycle (subsection 3.2.2) are highlighted in this subsection. Then, each step is briefly explained in the separate subsections.
One component of the actually executed life cycle is the investment analysis, which includes the predictions and expectations of Flanderijn. Flanderijn used these calculations in their decision-making around RPA and thus contributes to the answer to question 1a.
Another part of the life cycle discussed in subsection 3.2.2 is the process selection step. This subsection answers question 1b by looking at the criteria Flanderijn used to select processes suitable for applying RPA. In addition, it describes what they encountered during the execution of the RPA project, regarding the process selection.
The paragraphs explain how the various implementation steps proceeded and what Flanderijn had

to deal with. From this, issues are highlighted that are useful for answering question 2b about guidelines for the implementation of RPA.
The subsections titled 'Issues', discuss and explain notable events during the life cycle. This contributed to lessons learned for Flanderijn. The final subsections 3.2.3 and 3.2.4 give the results of the RPA project and the future expectations. The subsection "Result" lists the benefits and costs of the RPA project are given, as well as the performance of the different robots after the project ended. This part describes the success of the project at Flanderijn.
The subsection "Future expectations" tells what ding to Flanderijn the expectations look like in terms of performance and how the process will proceed.

3.1 Background

This subsection provides an introduction to the case study. The company Flanderijn, where the case study was conducted, is introduced. The arguments to start an automation project are given. Next, the challenges of Flanderijn are explained and how the choice for RPA as automation method came about. This section contributes to research question 1a, which is about the criteria that Flanderijn used to choose RPA over alternative automation methods.

For this research, the case study at Flanderijn is used to get more information about the implementation of RPA. Flanderijn has started using RPA to automate certain processes. They have commissioned a combination of two consultancy companies to help Flanderijn learn RPA, help them develop robots, implement the robots and train Flanderijn employees.
In this case study the life-cycle of the RPA project have been studied. This life-cycle includes the motivation, planning, decision-making, implementation and results of the RPA project.

Original Situation
Before the company started the project "Flanderijn vernieuwt", Flanderijn had to deal with a number of challenges. One of the challenges was that Flanderijn got a new major customer. This meant Flanderijn got more work than before. This required expansion of the capacity. More employees were needed, which was not easy at the time. The plan was to transfer employees with the title: "Administrative assistant" to the position of "Incasso employee". The work of "Incasso employees" requires much more human assessment thinking, while work done by administrative employees has automation, standardization and repetition as characteristics. The current process was inefficient and time consuming. So their desire was to automate the standardized and repetitive processes, and that required an IT solution.
The second challenge they faced was innovating the process to be automated. The existing process was very outdated. They were already in the process of transition from the old to the new system, but this process took a long time. They expected it to take a few years.
Flanderijn's third challenge was recruiting new IT capacity to automate certain processes. The current IT department was already working on the transition. However, hiring new IT staff was and still is a problem, as it is difficult to find affordable IT staff.
RPA erased as option from the "Flanderijn Vernieuwt" program, that could face and solve these challenges.

Motivation for RPA
Flanderijn's choice to opt for RPA instead of other automation options was based on a list of requirements. Their requirements for the automation the process were: it should increase employee satisfaction, reduce costs and improve service. Furthermore Flanderijn had to deal with the transition from an old to a new system. So they were searching for a flexible way of automation. Another thing is that Flanderijn has to deal with resource constraints. The automation should lead to reducing work for employees and the automation itself should not be too burdensome for IT department. In the long term it must be manageable in-house, reduce costs and have control over the knowledge that, according to the Flanderijn board, must remain within the organization. Other side aspects of this project were: reduction of paperwork, customer satisfaction, a more uniform and consistent process and an option for a dashboard. Based on the aforementioned situation, wishes and requirements, it was decided to implement RPA.

The concrete reasons why Flanderijn chose RPA are listed below:

- With RPA, employees can be quickly trained to become an RPA developer. RPA is not difficult for employees to learn. They don't need an IT background to learn about RPA and be able to create robots. So compared to other IT skills, RPA skills can be learned quickly. This means that no additional IT capacity is required. Furthermore, the knowledge within the organization can be gained in a short time through training. It is difficult to find RPA developers or other developers on the labor market, certainly not for a 'small' company like Flanderijn. Flanderijn is too small to compete with other organizations that could afford the high salaries of these developers. RPA is therefore suitable for these types of organizations that want to invest in automation.
- RPA is simple and quick to implement compared to other automation and heavier IT options. Flanderijn had to deal with a new major customer. This led to more work in a short time. The transition of the employees could not wait, so a fast automation project was very welcome. Other heavier IT options would take too much time.
- RPA is flexible. Given the transition from the old to the new system, RPA is reusable for both systems. This means that a robot can easily be redesigned so that it can also work on the new system, without high transition costs.
- RPA leaves the current process intact. This means significant time and cost savings, as the process does not need to be redesigned. RPA automates the handling of employees. Hence, no Application Programming Interface (API) or change to the current process is needed. Other automation solutions would change the current process.

There were more general reasons for Flanderijn to opt for automation in general. These reasons were:

- The performance of RPA is faster and with fewer errors. This saves costs, time and effort.
- A robot takes the work out of the hands of "administrative employees". They make it possible to retrain them as "Incasso employee". Flanderijn preferred this way, because these employees already knew the processes, as opposed to new employees. As a result, it took less time to train them and there was little or no need to recruit new employees.

- RPA is suitable for standard and simple tasks, but leaves room for exception handling. This means that the software of the robot can recognise, which part of the transactions cannot be done by the robot. The robot sends a message or forwards it to an employee.

3.2 Project Life Cycle

This subsection will describe the life cycle of Flanderijn. Flanderijn made a schedule before actually starting the project. This is described first. Next, a description of the life cycle actually implemented is given. In it, each step and its implementation will be described. Problems and other notable aspects that occurred during the life cycle are also mentioned. Finally, the result of the implementation is described, or in other words the performance of the robot after implementation.

3.2.1 Planned Life Cycle

After the decision was made to use RPA in the organization, several external ICT/RPA consultancies were asked to present their plan for implementing RPA. The assignment was to develop the robots, implement them in the organization and train employees for use and maintenance. A combination of two consultancy companies was chosen to help Flanderijn with the RPA implementation project. That have together set up the following implementation process.

The planned implementation process could be split into 3 parts: process definition, configuration and implementation. But before this process would have started, the consultant had to carry out, a Quickscan to provide a planning and predict the benefits of RPA. Furthermore, the consultant searched for a number of potential processes that could be suitable for RPA. These were identified and analyzed.
After the completion of the Quickscan, Flanderijn should start with the process definition phase. The process definition phase should take 4 weeks. During this phase, suitable processes will be described and mapped out so that each step could be robotized later. In addition, the exceptions, end goals of the process and instructions for the robot developers would have been drawn up for the next phase.
The next phase was the configuration phase. The goal in this phase was to set up the infrastructure, test scripts and security, install the robot software and configure the robots and documentation based on the new process descriptions. The next phase began when the go - no go proposal was accepted on the basis of tests by Flanderijn.
The third and final phase concerned the implementation phase. In this phase, management, employees and BOT controllers should have been trained. They had to be able to develop, test and implement the robots themselves. Robots should also be implemented in this phase.
The final planning would take 10 weeks. It was based on implementing 4 robots. It started with the definition phase in week 1. Three weeks were required to implement a robot: week 1 for development, week 2 for testing and week 3 for implementation and handover. In week 3 the same process started for the next robot. The definition and implementation phase thus would have take place in an iterative manner.

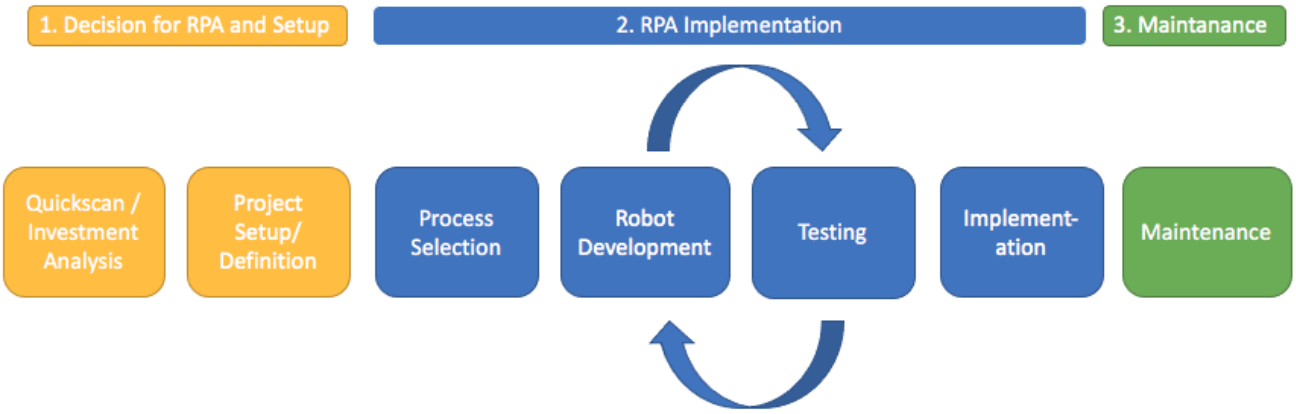

Figure 4: Flanderijn's Actual Life Cycle

3.2.2 Flanderijn's Actual Life Cycle

In the end, the life cycle did not run as described in the planned life cycle. Here we will now describe the life cycle as it has run at Flanderijn. In Figure 4 the actual life cycle of Flanderijn is shown. The automation project is divided into 3 parts. The decision for RPA and setup, the implementation of RPA and the maintenance. The life cycle of the automation project consist of 7 steps. The first two steps are the decision for RPA in the investment analysis and the setup of the organization. The next 4 steps are specific for an RPA project, which are: process selection, robot design, testing and implementation. The steps development and testing are iterative as the robot was redesigned based on the testing. Finally, the last step is the maintenance of the project.

Investment Analysis
In preparation for decision-making on RPA, Flanderijn began by conducting an investment analysis. The goal was to estimate whether the use of RPA would produce the results it desired. This analysis also shows criteria used by Flanderijn as relevant to the decision-making process in the application of RPA.

Flanderijn did start the project with the Quick scan. In it, several consultants estimated whether RPA was suitable for Flanderijn and what its potential was. This involved scanning whether processes within Flanderijn were possibly interesting and what the possible yield would be.

A combination of consultants was then chosen to start working with Flanderijn to implement RPA. Together with the consultants, Flanderijn first made predictions of the performance indicators for the decision-making process. To measure the performance of the application of RPA, three performance indicators are used. These indicators are the number of FTE, the total costs and the time saved. After the Quick-scan, the planning, the organization of the project and the processes were known. Table 1 shows the calculation of the productive hours of one FTE. Table 3 shows the costs of a full FTE. Based on these data, it can be calculated how many FTE are needed per process. This can be used to calculate how many FTEs are needed for a process using data on

Table 1: Productive hours per FTE (on a annual basis)

Productive hours FTE	Hours	Explanation
Contact hours	2,080	40 hours a week
Vacation days	240	30 days
Absenteeism	83	4%
Subtotal	1,757	
Productivity loss according to Flanderijn	527	30%
(Working on other task, helping colleagues, e.g.)		
Total amount of productive hours per FTE	1,230	

Table 2: Expected robotised hours and savings in hours and FTEs per year

Robotised process	# cases a year	Standard time in minutes per case	Total # hours a year	Result % robot	Savings in hours	Savings in FTEs
Business Register KVK	47,000	1	783	70%	548	0.5
Email processing & distribution	390,000	2	13,000	50%	6,500	5.5
"Invoeren zaken"	50,000	5	4,167	25%	1,042	1
						7.00

the number of work hours a process requires. In Table 2 shows the number of expected hours per process, which is needed to perform it. Tables 2 and 4 show the calculation of the savings per robotic process and other cost savings.

Table 5 shows Flanderijn's expected business case. It shows the expected costs and benefits of Flanderijn's project for three robots they created.
Finally, Table 6, show the expected return on investment. This is based on the first five years.

Project Setup
After Flanderijn decided to start with the RPA project, they thought about what the organization should look like. The planning states that the setup should come after the process selection. However, these two steps started at the same time, whereupon the setup was finally ready before the process selection. Also, the setup of the team that did the process selection was done in advance. This makes the organization setup before the process selection belong in the actual life cycle. Below is a description of how the organization was set up.
Flanderijn first set up a working group. This working group developed the business case to collaborate

Table 3: Cost per FTE

Costs FTE	€28,800

Table 4: Other cost savings (in euro's)

Other cost savings	Unit price	Total costs
Cost of paper per 500 sheets	3.25	1,267.50
Toner cost per 30,000 pages	200,000	1,300.00
		2,567.50

Table 5: Expected costs and savings Flanderijn (in euro's)

	2020				2021	2022	2023	2024
	Q1	Q2	Q3	Q4				
Savings								
FTE	-	25,200	37,800	50,400	201,600	201,600	201,600	201,600
Paper and toner costs	-	321	481	642	2.568	2.568	2.568	2.568
Total savings	-	25,521	38,281	51,042	204,168	204,168	204,168	204.16
Costs								
One-time investment								
Developing robots	50,000	-	-	-	-	-	-	-
Management and Maintenance	-	18,000	-	-	-	-	-	-
Training employee Flanderijn	-	18,000	-	-	-	-	-	-
Structural costs								
Management and maintenance	-	-	3,600	3,600	14,000	14,000	14,000	14,000
Licence costs Robot	6,000	-	-	-	6,000	6,000	6,000	6,000
	56,000	36,000	3,600	3,600	20,400	20,400	20,400	20,400
Total	-56,000	-10,479	34,681	47,442	183,768	183,768	183,768	183,768

Table 6: Total investment and savings (in euro's)

Total investment	180,800
Total savings	931,514
Total return	751,514

with RPA consultancy companies, so that Flanderijn could select a company that would help them develop and implement RPA in the organization. Flanderijn opted for an option consisting of two RPA consultancy companies. Following this decision, a steering group has been formed for the implementation of the project. The steering group consisted of two persons from Flanderijn, a member of the board and a program manager, and three of the two selected consultancies. Later a third person from Flanderijn was added to the steering group. This was the manager of the IT department. The steering group met once every two weeks. The steering group supervised the project, made choices and monitored the project.
A project group has been set up in addition to the steering group. This group analyzed the processes, developed the robots, tested and implemented the robot in the organization. The project group consisted of five members, four from Flanderijn and one of the two collaborating RPA consultancy companies: the program manager, a business process expert, an expert in the field of Flanderijn's current systems, a process developer, an architect of the consultant and an RPA developer of the consultant.
The program manager was in charge of daily management. The business process expert provided the connection between the project and the process owners. This function was responsible for the coordination of the business process part of the project, that is, of those responsible for the process parts. The business process expert linked the right employees to the project team, so that they could properly map the process.
The expert of Flanderijn's current systems was responsible for the connection between the project and the current system.
The job of the process developer was to select the right processes that are suitable for RPA and map the processes so that the RPA developer could create a robot for that process.
Finally, the RPA developer developed, tested and implemented the robots in the organization.
There was a Quality Assurance group to monitor the quality of the project. This group consisted of the program manager and a quality assurance expert from the consultant. This group met once a month.
One of the reasons that Flanderijn chose RPA was the possibility to train their own business experts to learn RPA. As a result RPA does not require a great effort from the IT department. The newly established organization took only a short time from two employees of the IT department, namely the manager of the IT department and an expert of the current IT systems. The other members of this project were the own business experts.
The position of the RPA project group was central in the organisation. No department was making their own robots. They only support with the development if the process, where a robot was be created for, was part of their department. It was also not part of the IT department. They only uses sometimes a IT'er for making some changes in te process.
Finally, the employees whose jobs would be replaced as a result of RPA are not fired. They are given new tasks or functions. For example, the mailing robots should reduce a high percentage of the mailings, but not all. Flanderijn has several offices. Before the transition to robots, each office handled its own emails. After the transition, the mailings that could not be sent by the robot were done by the employees at the head office. The work for the other offices is thus completely reduced to zero. Other work or new tasks will replace the robotic work.

After setting up the investment analysis, where the decision for RPA is made, and the organization is setup, the RPA project will be executed. This consisted of four steps:

- Process Selection. This includes the preparation / analysis of the processes. This phase involved analyzing the processes and documenting the processes so that they could be automated with an RPA robot.
- Development. This concerned the development of the robots from RPA with software from UIPath.
- Testing. The aim was to test the operation of the robots and to improve their performance.
- Implementation. Goes about putting the robots into operation

Process Selection
Flanderijn started with selecting the to be automated processes. The selection of these processes is based on a number of requirements formulated by Flanderijn. The criteria they used to select the processes are listed below.

- It must meet the three main goals of the organization: raise employee satisfaction, reduce costs and improve services.
- The number of transactions must be high enough to achieve time savings and profitability.
- The execution time of the process for employees must be long and the actions must be divided into two parts: requesting information and entering information
- Actions must be standard and repeatable. They used the 80-20 rule, which means that 80% of the process must be able to be automated.
- The process should be simple, not too complicated.
- During the development of the process, not much use should be made of the IT capacity of the IT department.

Flanderijn selected 5 processes on the basis of these criteria. These processes are described in the next section.

Processes that are Automated
Before starting this project Flanderijn selected 5 processes, that they will automate with RPA. These processes are:

- Transfer of information from the "Digitaal beslag Register"(DBR) to Pragma. DBR is a database where a debt collection agency can find information about the history of a debtor. Not everyone is allowed to use this database. But it is a database that is used nationwide. This process involves obtaining data from DBR and then storing it in Flanderijn's internal system (database), called Pragma.
- Link emails with attachments to files and distribute them to the appropriate treatment group, including formulating a task. Flanderijn receives e-mails from various customers and consumers.

- Passing on RDW data to Pragma and Flids (new internal system / database Flanderijn). Flids is a new system that will eventually replace Pragma. The RDW provides information about vehicles whose owner is in debt. This process receives the information and forwards it to Flanderijn's two internal systems.
- Transfer of "Business Information" to Pragma and Flids. "Business Information" is a site that has a database of information about companies. This site is used by Flanderijn to get more information to get in touch with debtors, which is data that is owned by the chamber of commerce(KVK). This process extracts information from this database and places it in the Pragma and Flids systems.
- Transferring information from the Tax authorities to Pragma and Flids. This process receives information from the Tax authorities and passes it on to the Pragma and Flids systems. It links the data to the customer base.

After analyzing the 5 processes, they selected 3 processes, for the first batch to automate them with RPA. One of these processes is split into 2 separate robots. The selected processes are:

- The transfer of DBR information to Pragma.
- Linking emails with attachments to files and distributing them to the correct treatment group.
- The transfer of business information to Pragma and Flids.
- The transfer of information from the Tax authorities to Pragma and Flids.

In December 2019, Flanderijn started analyzing the processes they had selected for automation with RPA. These processes concerned the mail process, the Business-info process and the transfer of DBR information to Pragma.

Issues

Flanderijn started with the preparation phase, with the intention of choosing the processes, describing the processes by means of interviews, analyzing the documentation and transferring it to the developer. But in this phase Flanderijn had to deal with a number of issues.

- Bad / inadequate description of the processes. When they started, the RPA team found that the major parts of the processes had not been described or that the descriptions were incorrect. This meant that they had to start from the bottom up and describe everything themselves in collaboration with the employees who carry out the process. This was time consuming. Furthermore, the RPA team discovered that the employees sometimes did not know how the exact process went. So they could not describe the process. This meant a lot of extra work for the RPA team.
- No uniform process and many parties involved. One of the processes to automate included 76 different mailboxes. Many customer numbers and file numbers. These numbers had to be cleaned up and tested to integrate them into the robot. Not every customer number was suitable for the robot, so analyzing which customer numbers were and which were not suitable took time. So the process turned out not to be as uniform as expected.

- Actual process could not be robotized. Some parts of the processes were not suitable for the robot. On paper they seemed suitable, but in practice this turned out differently. An example is a process where information from a specific system had to be used as a search term to find more information in another system. The employees did not have a fixed working method, it depended on the case which information they used as search term. They started with the name, phone number or address. So the process involved unexpected additional review work.

What was further notable was that less simple processes ended up being automated. However, this required an adjustment from the IT department. This led to the consideration of whether the time and costs of the IT person should be used for this, or whether it was too expensive.
In the end, this case study mainly automated processes that required the transition of information from one system to another and processes related to incoming mail traffic, of which information had to be moved to an internal system.

Robot Development
After the processes were selected, Flanderijn started developing the robots at the beginning of February. For this a robot developer was hired from the consultants. Eventually, this developer was employed by Flanderijn itself. In addition, it is the intention that Flanderijn itself will train personnel to become RPA developers. Two people within the organization have been appointed for this. They used UIPath as their software provider. In the development phase for this, a deal was struck with UIPath.

Issues
After analyzing the processes, Flanderijn started designing the RPA process. A developer from the consultancy started developing the robot. He needed more hours than expected. This meant that the estimated costs of €50,000 for the development amounted to €90,000. The reasons for the increasing costs were:

- The developer needed more hours to develop the robots compared to the original schedule.
- New process components had to be designed to make the process suitable for automation. For some processes, such as the mailing robot, some parts of the process had to be redesigned. In the mailing robot process was a step where documents were printed and scanned. The new process had to be digital, so a new place had to be designed for the storage / documentation of the documents. Furthermore, redesigning parts of a process led to a process change and extra work. To improve a process, IT employees had made additional IT adjustments to their current internal database / system, which allowed the robot to perform better. So an API has been created for the robot. That would not have been necessary if it were done by employees.
- Use of other software / techniques for the robot was necessary. Flanderijn used an internal database / system called Pragma. This system is an MS DOS application. However, the robot was unable to extract information from this system, which meant that screen scraping had to be used. This is possible with the UIPath software. However, it took extra time to figure this out and how to implement it.

- Training and documentation. Flanderijn wanted to train its own employees so that they could develop robots themselves in the future. However, no time appeared to have been reserved in the planning for training and documentation. As a result, the developer trained other employees and documented information during the planned development time. This extended the time of this phase.
- Extra functionalities had to be added. When the development of the robot was finished, Flanderijn wanted to add a few extra functionalities. For example a dashboard.

The development of the Mail bot took five months, started in January 2020 and ended in May 2020. After the development, Flanderijn had to wait for the implementation of the robot, because Flanderijn in a transition from an old to a new server (this is not the same as the transition from an old (Pragma) to a new system(Flids), as discussed earlier). It was possible to deploy the robot earlier, but they chose to wait, otherwise it would have to be replaced in a short time. Flanderijn had chosen to wait until the transition was complete.

Testing
The third phase concerned the testing phase. Compared to the schedule, testing actually took much longer. For this, 1 week had been scheduled. In the end, testing often led to the creation of an updated robot. This made the robot development and testing steps an iterative process. In May, the first prototypes of the robots were finished. Between May and September (2020) Flanderijn used the time to test the robots, train the employees and document everything.

Issues
Flanderijn had some delay in this phase. This delay was caused by the following:

- Difference in interpretation of employee and robot. The robot is more characteristic than the employee. During the tests, the RPA teams discovered that the robot did not envisage the same method as an employee. A robot needs more specifications than expected. For example, the robot had problems copying data from one system to another. At first glance it seemed like a simple copy paste operation, but in this case it also took some evaluation work. An abbreviation of a word is easily interpreted by an employee, but the robot cannot recognize it if it has not been initialized. So an address with the abbreviation "str." was simply copied by the robot, but did not work in the new system. Employees knew that in that case they had to enter "street". These little things required some adjustments in the process.
- Difference in optimal performance method between employee and robot. There is a difference between employees and robot in what is the best performing method of a process. During the tests, the robot's performance was somewhat disappointing. Achievements such as the speed of the robot. It was striking that the robot did a lot of unnecessary or inefficient work; work that people could recognize more quickly. After adjusting the method and selecting the robot, the speed was reduced from an average of 16 seconds over a case to 1 second.
- Disappointing performance of the robot. The application of other software / technology slowed down the robot. That's why it took a lot of time to optimize this process. To speed up the

robot, a more efficient approach / process had to be developed. This eventually led to a performance improvement, from 16 seconds per case to 1 second.

- Lack of documentation. At the beginning of the development phase, the developer was not busy with documentation. Later, the RPA team discovered that this was a bad choice, because it took more time to organize the documentation at a later stage.

Implementation
Flanderijn originally planned to go live immediately after the test phase of a robot. However, it was decided to wait until each robot had completed the test phase. One reason for this was that they could learn from the other robots and use that knowledge for all robots.
Flanderijn finally went live with the robots in September. They then also started the second analysis of suitable processes for RPA and continued to develop, test and implement RPA bots for these new processes. The KVK bot went live in August / September 2020.
The third bot, "Invoeren zaken" bot, had more delay. This robot went live in November 2020.

Issues
When the robots were developed and tested, the robots were implemented in practice. For this Flanderijn needed licenses, hardware to store it and to link it to their existing infrastructure. It took a few months to implement the first completed robots. This delay was caused by:

- Change of server in the organization (from Unica to Proxsys). After developing and testing the robots, they had to be implemented. When the robots had to be implemented, Flanderijn was also changing servers". That was a major change within the organization. Flanderijn decided to postpone the implementation of the robots so that they could be installed on the new server. For that reason, Flanderijn waited to purchase the license to run the robots. This has resulted in an additional delay of three months. These months were used to train the personnel and to get the documentation in order. In addition, they also started building the next robot.

- Authorization and responsibility over robot. It also had to be considered who would be responsible for the performance of the robot. This involved the fact that the robot needed its own authorization to have access to certain systems on the Flanderijn network. This was not planned in advance.

- Procurement and licensing could have been different, but did not matter much. Application and licensing could have been done earlier, but had no major influence on the planning. It was only when the robot was ready that buying the license was considered.

Finally, after the implementation of the robots, the employees received many phone calls about the robots. The employees were still busy with tasks related to their previous job. For example e-mails that could not be processed by the bots. Flanderijn solved this by creating / setting one central point where all cases that could not be handled by the robot were handled.

Maintenance
After the development and implementation of RPA, the robots must be managed and maintained. Flanderijn had estimated the maintenance differently in advance than the reality was. They assumed that maintenance would be necessary and that the robots had to be monitored for possible errors. In the actual life cycle, there is a lot more attention for the further development and improvement of the performance of the robot. It kept improving the robots to improve performance. An example is the Mail-bot, to which more email addresses have been added to the robot to automate more work.
Flanderijn wants to be able to develop, implement, manage and maintain RPA itself. The deal with the outsourced companies included a training part, which means that they will train Flanderijn employees to deal with RPA.

Flanderijn will also automate more processes with RPA. Two new bots are planned for further development. As a result of this development, Flanderijn has set up and trained a new team. This team consists of five members and one manager. The five members are divided into four roles. These are:

- RPA Developer. This role has two members. They will build and test new robots and will adjust the robots when necessary.
- RPA Infrastructure Engineer. This role includes the management of the infrastructure of the robot environment.
- RPA Business Analyst. This role includes the analysis and documentation of the business processes that are or will be built.
- RPA Application Manager, this function is responsible for the daily maintenance of the robots. If there are errors or other issues, the RPA Application Manager will try to fix the problem and keep the robots running.

This team will be the final organization of the RPA organization. It operates without the external consultancies.

3.2.3 Results

The first results of the implemented bots were known in October 2020. An overview of costs, as calculated by Flanderijn, is shown in table 7. Based on these data, the expectations for the first current year are presented below. The results show a high return on investment of 89%. The total revenue and savings are €359.000 and the total costs are €190.000. This makes the profit (see for cost Table 7 and for revenue and savings Table 8):

$$Profit = €359.000 - €190.000 = €169.000.$$

$$ROI = \frac{€169.000}{€190.000} = 89\%$$

Table 7: Overview Cost (in euro's)

	Budgeted	Actual
Developer	32,000	40,000
Consultancy	87,756.25	95,000
Department Operations		10,000
Department IT		20,000
Orchestrator licence		72,000
Robot licence		12,800
Total Licence		20,000
Developer UIPath		5,440
Total UIPath		24,440
Total costs	119,756.25	190,440

In addition, the bots achieved a reduction of approximately 15,000 working hours per year, based on the first two months of operating the bots. It reduced costs by €359,000 annually, which is €334,000 through the mailing bot, €12,500 through the KVK bot and €12,500 through the Invoeren zaken' bot.
It was hard to measure get the exact results, because it is about savings, and the results were not easy to separate of other performance. It can cause more savings than are described in this case study, and the exact time savings are based on expectations of the saved time of employees. Furthermore, the robot will be updated after the implementation, which can change the performance.

First of all, the development and implementation costs. From November 1 to June 1, Flanderijn made use of an external company. This company was responsible for advising and developing the first robots, setting up the infrastructure and training the employees of Flanderijn. The total costs amounted to €95,000. This includes the costs of the developer. Other development costs were the costs of the own team. Based on their salary and time, the total costs for the "Operations" and "IT" departments were €10,000 and €20,000 respectively. The costs for the infrastructure ordered from UIPath amounted to €25,440. This involved an Orchestrator license, the license for the robots and the development of UIPath, for €7,200, €12,800 and €5,440 respectively. Both licenses have a term of one year. At Flanderijn, 5 robots were allowed to run on one license.
The annual profit of the three completed robots is based on the first month. The savings, according to Flanderijn, are presented in table 8. The Mailing bot provides a saving of €334,000, the KVK bot a saving of €12,500 and the "Invoeren zaken" bot also a saving of €12,500. The last two bots, scored lower than expected, as the robot performed less than expected. The robot's coverage rate was lower than expected at the beginning, which resulted in fewer transactions being performed by the robot. One employee still had to work on the process as a result. However, this is expected to improve performance in the future as they continue to develop the robot.
Flanderijn calculated the savings using the following formula: $S = \frac{((T \cdot A) - W)}{1230} \cdot L$ In this formula, T is the average sum of time that an employee works per case without an operating robot in hours, A is the number of cases per year. W is the sum of time the employee works on the process with an

Table 8: Overview revenues and savings (in euro's)

	Expected	Actual
Mailing bot	158,400	334,000
Business Register (KVK) bot	14,400	12,500
Invoeren zaken bot	28,800	12,500
Paper savings	1,267.50	unknown
Tone savings	13,000	unknown
Total	214,867.50	359,000

operating robot each year, 1230 is the number of hours that a FTE works on a annual basis (see Figure 1) and L is the cost of one FTE per year.
From August 1, 2020, the new RPA team continued to develop and maintain the robots. This includes developing the robots, improving the robots, repairing the robots and solving problems. Each team member spent about eight hours a week, which costs Flanderijn about €50,000 per year, based on the salaries of the team members.

3.2.4 Future Expectations

Flanderijn expects to produce a robot every 8-10 weeks. The board gives priority to which bots are being developed. The RPA team meets once every two weeks. The reduction in FTEs will not lead to more layoffs. The employees are given a new position in the organization. The first batch of employees to be partly replaced by the robots are slowly starting new tasks to increase the positive response of the employees to the transition to robots. Later, employees will be given new tasks more quickly to take advantage of the robots. A new robot will be running in November: "prevention register" and it is expected that the "administration bot" will start running on 1 January 2021. From then on, approximately 6 bots will be delivered annually.
Flanderijn also expects to improve the current test robots. In October, 30,000 of the 45,000 emails were handled by the robot. They have also reduced the letterboxes from 76 to 50 by combining letterboxes.
Flanderijn is also thinking of creating an "Invoeren zaken" bot for the Flids system. Now they only developed a robot for the old Pragma system. Flanderijn wants to integrate this function to the Flids system, where in the future the "Invoeren zaken" bot will be integrated. In the meantime Flanderijn can use the bot to make use of the "Invoeren zaken" bot. It helps the IT department developing the new system to focus on other parts of the Flids system first.

3.3 Evaluation of the Project

After the implementation of the first bots, some comparison can be made about the success of Flanderijn's RPA project. First of all, making the robots took much longer than expected. This was because of internal and external factors. The main external factor was the server transition, which caused a three-month delay. The internal factors causing the delay were:

- Lack of process description.
- Redesigning of processes.
- Additional training and documentation time required.
- Extra functionalities.
- Correcting test errors.
- Performance improvement.
- Authorization and responsibility issues.
- Delay in purchasing licensing.

Although not all robots became operational on time, the savings of time and work in the first two months have become higher than expected. The fixed costs and costs per time are as expected except for the cost of the license. But because of the delay of the project, the total costs of the project are higher. The total revenue and savings of the robot are higher too. This because the robots do more work than was expected. A negative side is that the robots need more time per case than planned. Flanderijn expects to shorten this time by using the robots gradually improve.

The bots achieved a reduction of 15,000 working hours, which is more than the expected 8,610 working hours (7 * 1,230 (hours per FTE)). This means an almost doubling of the reduction in working hours per year.
Flanderijn is even thinking about making robots that will be linked to the new system, because of the rapid benefits it can deliver. The idea is that features of the more heavy-weighted IT system will be expanded, because RPA can solve this too. This means that RPA has become a major competitor for more weighted IT solutions. It lowers the priority of some planned functions for the heavier IT system. This was not the case during the planning. This says a lot about the positive performance and experience of RPA in the organization.

3.4 Conclusion

Research question 1a focuses on suitable criteria that can contribute to the decision for using RPA and traditional automation.
Flanderijn faced three challenges: A new large client, which created more work, need for more employees, who were hard to find, and had to deal with that current processes were inefficient and time consuming. The second challenge was that they were in a transition from an old system to a new one. The development of the new system took a long time. The third challenge was that IT personnel were expensive and hard to find. Requirements for a solution was that: it had to meet the three pillars of increasing employee satisfaction, reducing costs and improving services. Also, the solution had to be flexible in order to be able to switch easily to the new system, deal with resource constraints such as staffing, lead to less work, not require too much attention from the IT department, be manageable in-house and ensure control of data and knowledge. Additional requirements were that it provided for less paperwork, customer satisfaction, led to a more uniform

and consistent process and there was a possibility for a dashboard.
In the end, RPA was chosen because it could train employees quickly, it was quick and easy to implement, it was flexible, it could leave the current process and system intact, and it generally allowed for faster performance with fewer errors, took work off of employees, and it allowed for exceptions to the process to be performed by employees.

Research question 1b focuses on criteria that help identify suitable processes that can be successfully automated using RPA as an automation technique.
Flanderijn had six criteria that processes had to meet. First, the process itself had to contribute to the three pillars: increasing employee satisfaction, reducing costs and improving services. Furthermore, the transaction count had to be high enough to lead to time and cost savings. In addition, the work had to be time consuming for employees and had to consist of requesting and entering information. Another requirement was that the process should be standard and repetitive. Here they adhered to the 80-20 rule, where 80% of the process had to consist of standard procedures and 20% could be exceptions. Also, the process had to be simple and not too complex. Finally, any modification of the process should not take too much time for IT department.
In the end, it turned out that it was rare to have simple and uniform processes. Furthermore, it turned out that occasionally processes were suitable for a robot on paper, but ended up requiring assessment work at the time they were building a robot for it. Example here is the (str.). However, it was also the case that less simple processes could be automated, but this had to be partly adjusted by an IT employee. However, the consideration was whether the time of the IT employee could not be better spent.
Mainly processes that transfer information from one system to another are suitable for the use of RPA. Just like copying information from incoming emails into a system.

Research question 2a examined the planning of an RPA project. The steps according to Flanderijn are divided into three part which are "Decision for RPA and Setup", "RPA Implementation" and "Maintenance". "Decision for RPA and Setup" contain the first tow steps, which are the investment analysis and project setup. The "RPA Implementation" stage consist of process selection, robot development, testing and implementation. The final stage "Maintenance" is about the maintenance of the robots.
The first thing to notice is that the case study had a difference between the planning and actual course of the project. This was due to the various delays that the project encountered. The preparatory work for developing the robot took longer, because employees are expected to be familiar with the processes. But this turned out not to be the case. That's why the RPA team had to figure things out for themselves. Certain issues have caused some delay in implementation. For example, poorly documented processes caused delays in starting the development of the robot. The processes had to be clarified first. Furthermore, the robot developer needed more time to build the robots because the processes were not well documented and a system could only work together with the intervention of a screen-scrape software. Also, the transition of the server led to a delay in the implementation of the robots. This is however, an issue that occurred externally.
Furthermore, there was no time for the training of the staff by the external consultants and time for the documentation in planned.

Research question 2b is about the implementation of RPA within the organization. Here, im-

portant aspects for the setup, the optimal organization and implementation/execution of an RPA project are asked.
Flanderijn measured the performance of the project on the basis of three performance indicators. These are the number of FTEs that could be reduced, the cost reduction and the time that could be saved. Then they started the implementation. To implement RPA, Flanderijn used a consultant. They helped set up the organization, train employees, and develop the first robots. Flanderijn's organization consisted of a steering committee, and a project team. The steering committee was responsible for the project, made the decisions for the project, and monitored it. The project team consisted of the program manager, a business process expert, an expert in the field of Flanderijn's current systems, a process developer, an architect of the consultant and an RPA developer of the consultant. The position of the RPA project was central in the organization and not part of a department. Next is the selection of processes. Here it is important that processes are well documented so that a developer can start working with them. In addition, the extent to which the IT department should and can be involved in the RPA project must be considered. They can adjust the processes so that the performance of a robot can be improved. However, the question is whether their time should be made available for this. Furthermore, RPA apparently does not get along well with every system. With the MS DOS application, screen scraping was necessary to extract information from it. This is an additional step in the development of the robots. Flanderijn also ran into the problem of finding the right moment to train personnel for RPA. This needs to be considered carefully, to prevent it from happening too late. During the testing, Flanderijn ran into several issues. They found out that there is a difference in optimal process flow between an employee and a robot. This is because humans and robots work differently and therefore have a different optimal approach. This has to be taken into account to come to a better working robot. In the implementation step, one issue was that it was important to determine who is responsible for any errors made by the robot. This is legally an important aspect to prevent it from leading to conflict in the future. In the end, Flanderijn has chosen for a maintenance team of 4 roles: RPA developer, RPA Infrastructure Engineer, RPA Business Analyst and RPA Application Manager. Besides maintaining, improving and managing the robots, they were also responsible for the development of new robots.
Flanderijn is positive about the result of the RPA project. It delivered an ROI of 89%. In addition, it is so positive that they are considering developing more robots, to provide RPA as an interim solution for functions yet to be programmed in the new system. This would allow them to shift the priority of functions in that system to other functionalities. This means that RPA can also take work away from the IT department.

4 Conclusion

The research looked at the attractiveness of RPA as an alternative for traditional business process automation and conditions for a successful implementation of RPA in an organization. In this report a literature study and case study have both been done. The research focused on the motivation/criteria for using RPA, characteristics of processes, project planning and the implementation of RPA. The research has shown that there are several motivations for making the decision to use RPA. Motivations such as improved resource utilization, improved performance (such as faster execution),

improved quality, consistency and RPA as a relatively inexpensive alternative are underlined by the case study. In addition, another important finding from the case study is that RPA can serve as a solution to resource constraints. Finding IT staff is difficult and expensive. Flanderijn makes it possible for some processes to bypass the use of IT personnel, by using RPA. Although, the expectation of reduced IT usage has not turned out to be entirely true, because some capacity of the IT department is still required for optimizing the robots performance and the architecture. There has been no need to hire new IT staff, for the automation of processes. Another motivation is that, RPA has the ability to easily keep the development of robots within the organization. This is due to the ease with which employees of organizations can be trained to develop the robots. This is interesting when companies are dealing with sensitive data, where not just any new computer system or application can be used.
The case study took a closer look at characteristics of processes that are important to indicate the success of RPA. As the literature shows, features such as simple processes, with a high number of transactions, that are repeatable and can save costs or are valuable to the organization, are elements that are important for RPA to be a successful solution.
The implementation of RPA in the organization is critical to the success of RPA. Core elements of the implementation are the organization, description of the process, training of the employees and documentation of the processes and robots.
The difference in making a workable robot and a high-quality robot is made during the testing phase. Changing the process could lead to a higher performance of the robot based on the fact that the optimal way of executing a process of an employee is or can be different than the optimal way of executing a process by a robot. Important elements to pay attention to are the difference in cognitive skills, the importance of the correct input and the ability to deal with exceptions. Improvement of the robot could also be the case after the robot is fully implemented in the organization.
All in all, in this case study, the effect of RPA in the organization is positive for performance. It leads to better performance through cost savings, faster execution and more effective use of assets. RPA proved its added value as an automation tool that can be implemented quickly, which is useful for improving the performance of processes in the short term. This is also evident from the fact that Flanderijn viewed RPA as a substitute for planned heavy-weighted IT features.
This means that RPA is a suitable automation methods to address challenges with legacy systems. In contrast to traditional automation methods, it can be implemented in a much shorter period of time and the costs are also much lower. Furthermore, it is true that it is easier to get personnel who are capable of making these kinds of robots. However, this does not mean that there is no need for IT personnel anymore. They showed in this case study that the IT person can be important in optimizing the robot with the current systems, which can increase the performance.
The downside of RPA is that it does end up being limited in its capabilities, since processes have to meet requirements, like if and else statements and it can only optimize existing systems/processes instead of creating new optimized systems/processes.
In March 2020, Flanderijn had to deal with Covid-19 measures. This affected the organization to such an extent that many employees had to work from home. The influence of the Covid-19 effect has not been considered in this report.
Interesting future research is the longer-term effect of RPA in the organization. After the implementation of RPA in the organization, maintenance is an interesting part of using RPA. What is the effect of RPA bots in an organization over a longer period of time, when processes are changed and when employees who originally did the work before the robot was implemented have left the

organization. Another interesting research question would be the effect of the implementation of RPA on employee satisfaction.

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