

UTRECHT UNIVERSITY

MASTER THESIS

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# The Qualitative Impact of Robotic Process Automation

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# *Abstract*

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## **The Qualitative Impact of Robotic Process Automation**

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Robotic Process Automation (RPA) is a relatively new technology and started to gain traction at the end of 2014. RPA is a term for software tools that operate on the user interface that try to mimic a real user. Currently, there is limited insight into the qualitative impacts of RPA experienced by organizations. This research investigates qualitative impacts related to governance, process automation and workforce. As a result, a literature study and case studies have been carried out to learn more about these impacts and to create guidelines to either reduce negative aspects or reinforce positive aspects of these impacts. The developed guidelines have been evaluated using a Delphi methodology. The guidelines concerning governance formulate advice that can be used during the starting phase of RPA and beyond. It covers the relation between the business and IT and covers organizational models. Regarding process automation, guidelines are provided to reduce the burden of bot maintenance. The guidelines regarding the workforce cover topics such as: employee satisfaction, RPA acceptance and job insecurity.

**Keywords:** Robotic Process Automation - Qualitative impacts - Guidelines - Bot development – RPA governance – Workforce effects

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# List of Abbreviations

<b>RPA</b>	<b>Robotic Process Automation</b>
<b>NPA</b>	<b>Non- Person Account</b>
<b>BPM</b>	<b>Business Process Management</b>
<b>PoC</b>	<b>Proof of Concept</b>
<b>DT</b>	<b>Deutsche Telekom</b>
<b>FTE</b>	<b>Full-time Equivalent</b>

## Chapter 1

# Introduction

In the past century automation has driven innovation which has enabled organizations to increase their productivity. Automation has reduced the effort and attention required by human workers to perform the same tasks allowing for higher productivity per person. At first, automation was used to lessen the burden of hard manual labor or dangerous jobs. While this trend continued, the need for human labor was reduced in, for example, the agricultural sector [105]. This has changed entire industries and led to the creation of new ones leading to more innovation and new knowledge. In the agricultural sector, automation enabled by mechanization is only partly responsible for significant gains in output. Other innovations such as improved fertilisers, pesticides and modified crops has had an effect as well as process improvements resulting from better farm management and consolidation [105]. This has had a wide range of effects and farming today consists of vastly different tasks than a century ago. For example, skill requirements changed and farmers needed to be able to maintain their machines.

The widespread availability of computers and information systems has had a significant impact on office workers and the way they work. As with the agricultural sector example, there are tools that can increase productivity without increasing headcount. From an IT perspective, there are opportunities to extend and improve ERP systems or implement BPM solutions. Robotic Process Automation (RPA) is a tool among a diverse set of other tools to enable higher productivity as part of an automation and digitization strategy. RPA is a term for software tools that operate on the user interface that try to mimic a real user [91]. RPA is non-invasive to the underlying IT infrastructure as opposed to BPM solutions [46]. RPA is used to automate processes that are structured, rule-based and repetitive [2, 40, 86, 101]. In this thesis, the word *bot* will refer to a computer program that performs process automation. Other terms used in the industry are *robot* or *virtual-assistent*. The term *bot* is used as it refers to software [61], while the term *robot* refers to a machine [62].

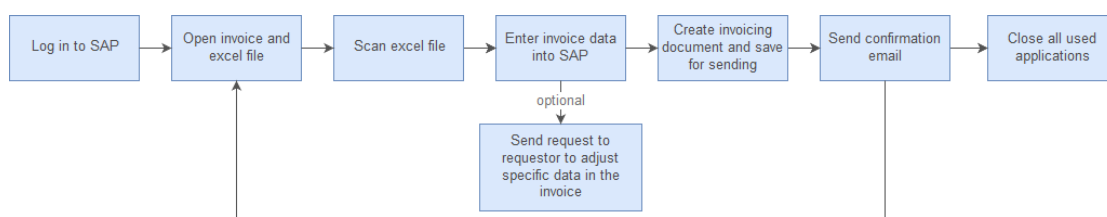


FIGURE 1.1: Overview of an RPA use case for invoice creation

**Example - invoice creation**

RPA can be used for creating invoices. This paragraph will discuss the actions a bot executes to create an invoice, based on a process described by KPMG [68]. An overview of the process is shown in figure 1.1. The process starts with the bot logging in to SAP. The bot receives an invoice request via email which has an excel attachment. The bot opens the excel file and scans each cell, to determine the input quality. For example, the bot checks if the right template is used. In the next step, the bot enters the invoice data from the excel file into the relevant fields of the SAP interface. If data is missing it sends out an email to the invoice requestor, with a request to complete the invoice. Once all the data is pasted into SAP, the bot creates the invoice by running all the transactions. The bot then sends an email to the requestor with the confirmation that an invoice has been created. The invoice is then moved into a relevant sub-folder in Outlook and the bot closes all the used applications.

## 1.1 Problem statement

Workers spend a substantial time executing business processes using ERP, CRM, spreadsheets or other specialized systems. These processes require manual repetitive tasks such as typing, copying and pasting of large amounts of data from one system to the other. Such repetitive and structured tasks can be automated by using RPA. RPA claims to reduce costs, improve efficiency, increase productivity and reduce errors [2,42,44,66]. However, organizations are starting to experience side-effects of using RPA. For example, RPA might be used as a 'band-aid' solution to speed up a process that has underlying issues. In such a case the core issues are not fixed and RPA can hinder real progress [38]. Another side-effect of RPA and automation in general is that less staff is required. As a result, staff can be employed differently. This can both positively and negatively impact employees [22,25,26]. Finally, as RPA evolves within organizations, it can become difficult to coordinate and prioritize different RPA projects [71].

RPA is a relatively new phenomenon as it started to gain traction at the end of 2014, which can be seen in figure 1.2. Currently, there is limited insight into the qualitative impacts of RPA experienced by organizations and how organizations can minimize negative aspects and reinforce positive aspects. In order to reduce this knowledge gap, the qualitative impacts of RPA have to be identified and researched in order to create a strategy to minimize negative aspects and reinforce positive aspects. Therefore the main research question is formulated as:

*RQ: What are the qualitative impacts of RPA experienced by organizations and how can organizations either reduce negative aspects or reinforce positive aspects of these impacts*

The main research question is formulated in two parts as it seeks to identify the qualitative impacts of RPA experienced by organizations and to propose strategies to reinforce positive aspects and reduce negative aspects. The term *qualitative impact* is chosen, since it has a more neutral connotation as opposed to the term side-effects, which has a negative connotation [18,19,63].

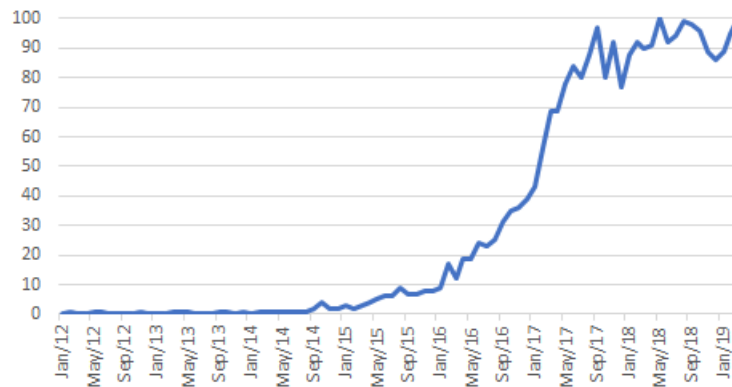


FIGURE 1.2: Shows the popularity of the search query Robotic Process Automation across the world starting from January 2012. The y-axis represents the relative popularity as a ratio of the query's search volume to the total number of searches. Data source: Google Trends (<https://www.google.com/trends>)

## 1.2 Thesis structure

Chapter 2 starts with the research methodology which outlines the research approach and the scientific methods used. Chapter 3 will present relevant literature and provide the theoretical foundation for this study. Chapter 4 will present the case study results. Chapter 5 will introduce and discuss guidelines to reinforce positive aspects and reduce negative aspects of RPA. The final chapter contains both the discussion and conclusion.



## Chapter 2

# Research Methodology

This chapter will discuss and justify the research approach and methods used in this study. The chapter starts with the introduction of the main research question as well as the sub-research questions. The design science methodology and the corresponding design cycle will be introduced in the subsequent section. This chapter will also discuss each step of the design cycle and their rationale. The chapter ends with a description of the research methods and techniques.

### 2.1 Research questions

Four sub-research questions have been formulated with a more narrow scope to answer the main research question of:

*RQ: What are the qualitative impacts of RPA experienced by organizations and how can organizations either reduce negative aspects or reinforce positive aspects of these impacts*

The first two sub-questions lay the ground work to identify the different qualitative impacts and provide a general overview of an RPA implementation process. Based on this information, strategies to reduce negative and reinforce positive aspects can be generated which should be part of an RPA implementation process. The sub-research questions are:

*SQ 1: What are the qualitative impacts of RPA experienced by organizations?*

The qualitative impacts of RPA that exist both in scientific literature and grey literature such as vendor or consultancy reports should be identified first. An impact is relevant if its effect on the organization can fully or partially be contributed to the use of RPA. Additionally, an impact will not be a direct limitation or benefit of RPA. For example, a potential benefit of RPA is that it increases the accuracy of a process and the impact could be increased customer satisfaction and retention. In this case, the increase in customer satisfaction and retention could be considered a qualitative impact of RPA.

*SQ 2: How is an RPA implementation process currently structured?*

To provide an advice that can be used during the RPA life-cycle, it is necessary to map out the implementation process. As stated in chapter 1 RPA is a relatively new phenomenon. Thoroughly used and verified methods for implementing RPA have not yet been established. As a result, the steps as part of an RPA implementation process will be described on a high level.

*SQ 3: How can organizations reduce negative aspects of the qualitative impacts of RPA?*

*SQ 4: How can organizations reinforce positive aspects of the qualitative impacts of RPA?*

The information resulting from answering sub-research question 1 and 2 will be used to create guidelines for organizations willing to implement RPA or those that already have implemented RPA. The guidelines regarding the negative aspects can be split into two types. The first type is about the mitigation of negative aspects, while the second type is about adaptation measures to reduce negative effects.

## 2.2 Design science methodology

The research goal is defined as a design problem. In this study, the problem is defined as the qualitative impacts of RPA and the goal is to design artifacts that accomplish the stated goal. As such, the design science methodology [98] has been adopted. This study follows the steps of the design cycle, as an actual implementation of guidelines at an organization is beyond the scope of the study. As visualized in figure 2.1, this method proposes to: characterize the problem that is to be solved, design one or more artifacts that could treat the problems and validate the designed artifacts.

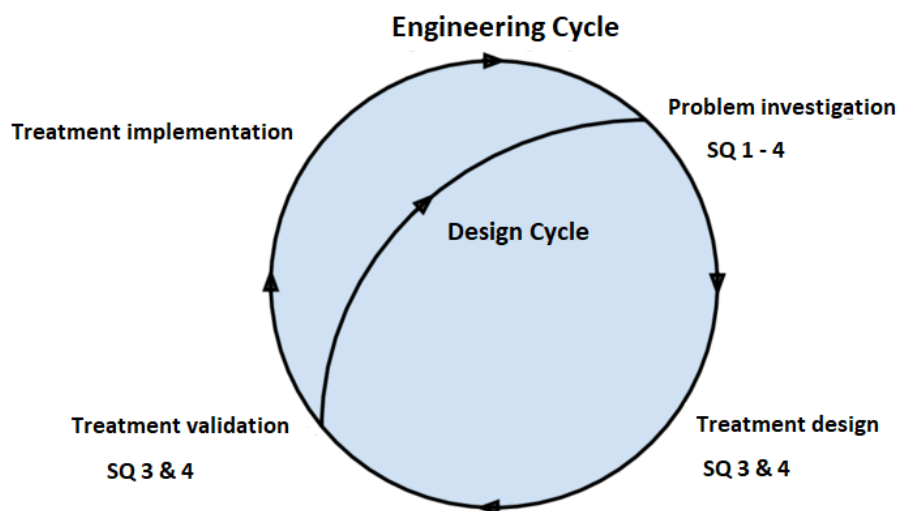


FIGURE 2.1: Design cycle by Wieringa (2014) [98]

The goal of the first phase, the problem investigation is to identify, describe, explain and evaluate the problem to be treated [98]. This will be done by conducting literature research and case studies. The qualitative impacts discovered during the literature research will be used as a basis for the interviews conducted as part of the case studies. The case studies will be used to gain more insight into various impacts and to validate whether its impact is contributed by RPA. Based on the information resulting from the problem investigation, artifacts, in the form of a set of guidelines will be designed that aim to reduce the impact of negative aspects and reinforce positive aspects of RPA. In this research, the treatment is the interaction between the artifact (guideline) and the problem context (qualitative impact). A guideline will describe an action or an advice that can be utilized by an organization and contributes to answering sub-research question 3 and 4. The artifacts are designed based on available treatments found in the literature and the case study findings. The designed artifacts will be validated to determine to which degree they contribute positively to a negative or positive aspect of RPA.

Within the design cycle, the goal of the validation is to determine how an artifact will interact within the context, without implementing it within a real-world context [98]. As part of the validation, it will be investigated whether an artifact produces a net positive effect and is deemed an acceptable solution by a group of experts. Additionally, trade-offs can be made between different artifacts.

## 2.3 Research methods and techniques

### 2.3.1 Literature review

The literature study follows a protocol which will be outlined in this section. The literature study starts with the creation of a long list containing both scientific literature and grey literature. Grey literature considered for the long list were websites and reports mostly from RPA vendors and consultancy firms. The materials considered for the long list were not yet strictly selected, as the initial objective was to cast a wide net containing a set of diverse information. After the creation of this long list, the literature study can be divided into three parts. The first part consists of creating a short list based on predetermined selection criteria. The second part concerned reading, summarizing and reflecting upon the literature. The reflection focused on the quality and the overall conclusions that could be drawn. The literature study ended with a critical synthesis in which the articles are compiled into a document discussing the newly created insight, discrepancies and knowledge gaps. The synthesis can be found in appendix A.

### 2.3.2 Case studies

A case study is conducted to investigate a contemporary phenomena in its context [78]. A case study is suitable if the phenomenon is difficult to study in isolation [78, 102]. For this study, it is difficult to isolate RPA as it is part of an organization, process and involves different stakeholders. The case study methodology is suitable for an exploratory research purpose that seeks to find out what is happening and to gain more insight [78, 108]. This study has a partly exploratory nature as one of its goals is to identify and investigate qualitative impacts of RPA. Another advantage of the case study approach is triangulation as studying the phenomenon from different angles provides a broader picture and strengthens the evidence [73, 78, 102]. Furthermore, fulfilling multiple cases increases the generalizability and provides more insight [64]. The cases are selected using convenience sampling. Convenience sampling involves drawing samples that are both easily accessible and willing to participate in a study [90]. The network of the external supervisor was used to select organizations for this research.

The main source of data collected from the case studies is derived from semi-structured interviews. These semi-structured interviews will be held with different participants at the selected organizations. Additionally, relevant documentation that can be acquired is analyzed. An overview of the data collection is shown in table 2.1.

This study utilizes the case study protocol provided by Runeson and Höst (2009) [78], which is based on the case study protocol of Pervan and Maimbo (2005) [73]. This protocol provides a case study outline divided into four parts. The first part is the preamble, which contains information about the purpose of the protocol and states the guidelines for data storage. In the second part, an overview of the project and case method is provided along with a detailed description of the procedures for conducting each case. The third part contains information and documents used for data collection such as the interview protocols. The final part includes a detailed description of the

data analysis procedure. The case study protocol can be found in appendix B.

TABLE 2.1: Overview of data collection

Case organization	Type	Persons involved
Rabobank	2 interviews, semi-structured	2
BankX	2 interviews, semi-structured	2
PostNL	1 interview, semi-structured	1
Municipality of Rotterdam	1 interview, semi-structured	1
	2 observations of an interview	2
	1 interview, unstructured	1
	3 pieces of documentation	

### 2.3.3 Analysis method

A multiple-case design allows for the use of a cross-case analysis [8,64,67,106]. A cross-case analysis enhances the generalizability of the results to other contexts [64,106]. Additionally, cross-case analysis is a widely used analytical approach in exploratory case studies [21]. This technique treats each individual case study as a separate study. There are several strategies that can be used for a cross-case analysis in order to study the data differently [23,82]. For example, the cases can be split into two groups based on an attribute, such as employee satisfaction, and then examined to discover the similarities and differences between those groups.

In order to analyze the themes, similarities and differences across the cases, the data collected is coded and grouped based on categories emerging from the literature review and the initial interview at the Rabobank. A thematic coding approach is used as outlined by Robson and McCartan [77]. Using this approach, all or parts of the data are coded and labeled that contain relevant and interesting information. The interviews are coded using NVIVO, the coding scheme can be found in appendix C.

### 2.3.4 Validation

To validate the created guidelines the Delphi method is used. The Delphi method is defined as *"a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem"* [55]. The method is based on the premise of collective intelligence that enhances the individual judgment by capturing the collective opinions of experts. This study uses surveys to collect the expert opinions, allowing for participants that are geographically far away and guarantees anonymity [89]. This allowed for higher expert selection criteria that have academic publications related to RPA. Another advantage of using surveys, is the opinions obtained are not influenced by the social pressure of a group or differences in status within a group [92]. The Delphi method has different types of which the *policy Delphi* is most applicable to this research. The policy Delphi is an instrument for policy development, which is the goal of this research in the format of guidelines. This distinction needs to be made, since the purpose of the policy Delphi is not focused on establishing consensus among experts. It is about clarification of divergent views, generating policy alternatives or decision making on them. Furthermore, it can be about estimating the impact and consequences of any particular option or examining the acceptability of any particular option [92].

The survey mostly uses statements with a nine point Likert scale to determine the corresponding agreement. Consensus is established for each statement, if a range of three consecutive points on the scale are selected by over 70% of the experts. Within Delphi research, there are no clear criteria available to determine at which percentage consensus has been reached [92]. McKenna (1994) [60] and Loughlin & Moore (1979) [56] suggest consensus is reached if there is 51% agreement amongst respondents. In other research 70% or 80% recommended. Two studies with a similar Delphi setup using a 9 point Likert scale have adopted a consensus of 70% and 75% respectively [1, 89]. Based on consensus percentages used in other studies, the percentage was set at 70%.

Artifacts not accepted by the experts will be redesigned. Such artifacts can be redesigned based on input provided by experts. It is possible that multiple artefacts are designed for a single problem, in that case the objective is to make a trade-off between the two artifacts.

## Chapter 3

# Theoretical Framework

The first section of this chapter covers an operating model for RPA. The second section introduces the qualitative impacts of RPA found in the literature and provides concrete examples. The third section covers the qualitative impacts that are related to governance and the IT function as it is a major theme within the literature. The second major theme is discussed in the final section, which concerns the impacts related to the workforce.

### 3.1 Operating model for RPA

Organizations that adopt RPA define their own *operating model* [48, 57, 58, 99]. An operating model is a blueprint outlining how RPA delivers value for the organization. RPA vendors, such as Blue Prism, have created their own operating models which they can adapt to their customer [14, 100]. An operating model can be largely centered around three distinct roles [34]. First, bot developers, that translate business logic into a robotic workflow. Second, process architects, who design processes empowered by RPA. Third, support and maintenance staff, who maintain and update the bots. The operating model describes where these new roles sit within the organization and what their responsibilities are. Understanding the operating model helps to answer sub-research question 2 that tries to answer how the RPA implementation process is currently structured.

#### 3.1.1 Product evaluation phase

One of the first steps is to analyze and evaluate the capabilities of RPA to determine its value to the organization [3, 100]. This includes analyzing the products of different RPA vendors [45, 100]. Key differentiators of RPA software relate to governance, control and analytics [52]. When evaluating RPA software, it is important to consider the organizational fit [45]. An RPA vendor not only provides the software, but can also provide additional services such as operating models, operating and training resources and general advice [100].

As part of the preparation phase, candidate processes have to be identified that can be used for a Proof of Concept (PoC) [15, 65, 80, 86, 100]. Processes consisting of high-volume and repetitive tasks are most suitable for RPA [65, 80, 100]. For example, a process in which information is extracted from various sources such as excel sheets and PDF files and pasted into another system to generate a report is often highly suitable. Employees, particularly at staff level are selected to support teams tasked to identify such processes [15, 65, 80, 86]. A project manager is then often tasked to select and prioritize the processes according to specific criteria [15, 86]. Once a suitable process has been selected, a PoC can be developed that aims to assess the financial and technical feasibility of RPA [15, 36, 45, 101]. A PoC is a good starting point as it is a contained

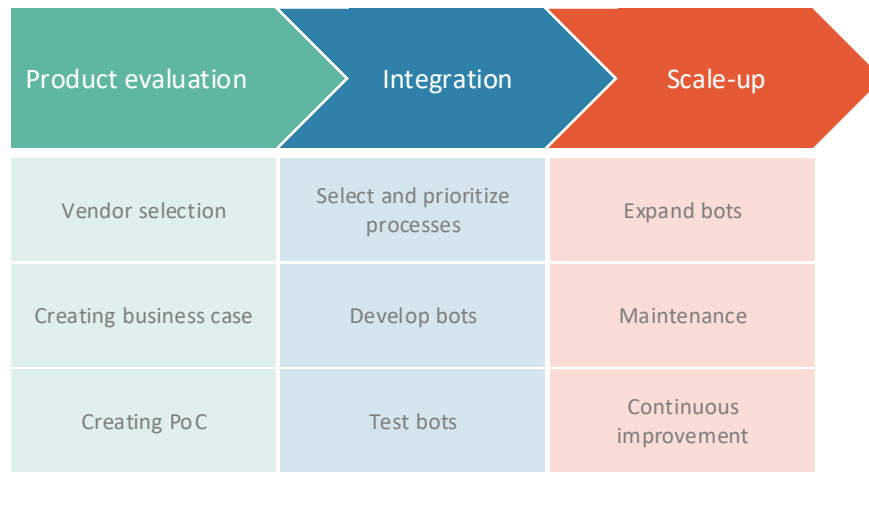


FIGURE 3.1: Overview of the phases and activities that can be part of an operating model

approach in which one or two processes are automated within a single department or business unit [36]. Some organizations choose a PoC for processes that are highly visible and thus create more interest and enthusiasm from within the organization [45]. The information gathered during the preparation phase can be used to draft a business case. Once the business case has been approved more resources can be secured and the project can be mobilized [100].

### 3.1.2 Integration phase

Once the preparation phase is completed and the project has sufficient resources and approval, the bots can be built and trained to perform selected tasks. Organizations can opt to apply a process improvement methodology, such as lean, before automating their processes. It can be useful to re-sequence activities or eliminate tasks from legacy processes that are no longer needed [101]. While lean principles can benefit organizations by eliminating waste and improving the efficiency [103], there can be negative side-effects. There is evidence indicating negative effects when introducing a lean methodology, which is not specific to RPA [9, 31, 70]. Process simplification and increased workflow integration could lower job quality and increase mental strain due to more monotonous jobs and less employee involvement [31]. However, a more positive outcome can be ensured if emphasis is put on social capital, change management and psychosocial factors during the development of lean practices. Additionally, lean practices in combination with RPA can potentially eliminate monotonous work.

Bots are often built by either business analysts or developers [14]. The effort required can vary between organizations due to different factors such as the number of bots and processes, difficulty of the process and capability and attributes of existing IT systems. Bots considered finalized are evaluated and feedback is collected to assess whether a bot can be put in a live environment. Further refinement by adding additional rules or by modifying existing rules is necessary if issues are identified [65]. Bots can be tested by running scenarios and monitoring their actions, which is done during acceptance testing [14]. Testing can be done by teams designing and building the bots [100], or be done by dedicated teams [80].

### 3.1.3 Scale-up phase

The scale-up phase is reached once a number of processes have been automated and a foundation is made to expand the number of bots. The objective within the scale-up phase is to expand the number of bots and realize the projected results. Aside from expanding the number of bots and maintenance, organizations can have different goals. Some organizations have a set and forget mentality and stop developing their RPA capability. Other organizations want to build an enterprise-wide RPA capability [100,101]. These organizations divert resources towards continuous improvement of bots and processes [100,101]. Whether organizations choose to expand their RPA capability depends on the size of the organization, the automation potential and attitude towards RPA. One organization went as far to implement a platform disaster recovery, in which each bot was duplicated at an external location [100]. Organizations can also opt to create bots with the intention to reduce the amount of tedious work or workload of employees [80].

## 3.2 Qualitative impacts

The rest of the chapter will discuss the qualitative impacts of RPA found in the literature. RPA is a tool to automate certain processes and, as a result, the employees previously executing these processes manually are affected. Furthermore, the bots have to be programmed and maintained and the overall process has to be governed, which includes different stakeholders with different backgrounds and visions. These themes are most present in the literature and will be discussed in depth in two separate sections. There are other less prominent impacts described in the literature and four topics related to: cost calculation, outsourcing, customers and organizational structure are briefly discussed in appendix D.

## 3.3 Governance and the IT function

RPA projects are mainly business driven, but the IT department has to be a part of the initiative [14, 25, 26, 84, 100, 101]. By organizing RPA within business units, local employees possessing the processes knowledge are more involved. Many organizations have claimed success by organizing RPA in the business side [46, 71, 86, 100]. However, the IT department has to be part of the RPA initiative as they can ensure that RPA solutions work securely, consistently and are scalable. Furthermore, business people will run into issues that are initially invisible to them, but not to IT such as, capacity planning, fail-over for servers and storage, licensing of virtual machines and network latency [84]. This can create tension as both of these stakeholders can have different views on RPA and there is a lack of oversight to coordinate and prioritize different RPA initiatives. In one case study the IT department reacted negatively to RPA as they viewed it as a temporary IT solution that was improperly integrated [86]. The IT department was concerned that RPA developers did not apply the methods and best practices that software developers use. RPA can also be met with scepticism from the IT department. [14]. Organizations need to plan and adopt effective governance for RPA implementations [25]. A crucial part of this is getting the right support from senior management [25, 50, 99, 101]. A project sponsor from senior-management can sell RPA to the organization and lower barriers that threaten progress. Additionally, it can provide central leadership and provide final responsibility.



To ensure sustainable development of RPA it is recommended that a central RPA governance is established. [71,99,100]. The RPA governance has to be controlled by interested stakeholders who will include at minimum: the head of RPA, business unit representatives and IT representatives. They will be accountable for demand management and generation, benefits tracking, continuous improvement initiatives and will be involved in emerging issues and risks among other responsibilities [99]. This governing body can also aid in the maintenance of bots as that can be more burdensome than initially expected [71,86]. It is important to note that a central RPA body is not always the right solution. To determine what is suitable for an organization several aspects need to be considered such as the size of the company and the type of the organization [71].

### 3.3.1 Organizational model

Schmitz, Dietze and Czarnecki (2019) [80] investigated the digital transformation using RPA at Deutsche Telekom (DT). DT wanted a lean and agile approach to their RPA effort to realize quick results and cost savings. The overall responsibility and accountability for RPA in its life-cycle was put into the Automation and Development Department. As seen in figure 3.2, a team of project leaders were responsible for multiple smaller automation teams. The project leaders had a role in the identification, design and implementation of RPA use cases that contributed to the overall objective of increased process automation. The RPA project leaders visited employees tasked with the processes to be automated at their workplace to understand their daily tasks. The detailed operational understanding helped to identify and prioritize ideas for RPA use cases. Once a bot was considered finished by an automation team, it was handed over to a dedicated team responsible for testing, operations and change management.

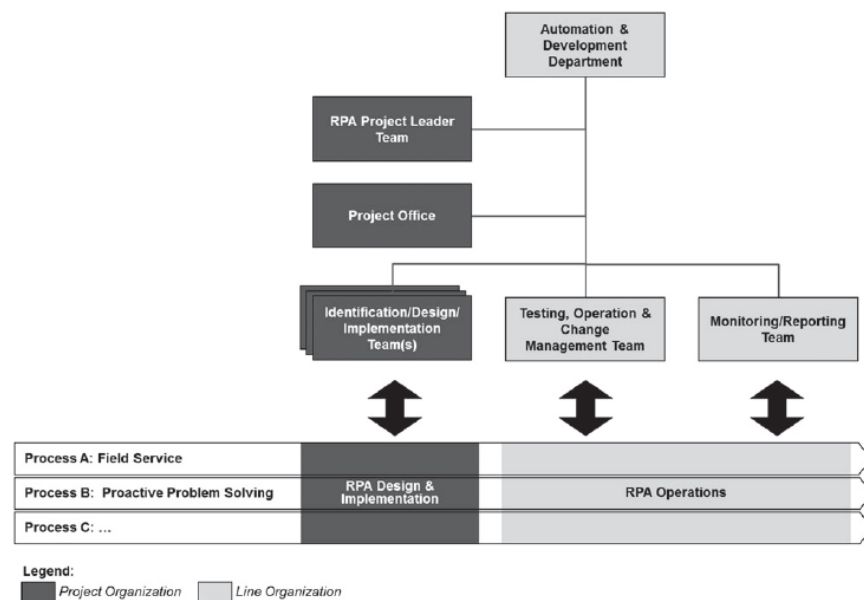


FIGURE 3.2: Organizational model of RPA implemented at Deutsche Telekom, by Schmitz, Dietze and Czarnecki (2019) [80]

The example at DT describes a centralized organizational model. In a centralized organizational model, a CoE is created containing the entire RPA capability. In the case of DT, this was the Automation and Development Department. Two other mainstream

approach are outlined in figure 3.3. A decentralized approach places the RPA capability in different business units without a governing body in place. Osmundsen, Iden & Bygstad (2019) [71] describe two advantages of a decentralized approach. First it creates enthusiasm for digitization due to the deep involvement of local employees within the RPA initiative. Employees realized how they could employ RPA software and make improvements themselves without the help of the IT function. By establishing local ownership, the employees knowing the processes were better involved. A decentralized approach has significant downsides however. For instance, it lacks control mechanisms to coordinate and prioritize the different RPA initiatives. Another downside is the lack of end-to-end process view. Process automation was done within departments without a perspective of how processes are part of and affect other parts of the organization. A federated approach combines the decentralized and centralized approach. It retains the benefits of local ownership and business involvement of the decentralized approach. The disadvantages of the decentralized approach are avoided by retaining a CoE.

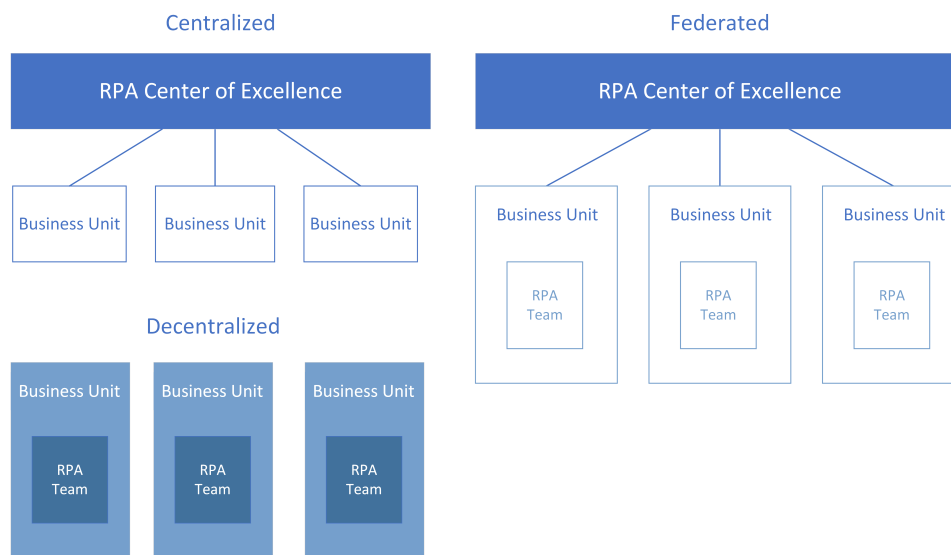


FIGURE 3.3: Overview of organizational models

### 3.3.2 Realizing results

The implementation of RPA is not always successful, Capco's [28] RPA experience has seen more failures than success stories. A failure in this sense is that the proposed benefits are not realized. Various reasons exist why RPA projects fail and one of them is when businesses try to solve everything with RPA, instead of realizing that RPA is one tool in a toolkit of different approaches. Businesses should focus on the process, not the technology and should try to understand the problem they want to solve. A common occurring issue is a robotics team solving one bottleneck in an overall business process only for another bottleneck to show up, leading to little improvement. Additionally, RPA can be used to covers symptoms without fixing the real issues. As a result, RPA might hinder real progress [38].

### 3.3.3 Security

RPA introduces a new attack surface that can pose a threat to availability, integrity and confidentiality of sensitive data and systems [12, 75]. RPA can be leveraged to gain further access to an organization. A secure robotics platform should provide integrity, traceability, confidentiality and control. A related topic is identity management for bots as they require a new type of account, a Non-Person Account (NPA). NPA introduces new issues as bots cannot perform multi-factor authentication. Strong NPA authentication is currently not possible, and is an issue needing to be solved [75]. This can be problematic for financial institutions that must be compliant with security standards such as PCI-DSS (Payment Card Industry Data Security Standard) for certain systems and require multi-factor authentication.

## 3.4 Workforce

This section will discuss the effects RPA has on the workforce and what this means for an organization. The following aspects will be discussed:

- Employee satisfaction
- RPA acceptance
- Changing job description
- Organizational structure
- Workforce reduction
- Training and education
- Changing hiring needs

### 3.4.1 Employee satisfaction and RPA acceptance

The use of RPA can have a positive effect on employee satisfaction, as employees have to perform less repetitive tasks and can focus on other, often more impactful work [15, 25–27, 41]. This can affect employee turnover as people are not stuck performing repetitive tasks [12, 15, 27, 39, 85]. For example, Fernandez and Aman [25] noted that RPA allowed accounts to develop their role and enhance their effectiveness leading to a higher jobs satisfaction. RPA helped them to eliminate time-consuming tasks freeing up time that can be spent on strategy and analysis that drew them into the profession in the first place. However, RPA brings change and it is in human nature to be vigilant regarding change. There are employees who are reluctant towards change and do not want to adapt or want to learn new things. Furthermore, there is a fear that jobs are being taken over by robots, which can lead to a technology acceptance problem [25, 50]. It should also be acknowledged that there can be a distinct population of technophobes who express disproportionate fears regarding new workplace technologies [59]. Part of this technological anxiety is driven by the fear of job loss. Perceived job insecurity should not be ignored as it can be directly linked to an employee's health [11]. However, regarding technology acceptance and perceived job insecurity in particular there can be significant differences between countries [24].

In order to increase the acceptance and improve the attitude towards RPA, effective change management and communication strategies are required [25]. In a case study by Willcocks, Lacity and Craig (2015) [100], the company Xchanging took an open approach regarding communication about RPA by creating newsletters and road shows. It showed all employees what RPA entails and what it means for them and the organization. As a result, there was much less resistance than initially expected. Furthermore, bots were given a name and adopted as part of the team. Overall, the concerns and

objections should be addressed from the beginning through transparent communication [80].

The Technology Acceptance Model [95,96] can be used to develop strategies to increase the acceptance of RPA. The perceived usefulness influences the acceptance of technology the most and should be used by demonstrating the capabilities of RPA to employees. Perceived usefulness is in turn affected by other factors such as result demonstrability and image. Peer support may influence the image associated with the use of a system as it is more likely that employees will be more favorable to a system if a coworker has a favorable perception of the system. Overall, there are many influencing factors. For example, management support, particularly in the form of direct involvement influences the determinants of perceived ease of use. If users or their representatives are directly involved in development or implementation activities it can positively improve perceptions of external control, perceived usefulness and objective usability.

### 3.4.2 Changing job description

To reiterate, RPA takes over repetitive tasks that were previously carried out by employees. The workforce consequences will be (partial) job loss, which will be discussed in the next paragraph, or changes to the tasks that an employee carries out as part of their job description. The changes to ones tasks will be referred to as a changing job description. Job description is defined by the Cambridge dictionary [17] as a list of the responsibilities that you have and the duties that you are expected to perform in your work.

Employees can be dedicated to perform more value added services, which can either involve customer interaction or solution and decision-making. [41, 101]. Employees will also have to handle non-routine exceptions that RPA software cannot process [99]. It is possible that employees will climb the ranks within an organizations more quickly as they improve critical skills at a faster rate due to the removal or reduction of unchallenging and repetitive work [15].

According to the World Economic Forum [104], new technologies and trends disrupt businesses models and change the division of labor between employees and machines, transforming current job profiles. The majority of employers expect the skills required to perform most jobs will shift significantly. Organizations have to start preparing for these changes by building the capability to support and train employees that will be affected by technologies such as RPA.

### 3.4.3 Workforce reduction

According to the World Economic Forum, nearly 50% of companies expect that automation will lead to some reduction in the full-time workforce by 2022. However, 38% of companies expect to extend their workforce and create new roles to enhance productivity [104]. Additionally, businesses are set to expand the use of contractors and use their employees in a more flexible manner by utilizing remote staffing and more decentralization [50, 104]. Where some businesses expect job loss, others will capitalize and create new value enhancing roles. *Employment polarization*, which is the observation that middle-class jobs requiring moderate level of skills seem to disappear relative to low-skilled and high-skilled jobs, will not continue indefinitely [4]. While some medium-skilled tasks are susceptible to automation, many middle-skilled jobs will still be in demand. Additionally, there will be a demand in middle-skilled levels of literacy, vocational skills, problem solving, adaptability and common sense that is

combined with automation.

On the meso level, the use of RPA can lead to a reduction in head count [22, 27, 40, 51, 101]. It is possible that headcount remains the same while the work volume increases [15, 50, 101]. For example, Xchanging did not report any lay-offs after implementing RPA [100]. A survey among large accounting firms has reported that headcount or hiring was not reduced even though the efficiency has increased [15]. Respondents in this study expect that the use of RPA will result in similar demand for employees, but the nature of work will shift towards more value-added work. However, there is still uncertainty as the suggestion is made that hiring at staff level might be reduced.

#### 3.4.4 Training and education

The introduction of RPA introduces the need for training or retraining of employees [10, 27, 39, 99, 101, 104]. For example, employees should be ready to deal with malfunctions of bots. A potential problem of automated systems is that it can create situations where staff is not capable to detect an automation malfunction. This problem is called *automation-induced complacency* [27, 30]. This issue should be addressed during process design and staff should be trained to deal with these issues. Additional training is also required if there is a shift in the tasks that are executed by an employee. Retraining will be required if employees are transferred to other parts within the organization. To facilitate this training effort, a life-long learning system should be created within the organization [104]. Investing in human capital and collaboration with other stakeholders regarding workforce strategy should be an important goal and is critical for medium to long-term growth. Additionally, organizations should recognize and prepare for a loss of entry level positions, by creating training protocols or changing in-house training programmes for juniors [10]. Furthermore, there should be better on the job learning by shadowing senior staff, and to support the juniors' abilities to interpret generated data.

#### 3.4.5 Changing hiring needs

Changing job descriptions creates the need for different skill-sets as employees are working with bots and have additional tasks. The vice president of a financial and accounting unit [25], noted a higher demand for accounting professionals who possess the educational qualifications alongside skill-sets that include data analysis and business intelligence. Accountants who not only have basic IT skills but are more flexible and adaptable will be ready to integrate new tools better into existing processes. Other organizations argue that the top skills needed by employees will largely focus on creativity [10]. It has also been suggested that critical thinking skills and communication skills would become more useful [15]. The enhancement of soft skills and social abilities should be prioritized rather than technical skills such as programming [10].

### 3.5 Synthesis

This section provides an overview of the qualitative impacts that can be extracted from section 3.3 and 3.4. All impacts listed in this section will be briefly discussed in chapter 5 and are used to base the guidelines on. The qualitative impacts that can be extracted from section 3.2 and 3.3 are displayed in table 3.1.

First off, establishing a stable foundation for RPA can be challenging to achieve. Decisions need to be made that are outlined in the operating model and more specifically the organizational model. Errors within decision making can lead to a failure of anticipated results. The operating model should describe that RPA is business led and the IT department should be involved early. Furthermore, business units can be enabled to develop and maintain bots. Enabling business units instead of developing RPA within a CoE can spread out maintenance, since maintenance can be more time consuming and resource intense than predicted. However, organizations should be aware of different visions regarding RPA between the business and the IT department. IT employees can be more resistant towards RPA based on preconceived opinions.

TABLE 3.1: Overview of impacts related to governance and the operating model and the sections in which it is discussed

	Impacts	Section
1	RPA integrations can be difficult to scale and significantly pressure its support structure after initial set-up.	3.3
2	RPA adoption can provoke resistance among IT employees based on preconceived opinions	3.3
3	Maintenance and bot oversight can be more time consuming and resource intensive than predicted	3.3
4	RPA can be used as a band-aid solution to automate processes that have underlying problems.	3.3.2
5	Bots can be developed and maintained by business units.	3.3
6	RPA brings new security risks and opportunities.	3.3.3

The qualitative impacts that can be extracted from section 3.4 are presented in table 3.2. To conclude, RPA can affect the workforce within an organization on different aspects. For instance, RPA can cause changes in job descriptions. This can affect job satisfaction as repetitive work can be automated and employees can be tasked with different, often more impactful work. However, there is a risk of an increase in perceived job insecurity. Changing job descriptions throughout the organization has further consequences for training and education, as employees need to adapt to these changes. This not only affects current employees, but also affects the hiring of new personnel. Overall, RPA can have a significant impact on employees and organizations will have to manage these changes.

TABLE 3.2: Overview of impacts related to the workforce and the sections in which it is discussed

	Impacts	Section
7	RPA can reduce the manual workload within an organization.	3.4.1
8	RPA can provide new opportunities for employees to grow within the organization.	3.4.2
9	RPA can put additional pressure on training and education of staff.	3.4.4
10	RPA can affect the skills sought after for new hires.	3.4.2, 3.4.5
11	RPA can change job description resulting in greater demand for certain skill-sets.	3.4.2
12	RPA can increase employee satisfaction.	3.4.1
13	Poor RPA acceptance could occur, leading to a failure of anticipated results.	3.4.1
14	RPA RPA can introduce or increase perceived job insecurity.	3.4.1, 3.4.3

## Chapter 4

# Case Studies Results

This chapter will discuss the results from the case studies, but first the participating organizations will be described. The chapter is divided into four parts. The first part concerns governance and describes how RPA is embedded into the organizations. The second part, named process automation, concerns the act of bot development and various aspects that are related to development. The third section covers the impacts experienced by employees and the measures that the organizations have taken. The chapter ends with a synthesis of the case studies findings.

### 4.0.1 Case descriptions

Four organizations participated in the case studies. One organization was anonymized and will now be referred to as BankX. The participating organizations are the Rabobank, BankX, PostNL and the municipality of Rotterdam. An overview of the participating organizations can be found in table 4.1. The Rabobank is a large dutch bank and is among the 30 largest financial institutions in the world. The Rabobank and its subsidiaries have approximately 59.000 employees worldwide and serve 7.5 million customers. In 2018 the bank had a revenue of 12.020 billion euros. The Rabobank is an early adopter of RPA starting with a PoC in the summer of 2016 and moving beyond a PoC in 2017. In terms of RPA adoption and more specifically processes automated, it is ahead of BankX PostNL and the municipality. As of early 2019, the Rabobank has approximately 150 operational bots.

BankX is a bank as well, but is significantly smaller and only services institutional customers. BankX has between 400 and 500 employees and a total revenue of roughly 100 million euros as of 2018. BankX started with a PoC in October 2016 and moved beyond their PoC in January 2017. BankX is second in terms of number of processes automated, with 50 operational bots as of early 2019.

PostNL is a mail, parcel and e-commerce corporation with operations mainly in the Netherlands, but also in Germany, Italy Belgium, and the United Kingdom. PostNL has approximately 38.000 employees and had a revenue of 2772 million euros as of 2018. PostNL came into contact with RPA at the end of 2017 and subsequently started their PoC. As of early 2019, PostNL has approximately 17 operational bots.

The municipality of Rotterdam, which will now be referred to as the municipality is the second largest municipality in the Netherlands in terms of inhabitants. It serves a total of 644,618 inhabitants as of 2019. In 2019, the municipality has a budget of 3.5 billion euros and employs roughly 11.000 people. The municipality started exploring RPA at the end of 2018 and plans to have 4-10 operational bots before the end of 2019.



TABLE 4.1: Overview of the organizations participating in the case studies

Case organization	Industry	Total employees	Operational bots
Rabobank	Financial services	59,000	150
BankX	Financial services	400-500	50
PostNL	Distribution	38,000	17
Municipality of Rotterdam	Municipality	11,000	4-10

## 4.1 Governance

This section expands upon the use of the organizational models as discussed in section 3.3.1, by the case study organizations. Subsection 4.1.1 discusses how the municipality and Rabobank have applied the federated organizational model. BankX and PostNL have opted for a centralized organizational model which is discussed in subsection 4.1.2. The case study organizations have been split, since they have a different approach regarding the adopted organizational model. The section ends with a description of the response of the IT department to RPA.

### 4.1.1 Federated approach

The municipality and Rabobank have a similar outlook on RPA in terms of organizational model. Both organizations have opted for a federated model, although the Rabobank is significantly ahead regarding integration and processes automated as the municipality has started exploring RPA at the end of last year. As a result, not all observations from the municipality are already implemented, but are planned to be implemented. Both organizations characterize a central CoE that has the knowledge, tools and standards to enable business units in their RPA effort. At the Rabobank the automation request comes from business units approaching the CoE. The CoE will then guide and advise a business unit in an exploratory phase, in which the context, resources and capabilities of the business unit are determined. Ultimately, the goal for each business unit is to be self sufficient, meaning that they have to build their own RPA capability. The presumption of self sufficient business units is what characterizes the federated model the most. At both organizations, employees within a business unit with the right skills and educational background are selected to become part of the RPA team. The CoE can provide training or additional experts to realize a full-fledged team, if not enough people with the right skills are available. Furthermore, the CoE provides development guidelines and standards to ensure a certain quality standard throughout the organization. Once a bot has been developed, a review will be done by the CoE as well as rigorous testing.

### 4.1.2 Centralized approach

BankX and PostNL share similarities in their approach as BankX has adopted a centralized model, while PostNL is only partially centralized. BankX has started building their RPA capability using a centralized model, but has the intent to shift to a federated model in the future. Currently, bots are developed within the CoE and a shift to a federated model should lead to a more direct involvement of the business during bot development. A centralized approach was chosen to prevent business units creating their own RPA capability without coordination and the use of development standards.

The long-term vision is to return the responsibility to the business alleviating the pressure that currently resides within the development team. PostNL has adopted a hybrid model that is both partially centralized and federated. Two divisions within the organization have the capacity to develop bots on their own, while the CoE develops bots for the rest of the organization. This hybrid approach has arisen as both divisions had already adopted RPA independently. It is foreseeable that another division develops the ability to build bots in the near future. Currently, there is not enough justification, in terms of automation potential to enable other parts of the organizations to develop bots independently. In terms of ownership, business units have full ownership of a bot that they have requested and once finished it is assigned to them. At both organizations the automation request are received from business units, after which the CoE will investigate their request. At BankX specifically, the end result will be a project definitions document containing a contextual description, benefits, risks and feasibility. This report is then passed onto a board of software architects determining the course of automation. This can result in automation using RPA or other means. It is possible that RPA is used as a temporary solution. At PostNL software architects have a similar degree of influence over decision making regarding RPA and will offer advice before a bot is built.

### 4.1.3 IT response to RPA

While introducing RPA, there have both been positive and negative responses at Rabobank BankX and PostNL. At these organizations, most negative responses aimed at RPA was voiced as it being a simple, messy and short-term solution. These kind of negative responses faded over-time once the people voicing these concerns noticed the capabilities of RPA. At all organizations, there were cases in which RPA was the only viable solution and a permanent solution would be too costly, time consuming or impose significant risk. Another negative response can occur as RPA can influence the decision making within the IT department.

At the PostNL and Rabobank it was explicitly voiced that RPA can have a significant impact on the internal IT roadmap. RPA can be used to connect multiple IT systems, which can have the added benefit of (temporarily) eliminating the need for a new all encompassing system. This could have the unintended consequence of extending the lifetime of existing IT systems. While RPA could remove resources from some parts of the IT department, it frees up resources for new opportunities.

## 4.2 Process automation

This section will discuss how the case study organizations have structured process automation. This section will discuss the following topics:

- Bot development
- Business involvement during development
- Quality control
- Maintenance
- Retaining process knowledge
- security

### 4.2.1 Bot development

At all organizations the automation requests originate from the business. The next step is to analyze the processes to be automated and determine the best course of action.

This can be: automation using RPA, regular automation or the processes cannot be adequately automated. From here on, there is a difference between the organizations operating a federated and centralized model. The interviewee at BankX summarized their course of action as follows: *"Automation request originate from the business. The robotics team performs a deep-dive to determine if the process can be automated. The architectural board and risk are consulted. During the subsequent deep-dive the process is evaluated and a process description is created. A bot is developed and tested during sprints of 8 weeks. Bots that are tested are signed-off and placed in a live environment."*

Organizations that utilize a federated model such as the Rabobank start collecting more information about the business unit that sends the automation request. There is a preliminary phase to establish how the business unit views RPA and its capabilities and limitations. The final step is to establish an RPA team with employees from that business unit. As a result, employees need to be selected based on their backgrounds and skills and need to be trained accordingly. IT affinity is needed to be able to understand the tools used to develop bots. The CoE supports such a business unit throughout this phase and can provide advice to structure an agile development methodology including a backlog and help select and prioritize processes. The goal is to create a self-sufficient RPA team with its own backlog and product owner. If a business unit does not have sufficient technical know-how to be able to successfully build bots, someone from the CoE is assigned to that business unit. The centralized organizations do not have to build an RPA capability in the requesting business unit. Instead, after consulting with the requesting business unit and gathering more information about the process to be automated, it can be determined whether the process should be automated using RPA. If the process is deemed suitable for RPA, the development phase can start.

#### **4.2.2 Business involvement during development**

The act of developing bots is similar across all organizations. The organizations develop bots using an agile software development methodology. Throughout the bot development, all organizations involve subject matter experts. These subject matter experts (SMEs) are employees that carry out tasks that are part of the process to be automated. At BankX for example, a bot development team requests at least one, but preferably two employees to the manager that is responsible for the process to be automated. In theory organizations utilizing a centralized organizational model have a greater separation between the development teams and the employees responsible for the process. SME involvement is vital and they are closely involved throughout the development processes. For example, throughout development bot components are demonstrated to verify if it adheres to the desired specifications.

#### **4.2.3 Quality control**

Testing is an integral part of software development. All case organizations employ software testing such as user acceptance testing, penetration testing or unit testing to test a bot or its components. At BankX and PostNL, the RPA development teams part of the CoE can test their own bots. They can impose their own standards upon themselves and ensure that all bots are up to a certain standard. The CoE at both municipality and Rabobank have to ensure that a bot deemed finished by a business unit adheres to the standards of the CoE and is ready for a live environment. Even though all RPA teams set-up within the different business units have received advice, support and training

from the CoE, the quality of a bot can significantly differ among business units. At the Rabobank a bot deemed finished by a business unit will be reviewed to determine the overall quality of the bot and to determine if all standards have been met. A coordinator from the CoE is assigned to a business unit to observe the development process who can examine progress made and provide guidance. This is done to prevent a long list of issues being reported by the CoE once a bot is deemed finished by the business. At the municipality the CoE will impose quality checkpoints during development and during the final sprint. The goal of the quality checkpoints is to ensure that development guidelines are utilized to prevent the need for a rework in the future. More specifically, the bots are reviewed in terms of re-usability of components, robustness, testability and resilience to future changes to reduce the risk of vendor lock-in. BankX noted that maintaining RPA can be more demanding than initially expected. Third party applications can change causing a bot to fail. BankX has made arrangements with software suppliers to be informed two months in advance on any changes made in the software. Unfortunately it is not always possible to make such arrangements, which is often the case with external websites. In addition to this, BankX is investigating whether processes at customers can be automated using RPA, to further automate and standardize the entire chain.

#### 4.2.4 Retaining process knowledge

Once a complete process has been automated it is either fully automated or partially automated requiring exceptions to be handled by an employee. In the latter case, process knowledge is retained as employees deal with exceptions manually as observed at the municipality. In both cases, the process is carefully documented during the development phase of the bot. At the Rabobank a bot has even been created to generate documentation. The potential advantages of such a solution is that all of the documentation is consistent across the organization. This documentation can be used by employees to manually complete processes if a bot is unavailable for any reason. According to the Rabobank this solution is sufficient for their processes. PostNL has a similar approach and pushes business units to create documentation. A different approach coined by BankX is to have a bot drop a certain amount of cases to be manually completed by an employee. In such a case, an employee is able complete a process from memory instead of relying on a process description. This enables employees to more quickly substitute for a failing bot. For BankX specifically, this approach also increases the chance of catching fraudulent actions. The main downside of this approach is if a process is rather lengthy. A process that takes two hours to complete becomes more costly. This approach was also discussed at PostNL that appreciated the idea and noted that it can also be used to verify if certain steps part of the process are still functioning, for example verifying whether the human authorization is still functional.

#### 4.2.5 Security

There is no evidence suggesting RPA imposes new significant security risks on basis of the cases. According to the Rabobank there are security risks. However that is the case with almost every piece of software. Measures can be taken to mitigate risk, such as implementing identity and access management. At BankX, bots have the ability to change their own passwords. A password can be retrieved by an authorized employee at the service desk. Afterwards, the password is reset again. At the different organizations, bots have their own identity and are part of a team. At BankX each team has a

supervisor who is accountable and all of a bots actions are logged.

When Rabobank began integrating RPA, the decision was made to not create bots for processes that handle data with a high protection level. However, after a year, processes were identified that would be cost effective to such a degree that it prompted a discussion. Technical solutions are available that can enable automation. When analyzing such processes a security officer is involved that has to sign-off on the proposal. Processes that handle data with a high level of confidentiality could benefit from RPA as a bot is unable to interpret or act on confidential information. As a result, RPA was a requested tool by security officers for these kind of processes.

### 4.3 Workforce

This section will discuss the impacts of RPA related to the workforce and how organizations manage these impacts. This section will discuss the following topics:

- Employee satisfaction
- Training and education
- Changing job descriptions
- Changing job qualifications
- New opportunities
- Employment effects
- Job insecurity
- Performance appraisal

#### 4.3.1 Employee satisfaction

RPA has different impacts on employees which can affect job satisfaction. The interviewed organizations measure overall job satisfaction, but not in combination with RPA specifically. However, first and second hand accounts can still provide an indication of the different impacts that exist and their influence on job satisfaction. One of the benefits of RPA is its potential to reduce workload. An example at BankX was described as: *"The dividend season, which runs from March to June, was normally rather stressfull combined with a lot of overtime. It is rather calm now as the bots process a great deal"*. Dividend season is a period when dividend is paid out to shareholders. RPA can also be used to handle repetitive and often tedious tasks. For example, at the Rabobank, RPA was tasked with data collection within Customer Due Diligence (CDD), the response was described as: *"The employees at CDD are ecstatic regarding their bot as it automates a task that used to take an employee 45 minutes. This time can now be spend on analytical tasks which they prefer"*. At BankX it is reported that employees who are working alongside bots, are enthusiastic about RPA as it reduces the repetitive nature of their work. RPA adds another dimension to their work as their work changes. The reduced workload frees up time for decision making and other tasks providing more value. These positive effects can transform employees into RPA ambassadors, that can promote RPA throughout the organization. Additionally, these ambassadors can come up with new ideas for robotizing new processes.

At the municipality, employees have more time for customers, other tasks, and meetings with colleagues. RPA has also provided the opportunity for some to climb up within the organization or transfer to other departments that suit them better. In one instance, an employee is now involved in bot development and maintenance. This person was previously employed within a unit, which is now partially automated by RPA. As a result this employee now has a higher job satisfaction, due to more interesting work. Through training and e-learning modules, this employee was able acquire the necessary skills in order to develop bots. However, this type of career switch does

not fit everyone. There is another instance of an employee that did not continue their job of maintaining and developing bots. This transition did not suit that person and was transferred to a different department. A career-switch to developing bots has been reported at all interviewed organizations. The skills and educational background required to be able to make such a switch is comparable among the interviewed organizations. A moderate level of IT affinity is strongly recommended as well as an average educational background. However, a high level of IT affinity can compensate for a lower average educational background. At the Rabobank the initial notion was everybody is able to develop bots if trained accordingly. However, this changed to having a way of thinking comparable to a medium educational level. Such an educational level is comparable to HBO in the Netherlands.

Negative responses as well as some positive responses are not unique to RPA, but to automation in general. The negative responses are often regarding the reluctance to change and not wanting to adapt or learn new responsibilities. However, these kind of reactions will always occur regardless of which automation tool is used. However no significant negative responses related to reluctance to change were reported. The main negative response to RPA is related to an increase in perceived job insecurity. The issue of perceived job insecurity was reported at all organizations, but was not deemed severe. At the municipality specifically, the fears regarding job insecurity were existing, but not critical. The perceived job insecurity caused a more uncertain future outlook.

### **Communication**

The interviewed organizations did not have an extensive communication strategy when RPA was introduced to their business units. However communication was still structured to a certain extent. At PostNL the communication regarding RPA focused on establishing a positive attitude towards bots and alleviating fears. At BankX, RPA was presented within the organization using roadshows. Communication was transparent and it was put into the organization as a tool that would alleviate workload. Additionally, it was positioned as a tool that would allow the organization to complete more work with the same amount of people or the same amount of work with fewer people. However, it was not introduced as a tool that would directly lead to downsizing. There have not been reports of job loss as a direct result of RPA.

The Rabobank put more emphasis on perceived job insecurity as it expected more scepticism due to fears regarding job loss caused by robotics. In practice this was less of an issue. RPA was demonstrated showing its capability to increase productivity, reduce workload and reduce the amount of tedious work. Once RPA was demonstrated, the overall attitude became more positive. Stakeholders were involved and informed at every step, discussing the vision of RPA and how it would be integrated.

### **4.3.2 Training and education**

RPA can affect the tasks that employees performing as part of their job position once it is setup and running. Additionally, RPA can provide new opportunities for employees elsewhere in the organization as total workload in a business unit can be significantly reduced. As a result the need for additional training might increase as a direct consequence of RPA. Not enough evidence was found at the interviewed organizations that would confirm such a connection. At BankX for example, there is a trend of an increase in training demand but this is caused by regular automation and regulatory changes.

At the municipality employees have been transferred to other parts of the organization. It was mentioned that awareness needs to be created at senior management level, as this could be a more pressing issue in the future.

### 4.3.3 Changing job qualifications

As RPA can change job descriptions, required job qualifications might change as well. In practice, BankX recognizes a shift outlined in the following quote: *"There is a shift from carrying out structured tasks to tasks that require more: autonomy, self-regulation and communication skills. In the past, an employee did not have to communicate to a customer directly, but this has changed and became more important. As a result, your focused shifts regarding the qualities that you desire from an employee"*. This trend was further confirmed at municipality and PostNL but there have not been policy changes because of it as of yet.

### 4.3.4 Employment effects

According to the interviewed organizations, there have not been any terminations as a direct result of RPA. However, the expectation is that this will change as RPA is scaled up and organizations clear their backlog. According to the Rabobank this is part of a gradual change in becoming more efficient and therefore requiring fewer employees. Especially highly repetitive work processed by lower-skilled employees will become in lower demand.

An organization seeking to reduce its number of employees, will start reducing the number of temporary workers, outside hires and job openings. BankX reported fewer job openings and temporary workers than a few years ago. However, this cannot be solely contributed to RPA as there are other external factors. In the case of BankX there has been a recent take-over and a corresponding downsizing.

A similar expectation is present at the municipality regarding a reduction in labor demand. However, the reality at the municipality is that it will face retirements in the near future reducing the need for downsizing. Additionally, it is not confirmed whether RPA will significantly reduce labor demand as freed up time could be used for more customer interaction or to increase the quality of work done.

### 4.3.5 Performance appraisal

Performance appraisal techniques that measure productivity are less relevant once RPA is being utilized. If RPA is used within a business unit to handle a majority of all cases, measuring employee performance with a set of targets that translate to complete X amount of cases becomes irrelevant. In this scenario, the performance of a bot is measured as they handle the majority of cases. At the municipality RPA is used to handle straightforward cases and exceptions are directed to employees. These cases are exceptions for a reason and require more time on average to complete them. In such a case performance metrics should adapt to this new reality. The expectation at the municipality, is a more prominent focus on the quality of the work done and customer service. Employee generated ideas to improve the cost efficiency of processes is another aspect that can be taken into account during an evaluation. At BankX, generating new ideas for process improvement or automation is part of their performance appraisal. Overall, the potential issues surround performance appraisal were not explicitly voiced at the interviewed organizations.

## 4.4 Synthesis of the case studies

The information presented in this chapter contributes to the creation of the guidelines and further supports the qualitative impacts. The topics discussed relate to a number of the aspects as discussed in chapter 3.

### Governance

The first section described how the case study organizations have integrated RPA. The case study organizations did not report significant issues when integrating RPA. However, the steps leading up to the automation of a process are similarly structured and thorough within each approach, indicating that a stable foundation has been put into place. In addition to this, the rationale behind the choice for the two different approaches has been discussed. Each approach has its own consequences related to the development track, maintenance and oversight. Lastly, the case studies show further support for existing preconceived opinions regarding RPA among IT personnel. The case study organizations have shown that demonstrating the capabilities of RPA can mitigate these negative opinions.

### Process

The case study organizations that have adopted either the federated model or centralized model have shown a similar priorities. All case study organizations rely on subject matter experts and are business driven. Further similarities are discussed related to quality control. Both the Rabobank and the municipality have structured a review process to ensure consistent quality across the different business units. Furthermore, all case study organizations create corresponding documentation, however BankX has coined a novel approach to occasionally have a case process manually. This posed a useful option that can also be applied to ensure that processes can still be manually executed by employees. The existence of this issue and subsequent solution led to the creation of an additional impact, formulated as: Process knowledge is lost over time for fully automated processes. The guideline related to this impact is discussed in section 5.2.3.

### Workforce

The introduction of RPA at the case study organizations indicate a net positive effect on the employee satisfaction. Automation of repetitive work and reduced workload were important contributors and allowed employees to focus on different, more enjoyable tasks. Additionally, RPA provides new opportunities for employees to be more involved in bot development or transfer to a different department. The main negative response was related to job insecurity, but was not deemed too critical. Communication is an important factor to mitigate perceived job insecurity. There is not enough support that employees transferring to other department or picking up different tasks lead to a significant increase in the need for training and education of employees. Nonetheless, this issue should be monitored in the future. Evidence was found that changes to the tasks performed by employees would affect the required job qualifications. However, no policy changes have been made as a result. Furthermore, no significant effects on employment were measured, however there is evidence suggesting a lower demand in personnel. Finally, changes were noted to the performance appraisal at the municipality and BankX as a result of RPA.



## Chapter 5

# Guidelines

This chapter describes guidelines aiming to reduce negative aspects or reinforce positive aspects of the qualitative impacts of RPA. The guidelines are based on the literature study and case study findings. A guideline is a statement which provides advice or a direction by which to plan a specific course of action [93]. This distinction can be made for the guidelines discussed in this chapter. A part of the guidelines are statements that offer advice, while other guidelines are statements providing a course of action.

This chapter is divided into three parts concerning: governance, process automation and workforce. Each part is structured starting with a qualitative impact and a brief description of this impact as these impacts have already been described in chapter 3 and 4. The impact and its description is followed by at least one guideline, which is again accompanied by a description and table. The table can contain literature references on which the guideline is based. Additionally, the table can refer to subsections part of chapter 4, which have also contributed to the guideline. In some instances, the guideline is either based on the literature or case studies. Finally, each guideline contains a statement that was used as part of the validation.

The validation followed the Delphi methodology as described in chapter 2.3.4 and comprised of two rounds of surveys sent to selected experts. These experts were referred to me or selected based on publications related to RPA. The first round received 16 responses, while the second round received 9 responses. Both rounds used statements to determine consensus and test whether the guidelines were accepted. Each statement is accompanied by a percentage conveying the level of agreement. In addition to this percentage, the range is displayed, such as 7-9. The range in this context means that the degree of acceptance lies between seven and nine, based on a nine point Likert scale.

## 5.1 Governance

### 5.1.1 Starting the RPA journey

*Impact 1: RPA integrations can be difficult to scale and significantly pressure its support structure after initial set-up*

This impact concerns the early phases of the RPA journey. It can be challenging to establish a sustainable foundation that can support the expansion in the number of bots [28, 71, 86, 99]. While there are many influencing factors, the operating model contributes significantly. To reiterate, the operating model is a blueprint dictating the strategies to integrate RPA within the organization. Choosing the right operating model is integral to achieve a sustainable, mature RPA capability. The organizational model as discussed in section 3.3.1, for example, contributes significantly to the ability of an organization to scale-up in the medium term effectively. For example, maintenance can be burdensome if it is designated to a central body or business units can

not be sufficiently enabled to develop bots. Lack of support or insufficiently adapting RPA to the respective organization can lead to a failure of the anticipated results or hinder progress. To mitigate this negative impact, guidelines have been formulated to: increase support, improve the integration and allow organizations to select the most suitable structure. An overview of the guidelines and at which phases of the RPA journey they should be applied is shown in figure 5.1. The green boxes reflect guidelines. While the figure shows a distinct order, activities can be done concurrently. A PoC is often developed early in the RPA journey before an operating model has been constructed.

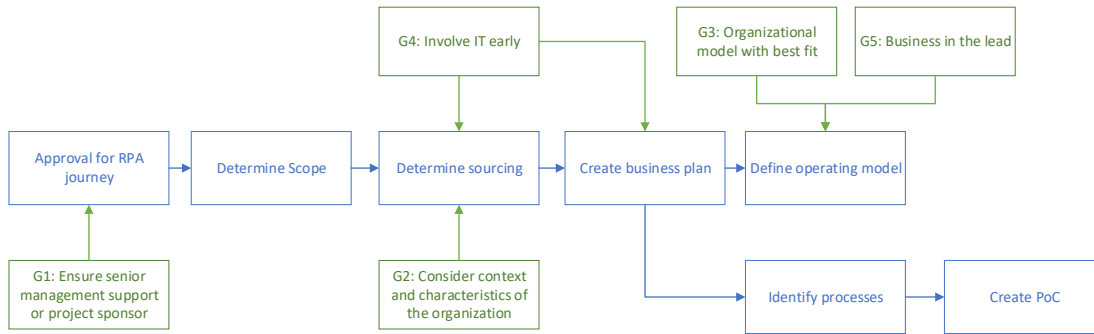


FIGURE 5.1: Guidelines related to the starting phase of an RPA journey

*Guideline 1: RPA needs a senior sponsor who can grow the RPA capability across the organization.*

Literature	[25, 50, 99, 101]
Validation	There is a need for a project sponsor from senior management who can grow the RPA capability across the organization - 88%, 7-9

A project sponsor from senior management can strengthen the foundation by spending a small amount of its time on RPA. Such a person can initiate the idea, secure resources, ensure progress and business adoption and use. RPA can gain more traction and growth if its adoption is pioneered by someone from senior management as opposed to middle managers with limited influence.

*Guideline 2: Organizations aiming for medium to long-term RPA implementations should take the context and characteristics of the organization into account as much as the financial aspects when selecting RPA vendors.*

Literature	[20, 45, 52]
Validation	Organizations aiming for medium to long-term RPA implementations should take the context and characteristics of the organization into account as much as the financial aspects when selecting RPA vendors - 89%, 7-9

Vendors can compete with each other on various aspects such as the total cost of ownership, ease of use, control, analytics and vendor support. Choosing the right vendor depends on variables such as the scope and size of the to be realized RPA capability, expertise within the organization and financial resources. For example, ease of automation can be a more important aspect for an organization lacking IT affinity and know-how among its business units. Easier to use solutions require less training and

accelerates the development of bots. Vendors can differentiate the amount of support offered. Some vendors are pushing for low-code or no-code RPA solutions. Organizations can have needs for certain features such as extensive logging. Additionally, a product roadmap is an aspect to consider as machine learning can be utilized to create more advanced automation capabilities in the near future. Furthermore, image recognition and natural language processing can significantly improve bots in the future. A vendor investing in such future capabilities can potentially provide a better long-term solution. In conclusion, vendors can differ on a multitude of aspects and organizations and organizations should be aware of their needs and aspirations. Choosing the right vendor can save costs and reduce the chance of failure.

*Guideline 3: Choose the organizational model with the best organizational fit.*

Case studies	4.1.2
Literature	[71,99]
Validation	Organizations should opt for an organizational model that best suit the characteristics of the organization - 81%, 7-9

Three options are available when selecting an organizational model, a centralized, decentralized and federated model. However, a decentralized model is the least used option and has significant drawbacks and was not used at any organization part of the case study. Therefore, it will not be further discussed. Both the centralized and federated model have their own benefits and drawbacks. A centralized model works well in an organization that has just established its automation capabilities and lacks the capacity to set up automation capabilities elsewhere in the organization. Additionally, a centralized model is suitable if the organization is already highly-centralized and the automation potential is modest. Organizations that start their RPA journey may choose to first opt for a centralized model and once a stable foundation is in place, it may switch to a federated model. This vision was communicated by BankX, and its benefits are easier to enforce standards, effective knowledge reuse and easier to scale up at the beginning of the RPA journey. A centralized model has drawbacks, it creates a greater burden on the CoE once RPA is scaled up as maintenance and bot oversight can be time consuming. Additionally, there is a limited automation capacity, therefore prioritization requires more attention. Lastly, depending on the type of organization, there is a greater chance for parts of the organization to create their own independent RPA solution.

A federated model is more suitable in a large organization that has a decentralized organizational structure. The federated model allows for a larger and more sustainable RPA capability, while retaining some of the benefits of the centralized model. The CoE allows for easier enforcement of standards and knowledge re-use. Additionally, this model allows the business to be in the lead. This is beneficial as the business is most familiar with the processes to be automated. This generates a stronger sense of ownership within business units generating more engagement. The drawback of the federated model is that it requires more effort to set up. Additionally, it requires certain skills and resources to be present in different parts of the organization. Business units wanting to adopt RPA, require employees with the right skills willingly to participate in the RPA effort. Nevertheless, bot development requires a professional education and some IT affinity, which are not steep or rare requirements. The CoE can provide training or provide experts to aid the development of bots.

In conclusion, the organizational model influences the organization's automation success. The decision to embrace either the federated model or centralized model depends

on the organization's circumstances and characteristics. Either model can be successfully used as long as the operating model is properly structured with well defined roles and responsibilities.

*Guideline 4: The RPA capability should be led by the business and IT should be involved early.*

Case studies	4.1.1
Literature	[14,25,26,46,71,84-86,100,101]
Validation	Regardless of organizational structure used, The RPA capability should always be business led - 80%, 7-9
	Organizations should involve IT early in the RPA journey - 94%, 7-9

Regardless of organizational structure used, the RPA capability should always be business led. The business side know their own processes intimately, and they would want to automate it correctly. Employees within business units can be trained to maintain and build bots. Support can be provided by the CoE. Additionally, RPA has a nature of rapid development and frequent process change, making it less feasible for IT to manage. Helping the business side is a better course for IT, which has often a large backlog of other tasks. It is critical to involve IT early in the RPA journey and they can evaluate software offered by RPA vendors. Furthermore, IT can help manage how bots access existing systems, and ensure the underlying infrastructure is available, secure and scalable for the introduction of bots.

### 5.1.2 IT RPA resistance

*Impact 2: RPA adoption can provoke resistance among IT employees based on preconceived opinions.*

IT personnel can have negative preconceptions regarding RPA [14,47,66,86]. RPA can be viewed as: a temporary IT solution that is improperly integrated [86], unsupported macros or screen scraping [47,66]. Additionally, the role assigned to the business and IT department as stated in guideline 4 can create tension. This can be caused by diverging views between the parties involved.

*Guideline 5: Organizations should demonstrate and structure communication to their IT department regarding RPA.*

Case studies	4.1.3
Literature	[25,66]
Validation	Organizations should have an internal communication plan when introducing RPA to the IT department that describes the capabilities of RPA, its benefits and limitations, the role of IT and the envisioned roadmap - 87%, 7-9
	Transparent communication to the IT department about the capabilities of RPA, its benefits and limitations, the role of IT and the envisioned roadmap is effective for minimizing the resistance to RPA - 80%, 7-9

The following topics regarding RPA should be communicated to the IT department: capabilities, benefits, limitations, role of IT and the envisioned roadmap. Preconceived opinions regarding RPA that can reside within the IT department should be addressed and discussed among IT personnel. A roadmap discussing the future directions of RPA

should be included as well. This should inform IT personnel about what RPA means for their own internal roadmap. Additionally, the role of IT should be discussed as they are in a supporting role. Friction between the business and IT side can develop if the roles and responsibilities are unknown.

## 5.2 Process automation

This section covers the guidelines that concern the development of a bot. The first subsection covers the preparation before a bot is developed, which includes steps such as the process identification, assessment, improvement and description. The second subsection concerns the delivery of a bot, which includes the design, configuration and testing. The third subsection covers the support, which includes monitoring and maintenance. An overview of these phases is illustrated 5.2 combined with guidelines for each part. Within figure 5.2, the boxes on the left side treat all the steps of the process automation. This section deviates from the structure established at the beginning of this chapter, of grouping one or more guidelines to an impact. Instead, three impacts are introduced first as a number of the guidelines treat more than one impact. The main structure returns once impact 6 is introduced. This section ends with impacts and guidelines related to security.

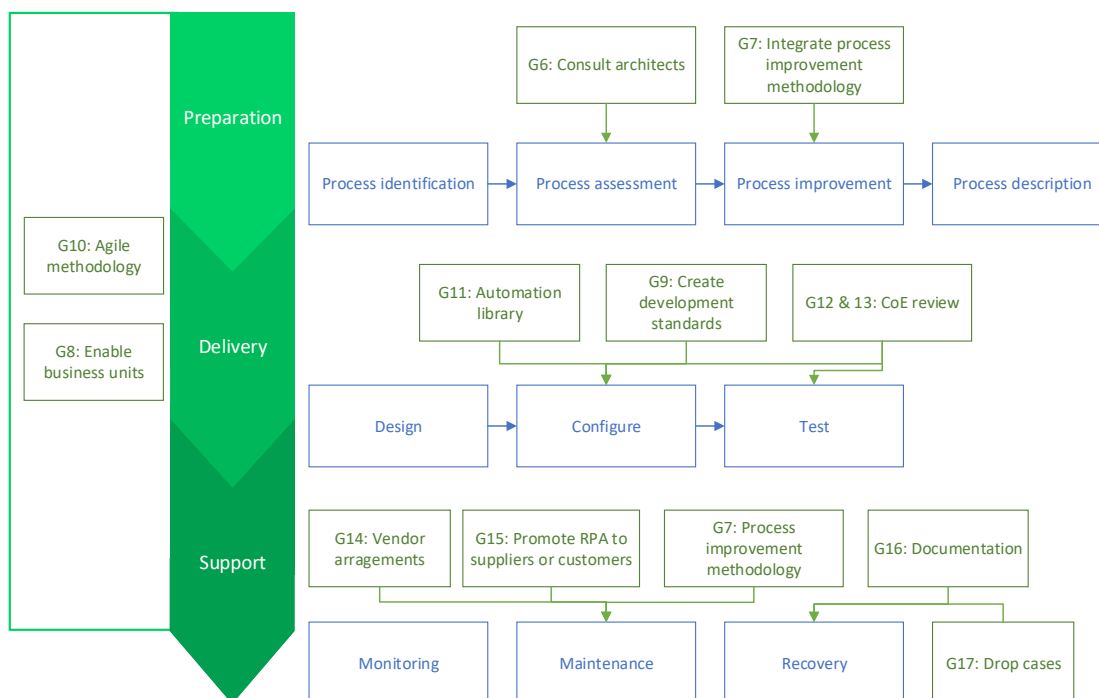


FIGURE 5.2: Overview of guidelines related to the act of process automation

*Impact 3: Maintenance and bot oversight can be more time consuming and resource intensive than predicted.*

RPA can require extensive maintenance due to the nature of the tool [71,86]. Especially bots designed to scrape data off of external websites or interacting with applications

prone to change can require continuous maintenance.

*Impact 4: RPA can be used as a band-aid solution to automate processes that have underlying problems.*

RPA is sometimes used to automate a process that has underlying issues. In such a case the core issues of the process are not fixed and RPA can hinder progress. This can result in more exceptions, increased maintenance cost and increased bot run-time. Therefore, it is advised to consider process improvement.

*Impact 5: Bots can be developed and maintained by business units.*

Vendors of RPA solutions claim to offer a low-code platform allowing developers to drag and drop elements with minimal actual coding. As a result, employees with zero to limited coding experience can be trained to develop bots [71]. However, IT affinity and an educational level of at least HBO are advised. It is possible that parts of a bot require manual coding, in such a case experienced RPA developers can offer help. The strength and unique selling point of RPA is that business units can automate their processes with relative autonomy.

### 5.2.1 Preparation

*Guideline 6: Consult software architects during the process assessment.*

Case studies	4.1.2
Validation	Software architects should be consulted when assessing a process - 71%, 7-9

Business units wanting to automate a process should consult software architects. Software architects can be part of the CoE. A board of architects can determine how the process should be automated. In some instances, a permanent solution using traditional automation is more appropriate than an using RPA. Alternatively, RPA can be used as a temporary solution until a permanent solution becomes available.

*Guideline 7: Consider adopting a process improvement methodology before or after a bot has been developed.*

Literature	[15,49,72]
Validation	Organizations should integrate process improvement methodologies such as lean, six sigma or kaizen as part of the steps leading up to the development of a bot - 73%, 6-8

Integrating a process improvement methodology such as lean, six sigma or kaizen can be used to streamline a process by eliminating waste or simplifying a process. A process improvement methodology can be incorporated in a training programme for employees executing the process to be automated. These employees are the subject matter experts and will be able to identify and eliminate waste. This will foster a culture of continuous improvement that engages employees to evaluate the actions they perform as part of their job. Improving a process can be done before or after a bot has been developed, depending on the circumstances. It would be ideal to improve the process first, but this can be too time consuming. Instead, an organization can opt for the most

optimal short-term solution by omitting process improvement. An expert participating in the Delphi research describes the issue in the following comment: *“It’s really a catch-22. It would be ideal to improve the process first, but sometimes that can take too much time. So a company has to decide do they want a quick win with RPA or to “get it right.” It can be very difficult to decide and other internal factors are necessary to make the decision.”* In conclusion, it depends on the context and attitude towards RPA. A short-term gain or a long-term solution are both acceptable solutions.

## 5.2.2 Delivery

*Guideline 8: Consider enabling business units to develop and maintain bots.*

Case studies	4.1.1, 4.1.2 4.2.1 4.3.1
Literature	[46, 71, 86, 100]
Validation	Organizations that have opted for a centralized organizational model and have sufficient know-how within their business units should over time empower business units to enable them to develop bots instead of maintaining a Center of Excellence - 88%, 5-7
	Temporarily extending a business unit that is lacking the expertise to successfully develop bots with an expert from the Center of Excellence enables that business unit to successfully develop bots - 100%, 6-8
	Training and mentoring-on-the-job facilitated by the Center of Excellence should be sufficient for business units with a moderate amount of IT affinity that want to start building bots - 88%, 6-8

Organizations that have opted for the federated model have automatically chosen to enable business units to develop and maintain bots. This guideline is aimed at organizations that have initially opted for a centralized organizational model. Adopting this guideline means that organizations transition to a federated model or adopt a hybrid model as seen at PostNL. Whether an organization should enable business units depends on contextual factors, such as the skills residing in the different business units. A transition can be facilitated by the CoE. In short, the CoE can help set up a robotics team within a business unit. This includes recruiting qualified people from within the business unit who are able to work with the tools provided. If necessary, a team can be extended with experts from the CoE. A product owner has to be appointed as well as establishing an agile working method with a product backlog. The CoE can facilitate training and ensure that development standards are uniform within the organization. Additionally, some RPA vendors can provide their own training services and additional assistance to ease the transition. Structured training material from vendors in the form of manuals or visual content such as video tutorials can be useful to get developers familiar with the technology and guide them through a development path. E-learning environments can provide even more extensive training. Vendor training content can alleviate pressure on the training role of the CoE. Furthermore, organizations can adapt training content to fit their own way of working.

The validation concluded a minimum educational level required to be able to develop bots with a mean of 5,1 and median of 6. A similar, albeit slight higher outcome can be reported for required IT affinity with a mean of 5,9 and median of 7. These findings indicate that successfully enabling a business unit to develop bots is achievable.

*Guideline 9: Organizations should create RPA development standards to create uniformity across the organization.*

Case studies	4.1.1
Literature	[33,46,50,58,66,81,99]
Validation	Organizations should create RPA development standards to create uniformity across the organization - 89%, 7-9
	A Center of Excellence should recommend development standards to create uniformity across the organization - 78%, 7-9

Organizations should create development standards to ensure uniformity across the organization. These standards can be related to for instance coding conventions, documentation, testing, which should lead to better bots. The role of the CoE should be to recommend standards and moderately enforce these standards.

*Guideline 10: Adopt an agile methodology for bot development.*

Case studies	4.2.1
Literature	[33,40,51,53,79,80]
Validation	Organizations should adopt an agile methodology for bot development - 71%, 7-9

Applying a traditional development methodology such as the waterfall approach can lead to over-engineered software and extended delivery times, often months when weeks should be the norm [107]. An agile methodology compliments the fast-paced nature of RPA allowing for short development cycles to deliver at pace. It allows for greater flexibility towards change and fosters a culture of continuous improvement. Scrum for example, is an agile framework for managing product development in an iterative and incremental way.

*Guideline 11: Create an automation library for reusing modules*

Literature	[13,46,48,50,85]
Validation	Organizations should create an automation library for reusing modules - 73%, 7-9

Reusability and modularity principles should be applied to bot development. Reusable components can be created for steps such as logging into SAP systems. Another benefit of modularity is its support for granular development and testing. Aside from increasing development efficiency, reusable components can bolster maintenance procedures. Updates to reused components can be applied to multiple processes across the organization.

*Guideline 12: Organizations should implement quality checkpoints during bot development to audit the usage of RPA development standards.*

Case studies	4.2.3
Validation	Organizations should implement quality checkpoints during bot development to audit the usage of RPA development standards - 78%, 7-9

During development, organizations should implement quality checkpoints to audit the usage of RPA development standards. This is done to prevent an accumulation of issues that is discovered during a technical review by the CoE at what is supposed to be



the final phase in development.

*Guideline 13: It is good practice to have the Center of Excellence perform a technical review of a bot that a business unit considers finished.*

Case studies	4.2.3
Validation	It is good practice to have the Center of Excellence perform a technical review of a bot that a business unit considers finished to determine if that bot is ready for a live environment - 78%, 7-9

The technical review done by the CoE takes place once a bot is considered finished by a business unit. This is done to ensure that a bot is up to a certain standard defined by the CoE and is ready for a live environment.

### 5.2.3 Support

*Guideline 14: Create arrangements with software vendors delivering software used by RPA.*

Case studies	4.2.3
Literature	[13,46,48,50,85]
Validation	Organizations should create arrangements with software vendors, who deliver software that is used by RPA - 75%, 7-9

RPA can use external applications or websites. Organizations cannot control the updating schedule of external sources. Organizations utilizing RPA should have knowledge of the updating schedule and change-logs to anticipate to updates well in advance. This reduces the chance for sudden exceptions created by changes within applications. Agreements with software vendors should be made, if possible, to be prepared for future changes.

*Guideline 15: Consider promoting RPA and sharing RPA related knowledge with suppliers or customers.*

Case studies	4.2.3
Validation	An organization should promote RPA and share RPA related knowledge with their suppliers or customers, when an organization is halfway at scaling up and can be considered experienced in RPA – 57%
	An organization should promote RPA and share RPA related knowledge with their suppliers or customers, when an organization has finished scaling up and can be considered an expert in RPA – 29%

The degree to which a process is standardized is used as an indicator to determine potential automation candidates for RPA. Highly standardized processes are easier to automate, require less run-time and will likely require less maintenance costs. It is possible that a bot relies on external information send by a customer or supplier. Such information needs to be highly standardized and uniform in all cases. Automatically generating documents such as excel sheets using RPA can ensure that every send excel sheet adheres to a certain set of standards, barring failures. As a result, promoting and sharing knowledge related to RPA could have a positive effect on RPA adoption

at customers or suppliers. This can contribute to further standardization requiring less maintenance and leading to fewer exceptions.

*Impact 6: Process knowledge is lost over time for fully automated processes.*

As RPA is further integrated and process are fully automated, knowledge retention becomes more important to organizations. The know-how among employees is lost if processes are fully automated, which poses a risk to a successful fallback if bots suddenly become inoperable [69]. Additionally, the use of automated systems have created the concern whereby employees are not capable to detect an automation malfunction [27, 83]. This phenomenon is termed as *automation-induced complacency*.

*Guideline 16: Create or generate documentation for each bot and store it in an accessible manner.*

Case studies	4.2.4
Literature	[27, 52, 66]
Validation	It is necessary to create or generate documentation for each bot and store it in an accessible manner - 93%, 7-9

To retain process knowledge and be able to fallback to manual processing, organizations should create process documentation. Such documentation should be stored in an accessible manner, to enable an organization to quickly fallback to manual processing.

*Guideline 17: Depending on the type of process, it can be considered to occasionally drop a case to be completed manually.*

The structure of this guideline description is slightly different as the guideline was not sufficiently accepted during the validation. However, strong support for this guideline was found during the case studies and described in chapter 4.2.4. The guideline will first be further explained after which the results from the validation will be discussed. Creating documentation for each running bot should be sufficient to ensure that it is possible to fall back to manual processing. In some instances it can be beneficial to occasionally have a (critical) process be performed manually by an employee. For example, a process such as creating an invoice may be done fully automated, but every 100th invoice is processed manually to retain process knowledge among employees. A fully automated process that contains all or a selection of the following characteristics could be considered for following such a scenario:

1. The process is error prone
2. The processed items are complex
3. The process is very length
4. Execution of the process is time sensitive
5. The process is of strategic importance to the organization

Especially processes that are time sensitive that must be immediately executed once an exception occurs are most suitable for such a solution. In most cases however, such a solution will not be necessary and be too costly.

As stated previously, this guideline was not accepted during the validation. One expert

agreeing with the statement, stated a counterargument however. This expert argued that such a measure is not necessary over time, as bots become more reliable over time like computers in the past. The mean and median for each characteristic are presented in table 5.1

Characteristic	Mean	Median
The process is error prone	5.4	7
The processed items are complex	5.9	6
The process is very length	4.6	4
Execution of the process is time sensitive	4.9	5
The process is of strategic importance to the organization	6.9	8

TABLE 5.1: Process characteristics that can be used to determine whether to drop a case

## 5.2.4 Security

*Impact 7: RPA brings new security risks and opportunities.*

RPA brings new security risks and opportunities [12,75]. The main security risk related to an RPA deployment concerns the storage of privileged account credentials used by bots. It poses a significant security risk if done improperly. Privileged accounts are currently the biggest security threats organizations face. The Forrester [16] estimates that at least 80% of data breaches are due to compromised privileged credentials. Nevertheless, RPA can provide opportunities for enhanced information security, especially in terms of confidentiality. A bot does not interpret data or use confidential information to commit fraud.

*Guideline 18: Organizations should set up a secure storage solution for storing and managing privileged credentials used by bots.*

Case studies	4.2.5
Literature	[14,57,74]
Validation	Organizations should set up a secure storage solution for storing and managing privileged credentials used by bots – 71%, 7-9

To prevent unauthorized access to systems, bot credentials should be stored using a secure storage solution. The credentials can be stored in an Application Identity Manager (AIM). Such a vault should hand the credentials securely to individual bots on demand. This should remove the human factor from the process and the security solution should be scalable for further RPA growth. Lastly, bot developers should not have access to the credentials used by business users.

*Guideline 19: Organizations should create a unique identifier for each bot and assign ownership.*

Case studies	4.2.5
Literature	[94]
Validation	Organizations should create a unique identifier for each bot and assign ownership – 88%, 7-9

A bot needs access to software systems like ERP-systems or email software. To access these systems a bot has to be granted access rights. Instead of using the account of an

existing employee, a unique account should be created for each bot. This is advised for compliance and security reasons as access rights may change in the future. Additionally, ownership should be assigned to a bot for accountability reasons.

*Guideline 20: Organizations should explore the opportunity to use RPA for processes that have a high security and an information security officer should be included during the assessment*

Case studies	4.2.5
Validation	Organizations should explore the opportunity to use RPA for processes that have higher security levels – 79%, 7-9
	An information security officer should be included when assessing processes that have higher security levels – 79%, 7-9

RPA provides an interesting use case for automating processes with higher security levels of both integrity and confidentiality. Bots are unable to interpret data, leak sensitive information or commit fraud using confidential information. When assessing the automation potential of processes that have a high security level it is advised to include an information security officer who can provide their own insight. A security officer can ensure that a solution is secure.

## 5.3 Workforce

This section is divided into two parts. The first part concerns the impact of RPA on the workload within business units that have adopted RPA and is visualized in figure 5.3. The second part covers RPA acceptance and employee satisfaction.

### 5.3.1 Impact on workload

*Impact 8: RPA can reduce the manual workload within an organization.*

The introduction of RPA to a business unit can affect the overall manual workload within a business unit [22,33,100]. In this section, workload is referred to as the amount of work expected or assigned to a single employee, business unit or bot.

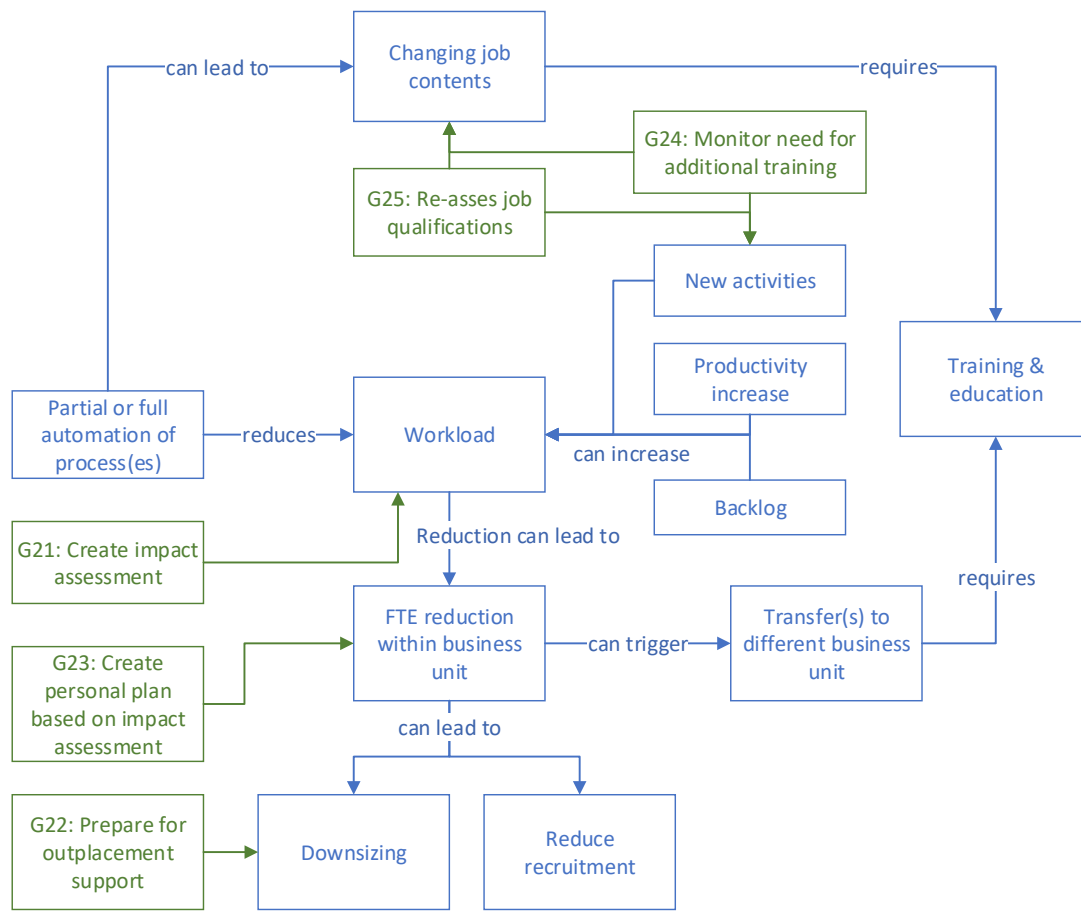


FIGURE 5.3: Overview of impacts and guidelines relating to changes to the workload

*Guideline 21: Create an impact assessment to review the effects RPA has on jobs within a business unit.*

Literature	[5, 15, 25–27, 41]
Validation	Organizations should create an impact assessment to review the effects RPA has on jobs within a business unit - 81%, 7-9

Creating an impact assessment will prepare business units for the possible disruptions caused by RPA. We can draw from the principles of social impact assessment [93], to make an impact assessment aimed towards RPA more tangible. The impact assessment should:

- Investigate how RPA affects the job contents of different roles within the business unit
- Assess the impact of RPA on the total workload of the business unit
- How the changes in workload will affect the employees within the business unit
- Historical impact and measures taken if there are any

Such an assessment compels organizations to consider the effects of RPA and allow it to plan ahead and be prepared for change. A workload reduction can be an opportunity to include new value adding activities within the business. The inclusion of new

activities can either offset a reduction in workload caused by RPA or reduce the need for downsizing of a business unit which can be costly if transferring employees to other business units is not feasible. Changes to job descriptions due to the inclusion of new activities will increase the need for new training activities.

*Guideline 22: Prepare for outplacement support based on the impact assessment.*

Case studies	4.3.4
Literature	[22, 27, 40, 51, 101]
Validation	It is good practice for organization to prepare for outplacement support when an impact assessment report indicates significant reductions in manual workload across different business units that will be adopting RPA - 71%, 7-9

A widespread and mature RPA capability can reduce human workload ensuring downsizing becomes inevitable. Based on the impact assessment the necessary preparations for outplacement support can be made. Preparing for outplacement support well in advance makes it easier to create an in-house capability if that is non-existent. The most common reason for using in-house provision as opposed to external services is cost [97].

*Impact 9: RPA can provide new opportunities for employees to grow within the organization.*

A workload reduction in a business unit can be used as an opportunity for employees to transfer to different parts in the organization. This was for instance observed at the municipality. Additionally, there is an opportunity for employees to make a career switch to bot development. However, employees transferring to other business units or adopting new tasks will have to be trained accordingly.

*Guideline 23: Create or adapt a personal development plan based on the impact assessment.*

Literature	[7]
Validation	Organizations should create or adapt a personal development plan based on the impact assessment - 80%, 7-9

It is advised to create or adapt an existing personal development plan for employees affected within a business unit by RPA. The outcome of the impact assessment can be used to create or adapt such a plan. The reasoning for such a plan are the potential effects RPA can have on employees ranging from changes to ones job contents to transferring to different business units or being involved in the development of RPA. A personal plan is the process of establishing the aims and objectives in the short, medium and long term in ones career. It addresses the current situation and identifies the needs for skills, knowledge or competences to achieve the desired objectives. Subsequently, it addresses the appropriate development activities to meet the needed expertise. The personal development plan can then be used to obtain an overview of desired future plans [7]. This information is valuable for matching employees with new opportunities that may or may not arise from RPA. Additionally, it can be used to match employees with different business units if necessary.

*Impact 10: RPA can put additional pressure on training and education of staff.*

Impact 8 and 9 indicate a need for additional training and education of staff and is further supported by the literature [10, 27, 39, 99, 101, 104]. As a result, a widespread integration of RPA can increase the need for additional training or education that is currently not foreseen.

*Guideline 24: Monitor the impact of RPA on the need for training and re-skilling of personnel.*

Case studies	4.3.2
Literature	[104]
Validation	Organizations that implement RPA across the entire organization can experience a significant increase in the need for training and re-skilling of personnel - 75%, 6-8

The precise impact on the training and education of personnel has not yet been determined and the impact may vary among organizations. However, it is advised to monitor this impact and take the effects on the training budget into account. Furthermore, organizations should be aware of the overall effects of digitization and new technologies such as RPA on the way people work in the near future. According to the World Economic Forum [104] no less than 54% of all employees will require significant re- and upskilling. To facilitate such a training effort, investing in a life-long learning system will be imperative for large organizations to update and develop skills in a cost effective way. E-learning can be utilized to provide additional training as it is cost-effective, convenient, accessible and customizable [37, 87].

*Impact 11: RPA can change job descriptions which can affect required skill-sets for current and future employees*

RPA can reduce the workload within a business units, which can free up time for other activities, such as more direct customer interaction [41, 101]. Job description changes such as more customer interaction can require different skill-sets. As a result, organizations should be aware of this possibility and consider this when hiring new employees.

*Guideline 25: Assess the impact of RPA on job contents and how that affects the required job qualifications.*

Case studies	4.3.3
Literature	[10, 15, 25]
Validation	Organizations should assess the impact of RPA on job content and how that affects the required job qualifications when hiring new employees - 94%, 7-9

Organizations should assess whether the changes caused by RPA affect the required job qualifications when hiring new employees. Due to the introduction of RPA job content can shift from mostly back-office tasks to a more customer facing role. Such a shift increases the importance of social skills. Furthermore, it can be beneficial to prioritize IT affinity and enthusiasm to select more individuals who can contribute to the RPA capability. However, non-technical skills such as, verbal and written skills, relationship skills and the ability to deal with ambiguity and change will still be most critical. In conclusion, organizations should re-asses their hiring protocol and check whether it

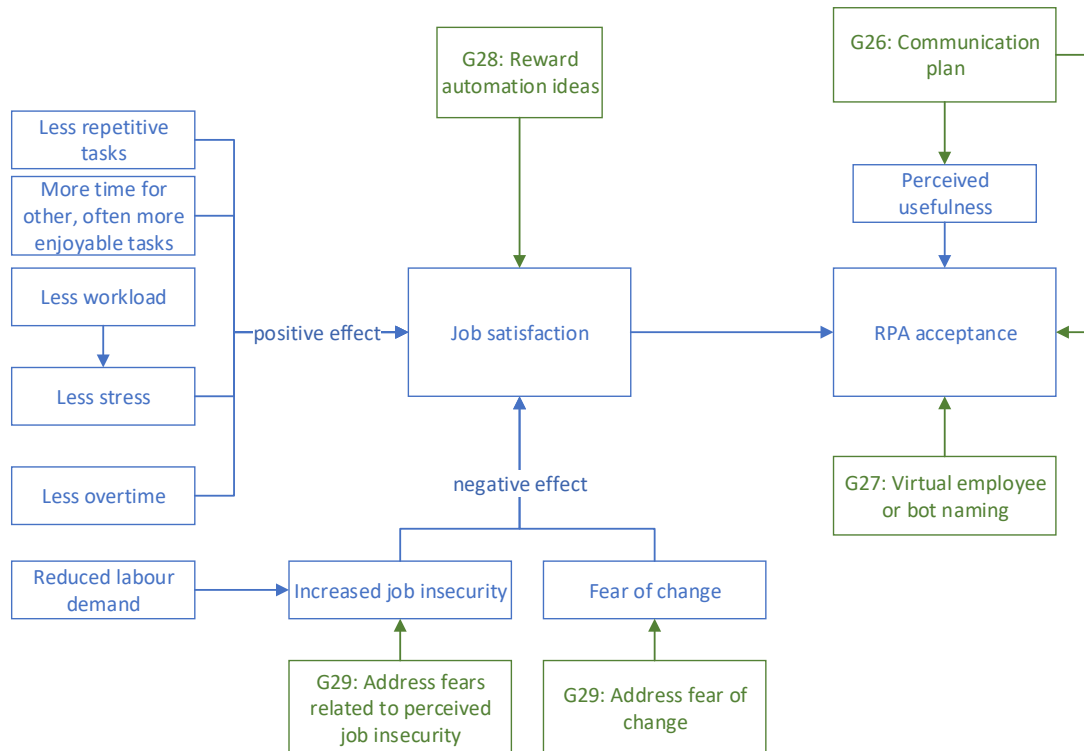


FIGURE 5.4: Overview of impacts and guidelines regarding job satisfaction and RPA acceptance

matches the current and future job requirements.

### 5.3.2 RPA acceptance and employee satisfaction

This section covers guidelines and impacts related to RPA acceptance and employee satisfaction. An overview of the impacts and guidelines are shown in figure 5.4. Impact 12 and 13 are introduced first, as the guidelines: 26, 27 and 28 treat both impacts.

*Impact 12: RPA can increase employee satisfaction.*

The overall job satisfaction is impacted by both positive and negative effects [15, 25–27, 41, 50]. The positive effects are related to: fewer repetitive tasks, more time for enjoyable tasks, less workload, less stress and less overtime. The negative effects concern increased job insecurity and fear towards change.

*Impact 13: Poor RPA acceptance could occur, leading to a failure of anticipated results.*

Job satisfaction and the perceived usefulness of the technology influence the acceptance of RPA [95]. Poor RPA acceptance can hamper adoption and lead to a failure of anticipated results [25]. Therefore, guidelines have been created to reinforce positive effects influencing job satisfaction and to mitigate the negative effects on job satisfaction. Furthermore, guidelines have been created to increase the RPA acceptance and perceived usefulness.



*Guideline 26: Organizations should create a communication plan when introducing RPA to the organization.*

Case studies	4.3.1
Literature	[25, 95, 96, 100]
Validation	Organizations should have an internal communication plan when introducing RPA to the IT department that describes the capabilities of RPA, its benefits and limitations, the role of IT and the envisioned roadmap - 94%, 7-9

Organizations should have a communication plan informing employees about RPA. This communication plan should discuss at least the capabilities of RPA, benefits, limitations and how it will be utilized within the organization. Additionally, the short-to medium term consequences for employees should be discussed. The aspects negatively impacting job satisfaction should be addressed and actions should be taken to ensure an overall positive outcome. Reluctance to change or adapt to RPA translates to a failure to accept the new technology. Low user acceptance of systems can be a leading cause for a failure to reach anticipated results [6]. The principles of the technology acceptance model [95, 96] can be used to determine the factors that influence the acceptance of technology. However, it only provides an abstract overview of the factors involved. The determinants of perceived useful presented below can be used as a basis when introducing RPA to the organization.

- Subjective Norm: The degree to which an individual perceives that most people important to him think that he should or should not use the system.
- Image: The degree to which an individual perceives that using the system will enhance his social status in his social system.
- Job Relevance: The degree to which an individual believes that the system is applicable to their job
- Output Quality: The degree to which an individual believes that the system performs their task well
- Result demonstrability: The degree to which an individual perceives the results to be tangible, communicable and observable

*Guideline 27: Referring to bots as 'virtual employees' or assigning a unique name can contribute to an increase in RPA acceptance among employees.*

Literature	[76, 100]
Validation	Assigning unique names to bots can contribute to an increase in the acceptance of RPA among employees - 78%, 5-7

Robots can be humanized through their role as a co-worker in a society. Humans are more likely to view a robotic co-worker as being more human [76]. Humans are more likely to trust robots they view as more human. Trust is an important barrier to the adoption of robots in a society. While a bot in the context of RPA differs significantly from a robot with a physical appearance, these findings are relevant to RPA. All organizations participating in the case study refer to their bots as 'virtual employees'.

Case studies	4.3.5
Validation	Organizations should stimulate a culture where automation and process improvement ideas are recognized and rewarded - 88%, 7-9

*Guideline 28: Organizations should stimulate a culture that recognizes and rewards automation and process improvement ideas.*

The use of RPA combined with a lean methodology creates awareness among employees with regard to process improvement and automation. Employees, who are subject matter experts within their own job function can provide ideas for further automation or process improvements. Members of the CoE cannot recognize all processes that can benefit from RPA. Recognizing and rewarding employees who bring useful ideas to attention can both increase employee engagement as well as further efficiency gains.

*Impact 14: RPA can introduce or increase perceived job insecurity.*

In the medium-term RPA can reduce the demand for labor [22,27,40,51,101], increasing the perceived job insecurity [80] as cost savings are often a driver for the implementation of RPA. Individuals will respond differently to these effects and some aspects such as the increased job insecurity can have a more profound effect.

*Guideline 29: Address fears related to perceived job insecurity.*

Case studies	4.3.1
Literature	[15,35,48,54,88]
Validation	Employment involvement practices, such as sharing information about organizational goals and including employees in decision making and problem solving can contribute to reducing perceived job insecurity – 100%, 7-9
	Temporarily extending a business unit that is lacking the expertise to successfully develop bots with an expert from the Center of Excellence enables that business unit to successfully develop bots - 100%, 6-8
	Empowering employees by providing additional training and education, making them more adaptable to changing conditions can contribute to reducing perceived job insecurity – 78%, 7-9

Fears regarding perceived job insecurity should be addressed. In the short term, no layoffs have been reported at the interviewed organizations. However, the expectation is that this will change over time as RPA becomes more integrated and labor demand declines. Organizations can reduce job insecurity of its employees and its negative effects. Factors shown in figure 5.5 can be used to create a strategy to reduce job insecurity and its negative effects. As part of the organizational antecedents, honest and open communication with employees and discussing what RPA means for their job in the short and medium term is one mitigating factor. Additionally, employment involvement practices, such as sharing information about organizational goals and including employees in decision making and problem solving increases the perception of control and therefore reduces perceived job insecurity [35]. Furthermore, organizations can empower employees by providing additional training and education, making them more adaptable to changing conditions. Overall, these measures will not eliminate job insecurity, but can reduce overall perceived job insecurity.

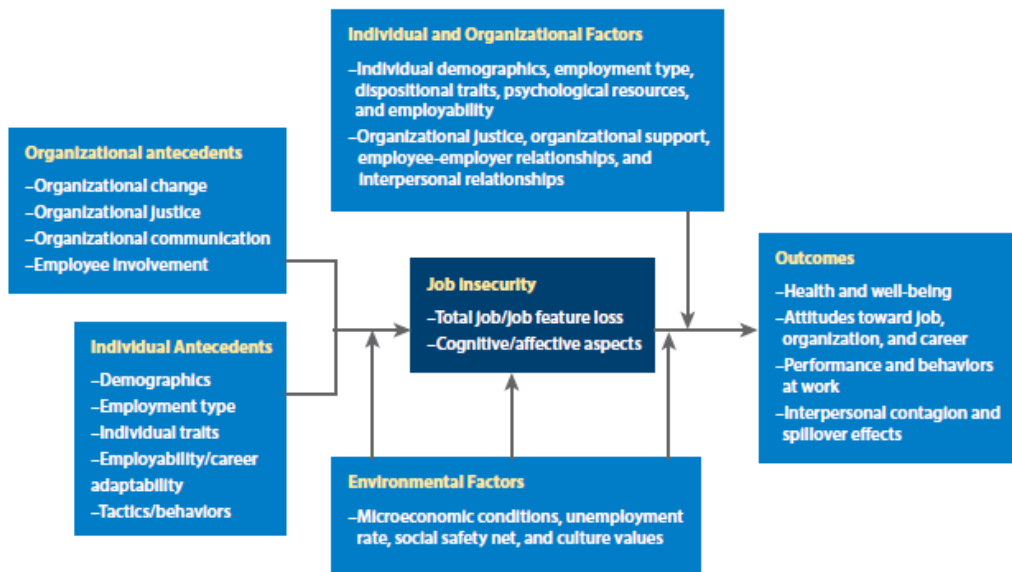


FIGURE 5.5: Factors influencing job insecurity, by Lee, Huang and Ashford (2018) [54]

Guideline 30: Organizations should re-evaluate their employee performance standards.

Case studies	4.3.5
Validation	Organizations should evaluate their employee performance standards within business units that have adopted RPA - 94%, 7-9

Measuring performance of business units or individuals using targets becomes less relevant once RPA is up to speed within a business unit. For example, measuring performance in terms of volume processed or time it takes to complete a certain action becomes irrelevant once a process is fully or partially automated. Instead, quality, customer satisfaction, automation ideas, ideas that improve efficiency can be more prominent factors to determine performance.

## Chapter 6

# Conclusion and Discussion

### 6.1 Conclusion

The main research question of " *What are the qualitative impacts of RPA on organizations and how can organizations reduce negative aspects and reinforce positive aspects*" can be answered by answering the sub-research questions.

*SQ 1: What are the qualitative impacts of RPA on organizations?*

The qualitative impacts of RPA were investigated during the literature study and the case studies. This resulted in a number of impacts covering various themes. Three main themes were uncovered and further researched. The first theme covers the operating model, more specifically the organizational model and the relation between RPA and the IT department. The main qualitative impact of this theme concerns the difficulty of establishing a mature and sustainable RPA capability to ensure all proposed benefits. The second theme covers the phases of bot development. Within this theme, the qualitative impacts relate to for example the maintenance of bots, which can more burdensome than initially expected. Furthermore, it covers the use of bots as a band-aid solution and the possibility to enable non-IT personnel to develop and maintain bots. The final theme concerns employees in some way affected by bots. Impacts discussed relate to employee satisfaction, changing job contents, training and education, changing requested skill-sets and downsizing.

*SQ 2: How is the RPA implementation process currently structured?*

An RPA implementation process is outlined in an operating model. RPA vendors have created their own operating models, but these are not available to outsiders. Common practices and themes were identified based on available literature. Three distinct phases were defined, namely product evaluation, integration and scale up. The product evaluation phase concerns vendor selection, creation of the business case and development of a PoC. Once RPA is green-lighted, RPA can be further integrated. The integration phase concerns activities such as the selection and prioritization of processes and the development and testing of bots. Once a stable foundation is created, can scale up their RPA capability.

*SQ 3: How can organizations reduce negative aspects of the qualitative impacts of RPA?*

*SQ 4: How can organizations reinforce positive aspects of the qualitative impacts of RPA?*

Qualitative impacts of RPA within the three main themes have been uncovered and described. Each qualitative impact describes a positive or negative aspect of RPA that

can be experienced by an organization. To reinforce positive aspects of RPA or reduce negative aspects guidelines have been created. The guidelines consist of an action statement or offer advice. The guidelines have been divided into the three major themes. The guidelines concerning governance formulate advice that can be used during the starting phase of RPA and beyond. It covers the relation between the business and the IT department and three organizational models characterizing how RPA can be integrated into an organization. The second theme covers guidelines aiming to enhance bot development. Additionally, advice is provided to reduce the burden of bot maintenance. The guidelines regarding the workforce can be split into two parts. The first part involves guidelines that deal with workload reduction and the effects it has on local employees. It also provides guidance on the effects of changing job contents. The second part contains guidelines that try to increase job satisfaction and RPA acceptance. Other guidelines are aimed at decreasing perceived job insecurity and other related aspects. Overall, the guidelines and their accompanied clarification should provide useful insight for organizations that have adopted RPA or are planning on adopting RPA.

## 6.2 Discussion

### 6.2.1 Limitations

To minimize the validity threats, a case study protocol was adopted by Runeson and Höst (2009) [78]. A total of four case studies were carried out to ensure data triangulation and allow for a cross-case analysis. More organizations could have been involved in the case study for greater generalizability. However, more qualitative impacts within the scope of the research would likely not have been found. While each organization is unique, the approach to RPA, while different is founded on a set of common principles. Furthermore, the organizations use an off the shelf RPA product from a selection of vendors that have relatively similar products.

Threats to the internal validity were encountered during the case studies. A number of qualitative impacts are influenced by external factors, such as employee satisfaction and downsizing. It was not possible to filter these external factors. Measuring and reporting on these impacts was done carefully to minimize the threat to the internal validity. Additionally, the interviewees at the case study organizations are involved or (partially) responsible for RPA. As a result, the interviewees are more likely to view RPA more positively.

Regarding the Delphi study, structuring a brief and concise survey proved difficult. The survey could not take too much time to fill out as that would increase the drop-out rate. Due to this limitation, the survey contents were less elaborate than aspired. Another threat concerns the selection of experts used for the Delphi study. The experts were selected based on RPA related publications, resulting in a minority of subjects that work in the industry. The threat herein, is a possible discrepancy between theory and practice. Nevertheless, the selection method was chosen, because all experts have proven their expertise.

### 6.2.2 Practical and scientific implications

Due to the relatively broad research approach a set of diverse issues have been addressed, which can have distinct implications among different organizations. Organizations planning to adopt RPA should review their plans and account for the issues

described. Organizations that have integrated RPA and are struggling with maintenance and oversight, should investigate whether the proposed solutions such as enabling business units can be beneficial. Additionally, organizations should pay significant attention to the human factor. Employees can be affected differently by RPA, new opportunities may arise and overall employee satisfaction can be significantly improved. However, organizations should be wary of negative reactions as well. Finally, organizations should monitor how the impact of RPA on their employees affects the organization.

This research further confirms the potential positive and negative impacts of RPA found in the literature. By combining these impacts, it can be inferred how these impacts are connected to each other. The guidelines combine theory, solutions found in practice and other disciplines to improve upon proposed solutions found in the literature. Additionally, the case studies provide new insight into how RPA is integrated and managed at the different organizations with regards to the themes described in this thesis. This, For example, prompted a guideline suggesting to occasionally drop a case to be processed manually.

### **6.2.3 Future work**

Due to the exploratory nature of this research it can be used as a foundation for future research into the various impacts discussed. Further research can be pursued into one of the main impacts such as the effects RPA has on employees or more specifically into employee satisfaction. Additionally, there are topics only briefly discussed in chapter three such as the effects RPA has on outsourcing. The topic of outsourcing was not further pursued, but it is still a relevant and debated subject. Finally, future research can be pursued into impacts unique to RPA, not prevalent in other forms of automation. For example, RPA provides the opportunity for local employees to transition to bot development.

### **6.2.4 Reflection**

The research findings have given more insight into the qualitative impacts of RPA with regards to governance, process automation and the employees involved. The research has resulted in a set of guidelines that can be used by organizations having implemented RPA or are planning to. The guidelines do not provide an unambiguous recommendation as to how to implement RPA, but it do provide an overview of potential issues and how to prepare or deal with these issues. Additionally, it presents a set of positive impacts of RPA and how to reinforce positive aspects of these impacts. While the guidelines have not been implemented and tested at an organization, they have been validated by a panel of experts and are based on literature and case study findings.

At the start of the study, it proved difficult to research a selection of qualitative impacts found in the literature more in-depth at the case study organizations. RPA is a relatively new phenomenon and organizations have picked up the technology only in recent years. As a result, the potential of RPA is not yet fully realized in organizations and some qualitative impacts have not yet manifested itself within the organizations. This led to the conscious decision to widen the scope of the research and investigate three major themes.

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## Appendix A

# Literature Review

The qualitative aspects of RPA are organized into five categories, which is Governance and the IT function, workforce, outsourcing, customers and miscellaneous, which is comprised of aspects that have fewer mentions. For each of these categories the main conclusions will be discussed, showing similarities, differences and research gaps in the literature. At the end of each category, I provide additional insight that touch on the conclusions, provide extra insight or point out potential flaws.

### A.1 Governance and the IT function

RPA projects are mainly business driven, but the IT department has to be a part of the RPA initiative [25, 26, 84, 100, 101]. IT ensures that RPA solutions work securely, consistently and are scalable. Furthermore, business people will run into issues that are initially invisible to them, but not to IT such as, capacity planning, failover for servers and storage, licensing of virtual machines and network latency [84]. This can create tension as both of these stakeholders can have different views on RPA and there is a lack of oversight to coordinate and prioritize different RPA initiatives. In one case study the IT department reacted negatively to RPA as they saw it as a temporary IT solution that was improperly integrated [86]. The IT department was also concerned that RPA developers did not apply the methods and best practices that developers used.

It is recommended that a central RPA governance is established to ensure sustainable development of RPA. [71, 99, 100]. The RPA governance has to be controlled by interested stakeholders who will include at minimum: the head of RPA, business unit representatives and IT representatives. They will be accountable for demand management and generation, benefits tracking, continuous improvement initiatives and will be involved in emerging issues and risks among other responsibilities [99]. This governance body can also help with the maintenance of bots as that can require more maintenance than initially expected [71, 86]. It is important to note that a central RPA body is not always the right solution. To determine what is suitable for an organization several aspects need to be considered such as the size of the company and the type of the organization [71].

When discussing the role of IT, it is important to zoom out and recognize that RPA is part of a larger digitization trend. RPA is part of a digital transformation in organizations which can divide the IT function. On one side, there is rapid experimentation and innovation of new technologies in order to quickly react to changing customer needs. On the other side, there is the traditional IT, with its established IT infrastructure. This phenomenon is called Bimodal IT [32] which was introduced by Gartner and is defined as *"Bimodal is the practice of managing two separate but coherent styles of work: one focused on predictability; the other on exploration"* [29]. In other literature the distinction

is made between lightweight IT and heavyweight IT, where RPA is categorized as the former [71,72,86,99]. The introduction of RPA raises a question about the overall structure of IT, and how it should adapt to these new innovations. There is also critique regarding bimodal IT, claiming that it can be harmful to the organization [32]. It can negatively affect the business culture and divide IT in fast and 'cool' and slow and 'un-cool' resulting in tension between teams. Furthermore, competition between the two modes could result in an uncooperative atmosphere. However, other operation models can help overcome these issues.

### **A.1.1 Governance and the IT function - Reflection**

The second paragraph regarding bimodal IT is relevant to a certain extent as it is not solely triggered by RPA. However, it is possible that RPA alters the organizational structure in the long term. It could be part of the advice for organizations describing how to deal with RPA. By putting RPA in lightweight IT you might be able to mitigate negative aspects resulting from both the traditional IT side as well as the business side. This hybrid approach can also be used for other technologies. However, this is only interesting when implementing RPA on an enterprise scale. When using bimodal IT within an organization, RPA would be part of lightweight IT instead of a central RPA body, but I doubt that distinction affects the performance of RPA much. This topic requires additional research to draw more meaningful conclusions.

Regarding the tension between IT and business units, there was one company that stood out which I referred to. This is just one case and it seems to be more the exception than the rule, but I have come across a few other reports that mentioned some disagreements between the business side and IT. If IT is not as stubborn and properly informed, most of these disagreements should be solvable.

## **A.2 Workforce**

This section will discuss the effects RPA has on the workforce and what this means for an organization. The following aspects will be discussed:

- Employee satisfaction
- RPA acceptance
- Changing tasks
- Organizational structure
- Workforce reduction
- Training and education
- Changing hiring needs

### **A.2.1 Employee satisfaction and RPA acceptance**

The use of RPA has a positive effect on employee satisfaction, as employees have less repetitive tasks and can focus on other, often more impactful work [15,25,26,41]. This can affect employee turnover as people are not stuck performing repetitive work [12,15]. However, RPA brings change and it is in human nature to be vigilant regarding change. There are employees who are reluctant towards change and do not want to

adapt or want to learn new things. Furthermore, there is a fear that jobs are being taken over by robots, which can lead to a technology acceptance problem [25, 50]. In order to increase the acceptance and improve the attitude towards RPA effective change management and communication strategies are required [25]. In a case study, the company Xchanging took an open approach regarding communication about RPA by creating newsletters and road shows and it is showing all employees what RPA entails and what it means for the organization [100]. Overall, the concerns and objections should be addressed from the beginning through transparent communication [80].

### A.2.2 Changing tasks

To reiterate, RPA takes over repetitive tasks that were previously carried out by employees. The workforce consequences will be (partial) job loss, which will be discussed in the next paragraph, or changing tasks. Employees can be used to perform more value added services, which can involve customer interaction, solution and decision-making. [41, 101]. Employees will also have to handle non-routine exceptions that RPA software cannot process [99]. It is possible that employees will climb the ranks within an organizations more quickly as they improve critical skills at a faster rate due to the reduction of unchallenging and repetitive work [15].

### A.2.3 Organizational structure

RPA could have an effect on the organizational structure, and cause a transition from a traditional pyramid shape to a diamond shape [101]. Pyramids are mostly populated with employees at the bottom doing work that has a higher potential to be automated. The benefit of this design is that employees gradually improve their skills as they are promoted to higher positions, retaining knowledge within the organization. A diamond-shaped structure replaces the bottom of the pyramid with robots, while fewer middle managers are needed. A diamond-shaped organization needs more higher educated employees to coordinate with internal business units, RPA and BPO providers. The benefits of a diamond-shaped organization are lower costs and greater flexibility as robots can more easily adapt to changes in the task volume. At the end of this document, there is a figure visualizing a diamond-shaped organizational structure [101].

### A.2.4 Workforce reduction

According to the World Economic Forum, nearly 50% of companies expect that automation will lead to some reduction in the full-time workforce by 2022. However, 38% expect to extend their workforce and create new roles to enhance productivity [104]. Additionally, businesses are set to expand the use of contractors and use their employees in a more flexible manner by utilizing remote staffing and more decentralization [50, 104]. Where some businesses expect job loss, others will capitalize and create new value enhancing roles. Employment polarization, which is the observation that middle-class jobs requiring moderate level of skills seem to disappear relative to low-skilled and high-skilled jobs, will not continue indefinitely [4]. While some medium-skilled tasks are susceptible to automation, many middle-skill jobs will still be in demand. Additionally, there will be a demand in middle-skill levels of literacy, vocational skills, problem solving, adaptability and common sense that is combined with automation.

On the meso level, the use of RPA can lead to a reduction in head count [22, 27, 40, 51, 101]. It is also possible that headcount stays the same and the work volume increases [15, 50, 101]. For example, Xchanging reported that there were no lay-offs after



the implementation of RPA [100]. A survey among large accounting firms [15] has reported that headcount or hiring was not reduced even though the efficiency has increased. The respondents in this study expect that the use of RPA will result in similar demand for employees, but the nature of work will shift towards more value-added work. However, there is still uncertainty as it is also suggested that there is a potential for a reduction in hiring at staff level.

### **A.2.5 Training and education**

The introduction of RPA introduces the need for training or retraining of employees [10,27,39,99,101,104]. Within an organization, additional training will be required to better adapt to RPA and a changing tasks. More extensive training will be required if employees are transferred to other parts within the organization. To facilitate this training effort, a life-long learning system should be created within the organization [104]. Investing in human capital and collaboration with other stakeholders regarding workforce strategy should be an important goal and is critical for medium to long-term growth. Additionally, organizations should recognize and prepare for a loss of entry level positions, by creating training protocols or changing in-house training programmes for juniors [10]. Furthermore, there should be better on the job learning by shadowing senior staff, and to support the juniors' abilities to interpret generated data.

### **A.2.6 Changing hiring needs**

Changing job descriptions creates the need for different skill-sets as employees are working with bots and have additional tasks. The vice president of a financial and accounting unit [25], noted a higher demand for accounting professionals who possess the educational qualifications alongside skill-sets that include data analysis and business intelligence. Accountants who not only have basic IT skills but are more flexible and adaptable will be ready to integrate new tools better into existing processes. Other organizations argue that the top skills needed by employees will largely focus on creativity [10]. It has also been suggested that critical thinking skills and communication skills would become more useful [15]. The enhancement of soft skills and social abilities should be prioritized more rather than technical skills such as programming [10].

### **A.2.7 Employees - Reflection**

There are noticeable trends when reading about the effects of RPA and automation in general on employees and how organizations should deal with these effects. Overall there is mixed agreement and some uncertainty. The amount of research is still sparse and some speculation is involved. The paragraphs below will contain separate comments regarding some of the aspects discussed above.

It is easy to (unintentionally) skew numbers regarding job satisfaction as an organization might lay-off or relocate employees after an RPA implementation. These employees, especially laid-off employees are more likely to be unwilling to change, have lower job satisfaction, etc. In the end you might end-up with a smaller more enthusiastic who had a higher job satisfaction in the first place. Another issue with some of the research into employee satisfaction is that often only people higher up in the chain are interviewed [15].

There might be geographical differences regarding the acceptance of automation and the fear of bots taking over jobs. An RPA study in Norway [71] discussed that deep

involvement of local employees in the RPA initiatives generated enthusiasm. There were no mentions of fear of job loss. This study takes place in Norway, which has good social security and strong employee protection laws, so this might affect this sentiment. I would not be surprised if there are significant differences between Norway and the US, as these places are completely different in this regard. A similar difference might exist between the EU and US, but perhaps to a lesser extent.

The topic of workforce reduction has some disagreement, with one paper stating that this is still an open question [15]. There are two arguments that have not been mentioned in the literature. First, this is influenced by other variables for example, economic stagnation or a new financial crisis could act as a trigger for lay-offs due to the need for cost savings. All of the RPA literature was written after 2014 and this period has seen economic growth and low unemployment numbers. Another point is the classic race to the bottom, where competing companies try to minimize cost. It is hard to compete with a better service if your competitor has similar quality and lower cost.

The article 'Why are there still so many jobs?', provides a macro overview of the effects of automation. The takeaway is that historically automation has led to the creation of new jobs and there will still be many middle-skill jobs that are not susceptible to automation, however the ones that are, will stop to exist. In my opinion, RPA will 'kill' jobs that will not come back, it will create new jobs and opportunities but this will not be in proportion to all the jobs lost, so there is a net loss. This means that people laid off who cannot find a similar job will have to be reskilled to work in a different field with a high demand for new jobs such as, teachers, nurses, plumbers, electricians and technicians.

### A.3 Outsourcing

RPA affects outsourcing as it can reduce the need for outsourcing [15,46,84]. It is still a debated topic as it is possible to implement RPA at an offshore location. The company Xchanging took the latter approach as it argued that there was no rationale to repatriate work done at offshore sites [100]. Xchanging had no quality problem with its many offshore sites and repatriation would not lead to a significant cost reduction. Instead they applied RPA to offshore sites to improve performance where needed. However, there are a number of arguments against outsourcing when using RPA [15,46,84]. The value of low cost locations diminishes when the number of FTEs are significantly reduced. There is also the avoidance of traditional outsourcing headaches such as, cultural differences, language barriers, relocation costs, unpopularity of shipping jobs overseas, time zone differences, IP security and confidential data crossing borders. In two cases [46] headcount was reduced at the outsourcing provider as this was less politically sensitive to do. In both cases offshore processes were reshored, but no new jobs were created.

#### A.3.1 Outsourcing - Reflection

First of all, RPA reduces the need for outsourcing and I think there is already an ongoing trend of the reshoring of manufacturing jobs. This is visible in the car manufacturing industry, where final assembly is reshored to new facilities that operate mostly automated resulting in an insignificant amount of jobs created.

The example of Xchanging shows why companies should think about the different options and not solely focus on reshoring. Xchanging has shown that this decision is based on the performance of offshore sites. However, Xchanging is just one case and

further research is required in order to provide more meaningful conclusions. Furthermore, the decision of reshoring and improving offshore sites will also be influenced by other factors which are outlined as part of the outsourcing headaches.

## A.4 Customers

The use of RPA can lead to an increased customer satisfaction due to higher processing speeds, increased accuracy and fewer mistakes [26, 41, 80]. Due to the workload reduction of RPA, employees can allocate more time for services that involve customer interaction. This results in a better customer experience and will likely enhance customer satisfaction, acquisition and retention [41]. However, this is not a given as some companies will use RPA to reduce cost. Companies that focus entirely on cost savings run the risk of missing opportunities to improve the customer experience and the satisfaction of their employees [50]. A robotic or automated customer experience does not have to be negative. For example, in the asset management industry millennials do not desire a humanistic relationship within their financial affairs as much as older generations [10].

Another side-effect unrelated to the previous paragraph is the required changes for calculating costs [15]. In public accounting, cost is calculated based on the hours worked or uses a fixed fee model based on the number and level of the employees assigned to the project. This is not a viable model when automation is involved as accountants spend less hours due to efficiency gains. The bots used have significant costs involved due to development, implementation and maintenance and these costs need to be charged to clients. Ultimately, the question is how much of the cost saving is kept by the firm and how much is passed back to the client. This has to be done carefully as firms do not want to trigger a race to the bottom.

### A.4.1 Customers - Reflection

The articles discussing that employees can participate in more value-added services that involve customer interaction did not factor in cost. Companies will want to maximize profit and they will likely try to cut costs by doing as much work as possible with the least amount of people. It is difficult to compete with a better customer service if your competitor is cheaper. Regarding the robotized customer service, I do not think that this will be a problem in the long run as human-machine interaction will become normalized in the future (see also, google duplex).

## A.5 Miscellaneous

There are other aspects of RPA that are discussed less often. These will be discussed in this section. The implementation of RPA is not always successful, Capco's [28] RPA experience has seen more failures than success stories. A failure in this sense is that the proposed benefits are not realized. There are various reasons why RPA projects fail and one of them is when businesses try to solve everything with RPA, instead of realizing that RPA is just one tool in a toolkit of different approaches. Businesses should focus on the process, not the technology and should try to understand the problem they are trying to solve. One of the most common issues is that a robotics team solves one bottleneck in an overall business process, only for another bottleneck to show up, leading to little improvement. It's also possible that RPA covers symptoms without

without fixing the real issues, hence the problem that RPA might hinder real progress [38].

**Reflection:** This side-effect is less relevant as the others, because this can be solved by a better implementation method which also focuses on process improvement.

Automated systems can create situations where staff is not capable to detect an automation malfunction. This problem is called *automation-induced complacency* [27]. This issue should be addressed during process design and staff should be trained to deal with these issues.

**Reflection:** As in the previous paragraph, this issue can be solved by addressing it in the implementation phase. Only one paper mentioned this problem, but this kind of problem is more likely to occur in the long term. However, I am not sure if this will be problematic at all. For pilots it certainly is, but RPA is a lot different than that. However, if you put RPA on laptops without documentation and forget about it then people forget about the processes as well and will be less capable to deal with exceptions/failures. This situation is mostly fixed with proper documentation and training.

RPA introduces a new attack surface that can pose a threat to availability, integrity and confidentiality of sensitive data and systems [12,75]. RPA can also be leveraged to gain further access to an organization. A secure robotics platform should provide integrity, traceability, confidentiality and control. A related topic is identity management for bots as they require a new type of account, a Non-Person Account (NPA). NPA introduces new issues as bots cannot do multi factor authentication. Strong NPA authentication is currently not possible, so that is something that needs to be solved [75]. This can be problematic, especially for financial institutions who must be compliant with security standards such as PCI-DSS (Payment Card Industry Data Security Standard) for certain systems and require multi factor authentication.

**Reflection:** There is not much literature that discusses both RPA and security. In my opinion it is an important and relevant topic as it can be a negative aspect of RPA. There are of course also positive effects of RPA on security, bots do not become disgruntled employees of themselves. Additionally, RPA can be used to improve security within an organization by reducing the time to detect and respond to incidents, automate resource-intensive tasks, minimize employee turnover and automatically deploy security controls [12]. Identity management and NPA is also an interesting topic which requires more research.

Figure 2: Transforming shared services from pyramids to diamonds

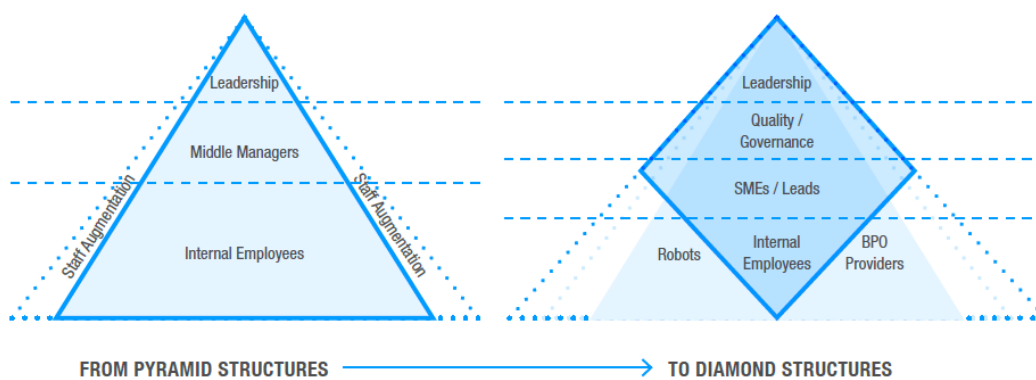


FIGURE A.1: This figure visualizes a pyramid and diamond-shaped organizational structure for shared services, retrieved from [101].

## Appendix B

# Case Study Protocol

### B.1 Preamble

The purpose of the case study is threefold. The first objective is to validate the qualitative impacts found in the literature. Secondly, the qualitative impacts are further investigated to gain more insight into the impacts in a real world context. Thirdly, to obtain insight in how organizations deal with negative impacts and try to maximize positive impacts.

The purpose of the case study protocol is to provide guidelines for information retrieval and analysis. This ensures a uniform procedure and strengthens the research. This protocol is divided into five sections, which covers each phase of the case study. The remaining sections are:

- General
- Procedures
- Research instruments
- Data analysis guidelines

The results of the case studies will be published as part of a master thesis for the Business Informatics master at Utrecht University. During the case study, different data types are gathered and processed. This includes interview recordings and written documentation. All the data gathered during the case study will be carefully stored and backed-up to a private google cloud. This data will be removed within a year when the research has been concluded. The participants will have the option to be anonymized.

### B.2 General

In the case studies, four different organizations will participate

The research goal is to identify and gain insight into the qualitative impacts of RPA as experienced by organizations. This research uses the design cycle of Wieringa [98]. The goal of the case study is to gain more insight into qualitative aspects discovered within the literature that are experienced by organizations. Three major themes have been uncovered during the literature study and the case study will be used to gain more profound knowledge regarding these three themes. The insight from the case study will be used to create guidelines to mitigate or adapt to negative impacts or reinforce positive impacts. Furthermore, these guidelines will be validated using a delphi method.

### **B.3 procedures**

Four cases have been selected at four different organizations. The four organizations have both overlapping and distinct features. Two organizations are banks, but they differ significantly. The other organizations are a municipality and a large postal delivery organization. This allows for a broad comparison and prevents the focus on one specific industry.

The first visit will be an introductory meeting to gain more insight into the context of RPA at the organization. The results from this meeting will be used to enhance the interview questions. The visits will last an hour on average. The meeting will start with the consent form, outlining the case, their rights and the data collection procedure. The interviews themselves will be recorded and notes will be made during the interview as well. When the interview has been conducted additional relevant documentation will be inquired if possible.

### **B.4 Research instruments**

The research instruments used have a qualitative nature. The primary source of data will be semi-structured interviews. These interviews will be held with different participants at the selected organizations. Additionally, relevant documentation will be gathered that for example contain information regarding the proof of concept (PoC) that has been developed by an organization.

#### **B.4.1 Consent form**

U bent gevraagd om deel te nemen aan een onderzoek over de effecten van RPA. Dit onderzoek wordt uitgevoerd door Philip Noppen, student aan de Universiteit Utrecht onder begeleiding van Hajo Reijers en Mathieu Jonker. Het doel van dit onderzoek is om informatie te vergaren over de effecten die organisaties ervaren door het gebruik van RPA. Het betreft een casestudy onderzoek waarin interview(s) plaatsvinden en relevante documentatie verzameld wordt. Deelname aan het onderzoek is geheel vrijwillig en kan op elk moment worden stopgezet. Tijdens het onderzoek worden er aantekeningen en een geluidsopname gemaakt welke uitsluitend voor het onderzoek zullen worden gebruikt. Dit geldt ook voor andere gegevens die worden verzameld in dit onderzoek. De gegevens worden zorgvuldig bewaard en binnen een jaar na afronding van het onderzoek verwijderd. Het is mogelijk dat de onderzoeksgegevens worden geanonimiseerd, dit kan onderaan worden aangegeven.

Als u na het onderzoek nog vragen heeft kunt u contact opnemen met Philip Noppen (p.v.noppen@students.uu.nl)

## B.4.2 Interview protocol

### Introductie

1. Wanneer is de organisatie voor het eerst met RPA in aanraking gekomen?
2. Voor welk proces is RPA als eerst ingezet en kunt u het implementatie proces beschrijven?
  - (a) In hoeverre is dit in de loop der tijd veranderd?
3. Voor welke processen wordt RPA ingezet?
  - (a) Voor hoeveel processen wordt RPA ingezet?
  - (b) Hoeveel bots hebben jullie ingezet of hoeveel FTE's besparen de bots?

### Organisatie en IT

1. Waar zit RPA binnen de organisatiestructuur?
2. Wie of wat is uiteindelijk verantwoordelijk voor de verschillende RPA projecten ?
3. Hoe worden de RPA projecten gecoördineerd?
  - (a) Hoe worden de verschillende projecten geprioriteerd?
  - (b) Als er een Center of Excellence is:
    - i. Hoeveel CoE's zijn er binnen de organisatie?
    - ii. Nieuwe technologieën en innovaties kunnen leiden tot meer CoE's. Kan dit op den duur organisatorische problemen opleveren?
4. In hoeverre is RPA opgeschaald en zijn er bepaalde factoren die dit kunnen verhinderen? Of zijn er bepaalde keuzes gemaakt die opschalen makkelijker maakt?
5. Hoe werd RPA geïntroduceerd binnen de IT afdeling?
  - (a) Hoe werd RPA ontvangen binnen de IT afdeling?
6. Voor welke taken is de IT afdeling verantwoordelijk binnen een RPA project?
7. Welke risico's voor de IT afdeling brengt RPA met zich mee?



8. Wat is de invloed van RPA op het IT beleid binnen de organisatie?
  - (a) Kan dit veranderen bij verdere RPA integratie in de toekomst?
  
9. Er is sprake van een digitaliseringstrend waarin allerlei nieuwe technologieën en innovaties worden geïntroduceerd – waarvan RPA een onderdeel is, die interessant kunnen zijn voor jullie organisatie. In hoeverre verwacht je dat dit de rol en functie van IT binnen de organisatie beïnvloed? (EVT nadere toelichting: merk je dat er een splitsing ontstaat tussen de rol van IT die zich enerzijds bezig houdt met nieuwe technologie en anderzijds bezig is met traditionele IT systemen.)

## Personeel

1. Hoe wordt RPA geïntroduceerd binnen een afdeling?
  
2. Hoe werd RPA ontvangen door medewerkers binnen de afdeling waarin het geïntroduceerd werd?
  - (a) Wat waren de positieve en negatieve reacties?
  - (b) Is er sprake voor angst voor veranderingen en is er een bepaald beleid om dit te verminderen?
  
3. Heeft RPA invloed op de medewerkerstevredenheid?
  - (a) Als ja: Hoe wordt dit gemeten?
  
4. In hoeverre wordt RPA gebruikt om risico's te mitigeren (bijvoorbeeld: verminderen van fouten)?
  - (a) Neemt de kwaliteit van het werk toe doordat er wellicht minder werklast is en men zich kan richten op minder eentonige taken?
  - (b) Performance wordt vaak gemeten door gebruik te maken van targets, zoals het voltooien van X aantal processen. Het gebruik van RPA beïnvloed dergelijke targets en maakt het wellicht moeilijker om objectief te meten. Zijn jullie op een andere manier performance gaan meten door de komst van RPA?
  
5. Merken jullie veranderingen in de personeelsverloop binnen afdelingen waarin RPA is geïntroduceerd?
  
6. Leidt het gebruik van RPA tot veranderingen van de organisatiestructuur? (verdere toelichting: verschuiving naar een diamantvorm)
  - (a) Kan dit in de toekomst veranderen door verdere RPA integratie?

7. Hoeveel FTE besparingen heeft RPA opgeleverd?
  - (a) Wat betekent dit voor de betreffende medewerkers?
  - (b) Evt: hoe wordt dit bepaald?
  
8. Zijn er nieuwe functies of banen gecreëerd als direct gevolg van RPA?
  - (a) Hoe staat dit in verhouding tot de banen die verloren zijn geraakt?
  - (b) Als er sprake is in een afname in de vraag voor personeel: In wat voor tempo is er sprake van een personeelsafname?
  
9. Wat is het beleid omtrent het trainen en verder opleiden van medewerkers die geconfronteerd worden met RPA, andere taken tot zich nemen of elders worden geplaatst binnen de organisatie?
  - (a) Hoe wordt dit binnen de organisatie georganiseerd?
  - (b) Observeren jullie promoties van mensen uit lage schalen die doorgroeien naar hogere schalen?
  - (c) In hoeverre, en hoe worden werknemers betrokken in het ontwikkel traject van bots?
  
10. In hoeverre beïnvloedt RPA de doorstroming van junior functies naar senior functies, doordat een deel van de taken kunnen worden geautomatiseerd?
  - (a) Zijn hier al bepaalde strategieën voor geformuleerd?
  
11. Heeft RPA invloed op de eisen die jullie aan nieuwe medewerkers stellen?
  
12. Afdelingen zullen in de loop van de tijd gewend en afhankelijk zijn van RPA. In hoeverre zijn jullie voorbereid op het falen van systemen, zowel het detecteren van fouten als het handmatig uitvoeren van processen.
  
13. Is er een verschil tussen de impact van RPA op medewerkers met een mbo achtergrond en medewerkers met een HBO+ achtergrond?
  
14. RPA kan een directe impact hebben op bepaalde werknemers die taken uitvoeren die nu door bots worden gedaan? Heeft dit ook indirecte gevolgen voor andere werknemers, wiens taken niet worden geautomatiseerd. Bijvoorbeeld minder werkzaamheden voor IT support staff

### **B.4.3 analysis guidelines**

The interview recordings will be transcribed. The transcription is not transcribed word for word, but is an edited transcription. In an edited transcription parts are omitted by the transcriber, that are irrelevant or fruitless and do not change the meaning of the recording. Each transcription is then coded using NVivo 12, based on a coding scheme. This scheme is based on the theoretical foundation of this thesis and the emerging themes resulting from the cases. Furthermore, a summary of the interview responses is made, which will be used combined with the coded transcriptions for the analysis. The chosen analysis technique is the cross-case analysis enhances the generalizability of the results to other contexts [64, 106]. This technique treats each individual case study as a separate study. There are several strategies that can be used for a cross-case analysis in order to look at the data in different ways [23, 82]. For example, the cases can be split into two groups based on an attribute, such as employee satisfaction and then examined to discover the similarities and differences between those groups.

## Appendix C

# Coding scheme

Each black dot represents a main nodes, while a dash (-) represents a subnode.

- Context
- Governance and IT function
  - CoE trend
  - Governance
  - IT relation
  - Maintenance and oversight
- Operating Model
  - Building and evaluating phase
  - Maturity phase
  - Preparation phase

Note: The preparation phase is synonymous for the product evaluation phase as introduced in chapter 3. Similarly, building and evaluating phase is the integration phase and the maturity phase is the scale-up phase.

- Workforce
  - Changing hiring needs
  - Changing tasks
  - Employee satisfaction
  - Junior to senior
  - Measuring performance
  - Organizational structure
  - RPA acceptance
  - Training and education
  - Workforce reduction
- Miscellaneous
  - Cost calculation
  - Customers
  - Digitization Trend

- New opportunities
- Outsourcing
- Realizing results
- Retaining process knowledge
- security

## Appendix D

# Supplementary Impacts

### D.0.1 Cost calculation

A relatively unexpected impact of RPA is related to the calculation of pricing using billable hours [15]. In public accounting, cost is calculated based on the hours worked or uses a fixed fee model based on the number and level of employees assigned to the project. This is not a viable model if automation is involved as accountants spend less hours due to efficiency gains. The bots used have significant cost involved due to development, implementation and maintenance and these costs have to be charged to clients. Ultimately, the question is how much of the cost saving is kept by the firm and how much is passed back to the client.

### D.0.2 Outsourcing

RPA can reduce the need for outsourcing [15, 46, 84]. It is still a debated topic as it is possible to implement RPA at an offshore location. The company Xchanging took the latter approach as it argued that there was no rationale to repatriate work done at offshore sites [100]. Xchanging had no quality problem with its many offshore sites and repatriation would not lead to a significant cost reduction. Instead, they applied RPA to offshore sites to improve performance where needed. However, there are a number of arguments against outsourcing when using RPA [15, 46, 84]. The value of low cost locations diminishes if the number of FTEs are significantly reduced. Additionally, traditional outsourcing headaches can be avoided, such as: cultural differences, language barriers, relocation costs, unpopularity of shipping jobs overseas, time zone differences, IP security and confidential data crossing borders. In two cases [46] headcount was reduced at the outsourcing provider as this was less politically sensitive to do. In both cases offshore processes were reshored, but no new jobs were created.

### D.0.3 Customers

The use of RPA can lead to an increase in customer satisfaction due to higher processing speeds, increased accuracy and fewer mistakes [?, 41, 80]. Due to the workload reduction of RPA, employees can allocate more time for services that involve customer interaction. This results in a better customer experience and will likely enhance customer satisfaction, acquisition and retention [41]. However, this is not a given as some companies will use RPA to reduce cost. Companies that focus entirely on cost savings run the risk of missing opportunities to improve the customer experience and the satisfaction of their employees [50]. A robotic or automated customer experience does not have to be viewed negatively. For example, in the asset management industry millennials do not desire a humanistic relationship within their financial affairs as much as older generations [10].

### D.0.4 Organizational structure

RPA could have an effect on the organizational structure, and cause a transition from a traditional pyramid shape to a diamond shape [101]. Pyramids are mostly populated with employees at the bottom doing work that has a high potential to be automated. The benefit of this design is that employees gradually improve their skills as they are promoted to higher positions. This ensures that knowledge is retained within the organization. A diamond-shaped structure is shown in figure D.1, replaces the bottom of the pyramid with robots, while fewer middle managers are needed. A diamond-shaped organization needs more higher educated employees to coordinate with internal business units, RPA and BPO providers. The benefits of a diamond-shaped organization are lower costs and greater flexibility as robots can more easily adapt to changes in the task volume.

A similar transformation from a pyramid-shaped organization to a diamond-shaped configuration at law firms was noted by Kuruvilla and Noronha (2016) [43]. The transformation was started by offshoring legal work. This change required less junior associates at the bottom of the organization leading to a recruitment decline.

Figure 2: Transforming shared services from pyramids to diamonds

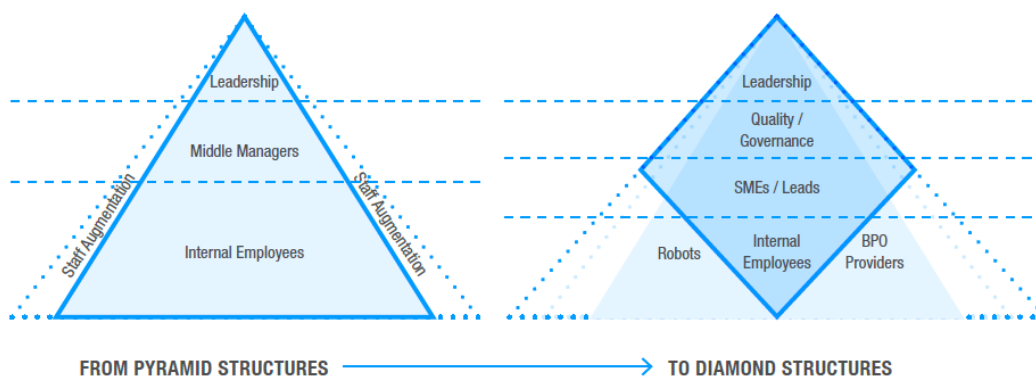


FIGURE D.1: Pyramid and diamond-shaped organizational structure for shared services, by Willcocks, Lacity and Craig (2017) [101].