Leopold-Franzens-Universität Innsbruck

Faculty of Business Administration

Master Thesis:

Potential Analysis for Robotic Process Automation in the Public Sector

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Abstract

Robotic Process Automation (RPA) is an umbrella term for the automation of repetitive and rule-based business processes and can be used to automate simple clerical tasks at user-interface level. The use of RPA promises to save costs, increase productivity and reduce the workload of personnel. Due to numerous possible uses and the anticipated benefits that can be realized with RPA, it is predicted that RPA will play an increasingly important role in the coming years. The public sector in Germany and Austria is currently undergoing a transformation phase, which also includes comprehensive digitization measures in the context of which the use of RPA is also being considered. Due to the lack of research on RPA use in the public sector to date, 7 expert interviews were conducted with representatives of public sector institutions and an analysis of the potential for RPA in the public sector was carried out. The findings suggest that RPA can contribute to solving a number of problems facing public administration. Especially in view of the existing staff shortage and obsolescence in public sector organizations (PSO), the use of RPA can help. However, the process selection approach and existing rules and regulations hinder the use of RPA and would need to be revamped to realize benefits on a bigger scale. Existing skepticism about the technology within organizations, is another reason why RPA has played a comparatively minor role to date. Further research should attempt to quantify, whether and to what extent RPA can contribute to solving existing problems.

Content

List of abbreviations

BPA: Business Process Automation

BPM: Business Process Management

BPMN: Business Process Management Notation

GDPR: General Data Protection Regulation

IT: Information Technology

PSO: Public Sector Organization

RPA: Robotic Process Automation

TPA: Traditional Process Automation

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Introduction

Performing redundant or simple tasks such as transferring data from one information system to another or filling out forms is often a time-consuming activity that ties up human resources, which is a problem for many organizations (Leno et al. 2021). In addition to freeing up resources, that can be used for more cognitively demanding activities, the automated execution of such tasks usually results in faster, more thorough, and less expensive execution, thus generating an economic advantage for organizations (Cernat et al. 2020). Accordingly, many organizations strive to automate such tasks, which is increasingly possible due to technological change and digitization (van der Aalst et al. 2018).

Traditional process automation (TPA) is limited in its application possibilities and is suitable primarily for tasks that are frequently repeated and follow a similar structure, which enables the economic use of process automation. Processes that differ more in structure and repeat less frequently are potential candidates for Robotic Process Automation (RPA) (Hofmann et al. 2020; van der Aalst et al. 2018). In this context, RPA is an umbrella term for tools that execute specific processes in an automated manner, interacting with the system at the user interface of an information system, the same way as a human would (van der Aalst et al. 2018). While research on RPA is just gaining momentum, RPA tools are already experiencing a boom, as evidenced by the high number of product vendors (Syed et al. 2020) and from surveys in which over half (54%) of all European companies surveyed say they plan to use RPA tools in the coming years (van Helden and Reichard 2016; Hofmann et al. 2020). RPA is seen as one of the most important digital innovations of the coming years (Sobczak 2021).

The aforementioned gap between research and practice is even more pronounced in the case of the public sector. At present, only a few studies are known which are dedicated to the use of RPA in public administration organizations. Especially in German-speaking countries, this area is still largely unexplored. Since the public sector usually differs from the private sector with regard to many factors such as legal regulations, organizational conditions, personnel structures, financing, responsibility and control, (Buelens and van den Broeck 2007; Christodoulou et al. 2018), the focus of this work will be on RPA in the public sector. Although, contrary to common preconceptions the public sector is not necessarily inferior to the private sector in terms of technical novelties and innovations (Ward, 2006; Negassi et al. 2019). There

is evidence though that these tend to be adopted in the public sector at a different, sometimes slower, pace (Christodoulou et al. 2018).

Because the state of research on RPA in the public sector is still in its initial phase, the goal of this work was to shed light on the potential for RPA in the German-speaking public sector. For this purpose, a qualitative research approach was used to gather data on possible applications for RPA through expert interviews. Furthermore, potential advantages and also disadvantages of RPA usage were investigated, as well as specific conditions for RPA usage in the public sector. In addition, criteria and procedures for process selection and approaches to quality assurance were examined. Through a structured content analysis according to Mayring (2019), the main findings were extracted and recommendations for practice were derived, as well as further research approaches were identified.

1. Theoretical Background

1.1. Business Processes

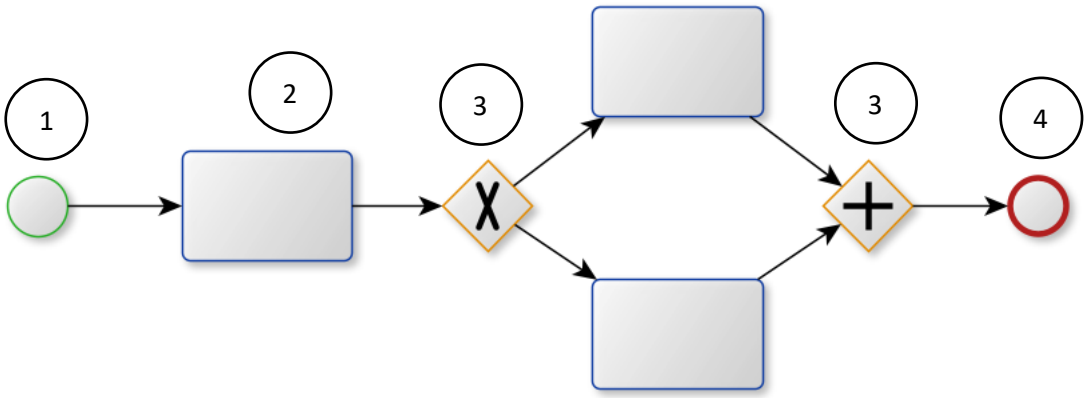
Business processes play a central role in almost every organization and company. They contribute decisively to the (mis)success of an organization and have a far-reaching influence on the output of an organization. Business processes are core assets of almost all organizations. They define tasks, their distribution, and responsibilities, are responsible for the integration of different systems and data flows and govern the interactions or points of contact between different organizations and other external parties (Dumas 2013). A business process strives to achieve a specific target state. It consists of a series of activities, which are executed in a coordinated sequence, by specific roles, each of which has been previously defined (Weske 2007). In addition, a business process consists of events. Events are atomic in nature in the sense that they have no duration of their own. An example of an event is the goods entrance of a particular product. Events can trigger activities or a series of activities in sequence. In the example, the event goods entrance could trigger the activity goods inspection. If an activity consists of a single step, it is called a task (Dumas 2013). Events can

start or end a business process. Further elements of a business process are so-called decision points or gateways. Decisions can be exclusive, inclusive or complex. Furthermore, the actors are part of a business process, i.e., the persons involved in the business process and responsible for the activities. In summary, a business process can be defined as "a collection of inter-related events, activities and decision points that involve a number of actors and objects, and that collectively lead to an outcome that is of value to at least one customer." (Dumas 2013).

1.1.1. Business Process Management

Business process management (BPM) is "a body of methods, techniques and tools to discover, analyze, redesign, execute and monitor business processes" (Dumas 2013). BPM provides the opportunity to improve and adapt an organization to changing external conditions. Increased effectiveness of existing systems, processes, and products should be achieved through the use of methodological tools and the principles of BPM. This enables organizations to adapt their processes and themselves according to existing necessities and to improve the outcome of business processes in a continuous way (Larsch et al. 2017; Bitkowska 2019). Components of the BPM cycle are process identification, process modeling and documentation, process analysis (both qualitative and quantitative), and process redesign and optimization based on these (Dumas 2013). As a first step towards adaptive business process improvement, the processes of a company or organization must be identified, which in many cases is done with IT or technological support (Neubauer et al. 2009). Process modeling and documentation is usually performed in an iterative manner in a specific, usually predefined, modeling style (Pinggera et al. 2012). Business Process Management Notation (BPMN) (Figure 1) is an established and uniform set of rules for the notation of business processes, which is frequently used in the modeling and documentation of business processes (Dumas 2013). The components of a business process described in chapter 1.1. can be represented using BPMN. Start (1) and end events (4), activities (2) and gateways (3) of a business process are displayed in the corresponding order.

Figure 1
BPMN



Process analyses are carried out using BPM with the aim of either validating existing processes or identifying approaches to improve them (Pedrinaci et al. 2009). There are different approaches to process analysis. Qualitative process analysis techniques, such as value-added analysis or root-cause analysis, are used to systematically gain deeper and more substantive insights into the respective business processes. Quantitative process analysis is aimed at more objectifiable metrics such as the throughput or waiting time of a process or the costs and thus enables, for example, processes to be compared with one another. Examples of quantitative process analysis are flow analysis, queueing analysis or simulation (Dumas 2013).

Process redesign refers to the restructuring of existing business processes. It is an important and central component of BPM due to changing external influences, organic growth and further development of organizations, and growing complexity (Dumas 2013; Gross et al. 2021). Process redesign should ideally include process optimization.

1.2.Robotic Process Automation

Business process automation (BPA) in general, describes the automation or automated execution of any step within a business process or an entire business process of varying degrees of complexity (Dumas 2013). A specific form of process automation is Robotic Process Automation (RPA). RPA is an umbrella term for the automated execution of certain repetitive business processes. Thereby, RPA tools execute statements on structured data, which usually includes various user-interface interactions that are automated or involve a connection to

various APIs. Within RPA tools, the process is mapped in advance so that it can be executed by the "robot" according to a certain schedule (van der Aalst et al. 2018; Tornbohm 2017).

While the processes under consideration in traditional process automation are characterized by a high frequency and by a high degree of homogeneity, so-called candidate processes for RPA tend to be characterized by a higher complexity (van der Aalst et al. 2018). These processes are typically somewhat less redundant and are repeated less often within a given period of time. In addition, significantly more different processes can be automated. It should be emphasized here that there are still certain creative or otherwise demanding processes and tasks that can still only be performed by humans. RPA still mainly targets simple, so-called "back-office" tasks. Also, such processes that require human decision-making, for example, are only suitable for the use of RPA to a limited extent. In many cases, there is a pareto-distribution in process frequency. Few processes are executed very frequently, and a large number of processes are executed rather infrequently, which has so far made automation of the less frequent ones unreasonably costly (van der Aalst et al. 2018; Sobczak 2021; Syed et al. 2020).

The "robotic" in RPA can be seen as a rather metaphorical term, since IT tools that are categorized as RPA are not devices per se but specific software that, however, acts like a human being and therefore functions quasi as a robot (Sobczak 2021). RPA usually acts at the user-interface level, interacting with the surface by clicking on fields or filling them with information that it copies from other sources, thus creating an independence from the software to be operated. The existing system is not changed but merely operated by the RPA tool instead of a human (Cernat et al. 2020). RPA is thus easy to implement in a wide variety of contexts and can therefore be implemented and used with comparatively little effort.

RPA offers other benefits in addition to the previously mentioned improved operational efficiency and associated cost savings (Anagnoste 2017). Human errors such as incorrect data entry or typos, which are particularly common with RPA process candidates due to their monotonous nature, are significantly reduced using RPA (Tarquini, 2018). Furthermore, certain services can be provided virtually "24/7" due to the independence from human labor, thus the increased availability leads to improved productivity. Compared to other automation software, RPA is also easy to implement, maintain, and operate (Lacity, M., & Willcocks, L. 2015).

As far-reaching as the mentioned benefits of RPA are, implementing RPA is not a guarantee for improved performance and the proper use of RPA can be challenging for organizations. RPA should not be applied to overly complex processes, as this can lead to exorbitant automation costs that outweigh the intended benefits. Likewise, the ease of use of RPA tools for users can lead to the misconception that the ability to implement simple processes already enables them to automate complex scalable business processes. In addition, processes should not simply be automated, and all human input disappear. Rather, processes should be adapted to automation and human input retained where it makes sense so that use also adds value (Lamberton et al. 2017).

In summary, it can be stated that RPA has great potential to further drive digital transformation and become one of the major digitization topics in the coming years. The potential of RPA also makes it an important topic for the public sector.

1.2.1. Functionality of RPA

RPA is an umbrella term for the automation of repetitive business processes and software or a class of certain IT tools (van der Aalst et al. 2018). These include, among others, software robots or artificial intelligence components that are used to automate certain processes and simplified, mimic or replace the human who would otherwise execute the process. RPA tools thus interact similarly to humans with desktop apps and the Internet, using existing applications and IT infrastructure (Lamberton et al. 2017). However, humans are not completely obsolete here and are still involved in the use of RPA, as they are needed to monitor the RPA tools, to deal with any errors or exceptions that may occur and at decision points, in addition to providing guidance in process mapping (Sobczak 2021). RPA interacts with the system at the UI level, which means that APIs are not required (but can still be used) and that no major changes need to be made to the IT infrastructure or the system itself to use RPA (Osman, 2019).

RPA tools execute previously created scripts that describe the mapped processes in the language of the RPA tool (Tornbohm, 2017). Screen recordings of process execution by humans can also be used as a template for the RPA tools. However, it must be emphasized, that methods such as screen recordings or scraping tend to be more typical for traditional

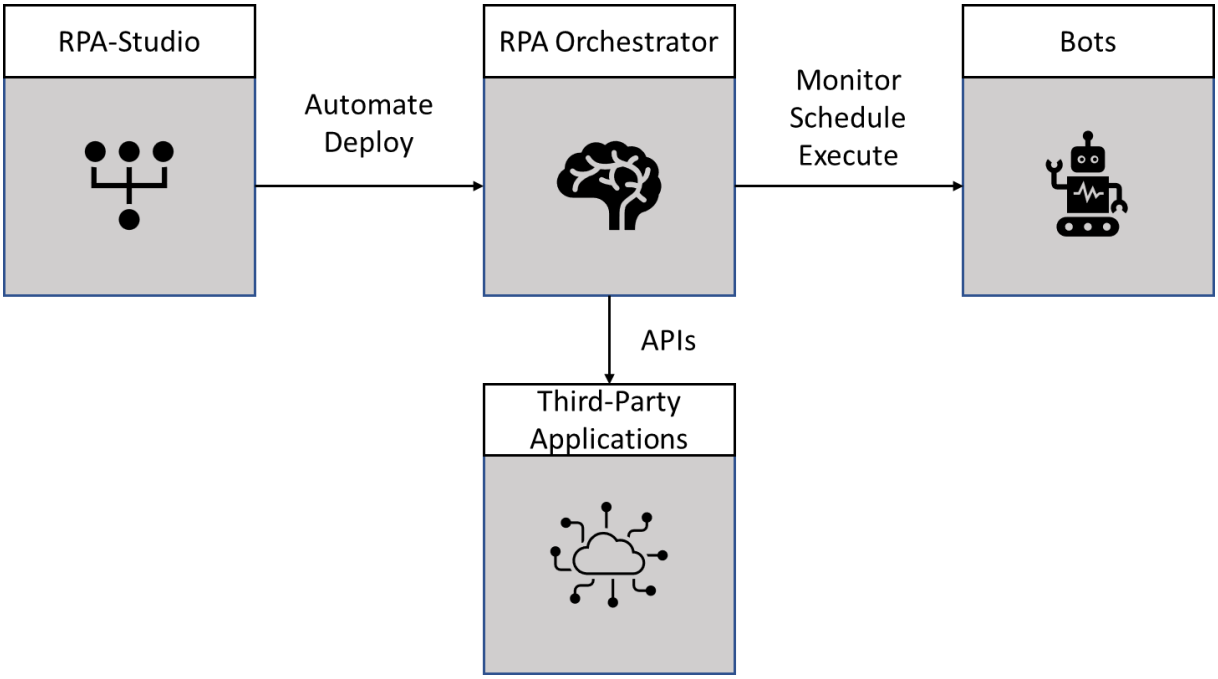
process automation, while the typical functionality of RPA is element identification within an interface (Asquith and Horsman, 2019). Furthermore, the process variables relevant to each process must be accurately defined in advance (Ribeiro et al., 2021). The scripts contain granular instructions for interacting with the respective applications and web pages (Leno et al., 2021). The if, then, and else statements instructed to the RPA tool are subsequently executed at the specified time by the software robot via the user interface, APIs, or a combination of both (Tornbohm, 2017). The interactions or the executed process steps can be recorded and thus a log can be created.

In order to understand the functionality described in the previous section, the structure of RPA should be described in more detail. It is of important to note, that RPA consists of different components (figure 2). RPA is usually composed of the bots, the studio, and the orchestrator. The bots are those elements that execute the tasks and thus take over the work that was usually performed by humans. A distinction is made between attended and unattended bots, with the former executing the tasks in collaboration with humans, such as when there are certain decision points. Unattended bots execute the tasks in the background without human intervention and start executing the process steps either triggered by certain events or at predefined times. In the RPA Studio, the workflows that are later executed by the bots, are created, modeled and, if necessary, configured by the users. The RPA Orchestrator is where the planning, administration and testing of the bots takes place. As already described, RPA can be used without the use of APIs, but these are necessary when linking to or using third-party applications (Choi et al., 2021).

The capabilities of RPA are currently often still limited in that very complex processes are difficult to automate, and RPA is used more for classic back-office tasks. RPA is often insufficient for processes that require decisions, for example. For a more widespread use of RPA, it therefore needs to become smarter (van der Aalst et al. 2018). Combining RPA with artificial intelligence or machine learning should make it possible to automate more complex and less extensively defined tasks, as well as to deal with errors and exceptions. While "classic" RPA is only capable of doing what it has been instructed to do, linking it with AI and ML provides opportunities to expand the deployment horizon, make RPA more adaptable, and hence increase its utility (Yatskiv et al. 2019).

Figure 2:

Components of RPA according to Choi et al. (2021)



It is envisioned, for example, that RPA will learn from people and how they handle certain situations and adopt their behaviors, recognize patterns in process execution and use them to improve performance, and learn to handle more complex situations (van der Aalst et al. 2018) or autonomously evaluate existing data so that it can be used to manage deviations from the norm in process execution (Yatskiv et al. 2019). In summary, by using RPA in combination with AI and ML, it is possible to identify specific patterns, make classifications or correlations, optimize processes and make predictions. Consistently, in recent years, there has been an increasing integration of AI and ML in RPA tools (Ribeiro et al. 2021). Approaches such as Intelligent Process Automation (IPA) aim to improve and empower RPA for more complex tasks using artificial intelligence. In doing so, RPA should be able to be more generalized and enable complex interactions with minimal human intervention (Ferreira et al. 2020). Some RPA vendors already offer AI capabilities by default or enhance automation through the use of algorithms (Ribeiro et al. 2021). It is therefore expected that the use of AI and ML will further improve RPA and that they will play a formative role in the further development of RPA in the coming years.

1.2.2. Process Selection

A central challenge in the use of RPA is the correct selection of the processes to be automated. Already at the beginning, organizations that want to use RPA are faced with the task of selecting processes and identifying suitable routines that are well suited for automation (Leopold et al. 2018). Process selection is sometimes considered the greatest challenge in implementation, and the success of RPA use depends largely on whether this is achieved (Choi et al. 2021).

Often, direct questioning of the process owners via interviews or observation of the work, either in situ or video-based, is used to identify those processes. Going through the processes step-by-step is also a way to manually capture potential RPA candidates (Leno et al. 2020). However, since process steps in large organizations are often scattered throughout the organization or process landscape, this approach is in many cases both uneconomical and very difficult to implement in practice. Due to a lack of available alternatives, however, suitable candidates are still frequently sought in this way (Leno et al. 2021).

At first glance, the creation of a criteria catalog or step-by-step instructions for the selection of suitable processes to ensure target-oriented use of automation is a good approach to process selection. However, this method also faces a similar problem as manual process selection. An organization that has been provided with comprehensive instructions or guides for optimal process selection is still faced with the challenge of ascertaining the current status of the degree of automation, which involves considerable effort, especially in large organizations. Newer approaches enable the automated detection of the degree of automation from text sources. The analysis of frequently existing process documentation in text form to identify the automation potential is therefore a promising, albeit not yet fully developed, approach to finding suitable processes. Since only the current degree of automation is recognized here so far, a well-developed candidate recognition is not yet given (Leopold et al. 2018).

Another approach to efficiently and meaningfully capture RPA candidates is Robotic Process Mining. RPM tools aim to identify automatable processes from user interaction logs, which record people's interactions with the Internet or desktop apps, to provide suggestions about which processes are candidates for RPA use (Leno et al. 2020). UI logs contain detailed

information about users' interactions with the system, such as which apps are opened or copy and paste commands. Based on these UI logs, RPM tools should, on the one hand, recognize patterns, and on the other hand summarize variants of task execution into standardized routines. These routines should be presented in such a form, that they can be evaluated by analysts in terms of automation costs and benefits realized through automation, which can greatly reduce the burden on organizations with numerous processes and routines in particular (Leno et al. 2020). Some difficulties in analyzing UI logs are, that steps irrelevant to the process are also recorded or that the logs occur in an unsegmented manner and must first be edited (Leno et al. 2021). Overall, there are still some open challenges here as well. However, results to date make authors confident that the use of RPM will make it considerably easier and faster to find RPA candidates.

1.2.3. Application of RPA

RPA is best suited to be used in the automation of standardized, rule-based processes that were previously performed manually by humans, are performed frequently, and do not require decision making, human judgment or higher cognitive performance (Hofmann et al. 2020; Osman, 2019). Accordingly, RPA tools are often used to automate the execution of certain "back-office" tasks. These include, for example, periodic reporting tasks, data entry and transfer, or archiving. In this role, i.e., taking over such clerical tasks, a number of fields and areas present themselves, where RPA can be applied to automate various processes. Examples include applications in the telecommunications sector to make back offices more efficient (Lacity, M., Willcocks, L. & Craig, A 2015), in anomaly detection in the insurance sector (Guha and Samanta 2021), in improving invoicing processes and the associated linking of front and back-office activities (Aguirre and Rodriguez 2017), and in data and document analysis in the public sector (Houy et al. 2019). RPA is also seen as a promising tool in the area of fraud prevention and the reduction of possible fraud opportunities or in auditing (Griffiths & Pretorius 2021). Another field in which the application of RPA is currently considered to have high potential is software testing (Yatskiv et al. 2019; Cernat et al. 2020). Since only a small portion of this work has been automated to date and the volume of total tests to be performed is expected to increase dramatically in the coming years, the conditions are in place for the increased use of RPA. Especially in the area of UI testing, where work is still largely manual

and testers often click through various interfaces, the use of RPA can be of great benefit. Compared to previously used methods such as test scripting or programming, RPA is considered superior because it can be used more flexibly and is more accessible to different domains (Cernat et al. 2020).

With regard to possible applications in the public sector, automated filling of screens, reading and filling databases, extraction of specific data from electronic documents, automated creation of reports, access to data from ERP systems, making rule-based if-then decisions, e-mail management, and performing calculations are mentioned (Houy et al. 2019). Thus, the potential fields of application for RPA in the public sector do not differ decisively in principle from those in other sectors.

RPA tools generally help to ensure that processes are error-free, traceable and executed faster. In this way, they help to significantly improve important KPIs of process execution. At the same time, however, they are not suitable for improving or optimizing inefficient or incorrectly designed processes. If a process contains deficiencies prior to the implementation of RPA, these are usually inherited by the RPA tool (Hofmann et al. 2020). Process optimizations should be achieved with the use of BPMS rather than RPA.

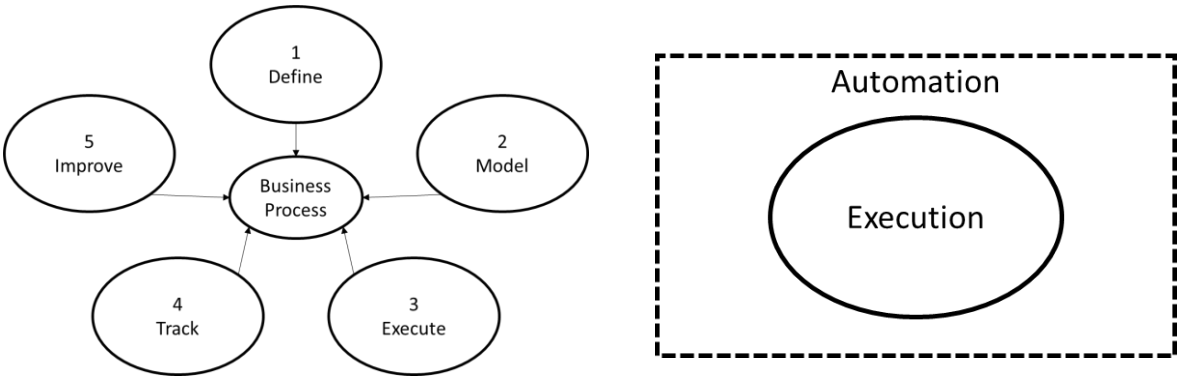
1.2.4. Differentiation from Business Process Management Software

Business Process Management Software (BPMS) refers to programs that are tasked with defining, modeling, analyzing, executing, and tracking business processes (Bosilj Vuksic et al. 2018). As shown in Figure 3, BPMS affects and changes the process in different ways. The holistic approach distinguishes BPMS from RPA, along with several other points. In some cases, RPA is referred to as a slimmed-down version of BPMS, as there are a number of similarities between the two, but there are also clear differences (Osman, 2019). The task of RPA tools is solely to automate the execution of certain processes. BPMS is also usually designed to identify approaches to improve the process in question. While RPA acts as so-called "lightweight IT" in the front end, BPMS is to be located as "heavyweight IT" in the back-end, which thus makes the implementation of RPA comparatively easy (Osman, 2019). In addition, BPMS typically interacts with IT via APIs, whereas RPA can directly intervene in the system via the user interface or a combination of API and user interface. Due to its smaller

scale, implementations of RPA are usually associated with lower costs and lower resource usage, compared to BPMS (Lacity, M., Willcocks, L. & Craig, A 2015). RPA thus acts as a transitional element between human labor and extensive business process automation, which is part of BPMS, as it offers economic advantages over the latter as well as easier implementation and use (van der Aalst et al. 2018). RPA should not be seen as a replacement for or a competitor of classical BPA, as they can be applied for different purposes. Rather, RPA is a complement for classical BPMS (Osman, 2019). In this regard, RPA is the better choice for straightforward automation of certain processes, while BPMS is better suited for new, inefficient, or outdated processes due to its ability to improve them (Mohapatra 2013).

Figure 3:

Tasks of BPMS vs. RPA



1.2.5. Advantages of RPA

As already described, RPA is a technology that currently has a high growth potential and is becoming more and more the focus of scientific research as well as being increasingly used in practice (Sobczak 2021). The reasons for this are rooted in numerous advantages that the use of RPA promises. First, the use of RPA is usually accompanied by significant cost savings (if applied correctly). Lacity et al. (2015) report that by automating 15 core processes using RPA, several hundred full-time equivalents became obsolete and an ROI of 650-800% was achieved. The implementation itself is also comparatively inexpensive to realize, since no profound changes have to be made to the already existing IT here (Sobczak 2021). Other sources put the cost of process execution by software robots at 30% of the cost of a full-time employee (Anagnoste 2017). Many companies report that the cost of using RPA could be amortized

within one year (Ivančić et al. 2019). In addition to cost savings, RPA can also be instrumental in increasing productivity. Aguirre and Rodriguez (2017) showed in a case study that the number of actions or processes performed by a given number of people can be significantly increased by using RPA. At the same time, the use of RPA did not reduce the processing time for a single action, contrary to what might be assumed. However, the parallel execution of several actions at the same time made it possible to handle a higher volume. Accordingly, the increase in productivity is one of the most important arguments for the use of RPA, along with cost savings (Aguirre and Rodriguez 2017). Especially in the case of tasks typical of RPA, the execution of repetitive tasks that tend to be perceived as tedious, there is an increased risk of error due to the nature of the task, if humans perform the activity for a longer period of time. Particularly in the execution of critical processes with low error tolerance, RPA is therefore well suited to positively influence both productivity and accuracy (Séguin et al. 2021).

The advantages described so far mainly refer to the comparison with humans performing certain tasks. However, RPA also has some advantages compared to other systems such as BPMS. On the one hand, RPA is easier to implement than other process automation tools by accessing the user interface instead of APIs (Osman 2019). In addition to saving human resources during implementation, this also results in more flexible application options and the ability to use RPA in a fairly system-independent way to automate a wider range of processes (Cernat et al. 2020).

In summary, the use of RPA can be justified with the arguments of cost savings, quality assurance or increase as well as productivity growth and process standardization (Anagnoste 2017; Suri et al. 2017).

1.2.6. Critical Aspects and Risks

Even though RPA is seen as a forward-looking and in many respects promising technology with disruptive potential (Anagnoste 2017; Ivančić et al. 2019), there are some criticisms and reminders to consciously deal with the risks inherent in its application. For the aforementioned benefits of RPA to be realized, proper use and also consideration of potential organizational changes is essential. Not only technical aspects should be taken into account, but also adequate change management strategies should be strived for, in order to achieve

sufficient acceptance within the organizations, which is a prerequisite for a successful use of RPA.

As RPA typically promises productivity gains, some of which are accompanied by job losses (Lacity, M., Willcocks, L. & Craig, A 2015), skepticism within organizations regarding its use, coupled with fear of job losses, can be a problem (Suri et al. 2017). Lack of understanding about the actual capabilities and limitations of RPA, which can also manifest in lack of management support, can create resistance to RPA-use within organizations and therefore require measures to promote acceptance (Suri et al. 2017). RPA-use should be understood less as the mere introduction of one more technical tool among many, and more as a comparatively profound change in organizational structure (Sobczak 2021). A suitable change management strategy that addresses concerns within organizations and can mitigate potential conflicts, a change or adaptation of organizational culture, and a shift in mindset are cited as possible ways to address this issue. This should reduce the perception of RPA as a mere IT tool and bring business aspects into focus (Ivančić et al. 2019). Ultimately, employees who fear job cuts can also benefit from RPA making their work more attractive by eliminating redundant tasks.

Furthermore, too high expectations of RPA can be problematic, as they may lead to disillusionment and disappointment after implementation. Currently, RPA is in a state of "hype," which can lead to overestimating the potential of RPA (van der Aalst et al. 2018). Assuming that RPA implementation alone is sufficient to achieve significant ROI is misleading. Often, appropriate linkages must be provided via digital applications or OCR to holistically transition even those processes that begin paper-based or otherwise remote from IT into an E2E process. Failures in this regard can lead to only individual sub-processes being automated, which significantly reduces potential cost savings (Lamberton et al. 2017). Extensive documentation of the processes to be automated and the interface used is also needed to make process automation possible at all (Yatskiv et al. 2019). Moreover, the mere automation of certain processes by no means implies that the processes will be executed better as a result. It is repeatedly pointed out that RPA is not suitable for process optimization (Hofmann et al. 2020; Osman 2019). Accordingly, the concern that faulty processes are automated without taking into account the actual problems and that future process optimizations are subsequently made more difficult is a central risk in the use of RPA. Suri et al. (2017), who

identify this risk, refer to a quote from a study participant "Drink coffee and make stupid things faster and with more energy," which exaggerates this concern. Since another challenge in the implementation of RPA is the sometimes unclear, dividing lines between IT and business, it should be avoided that, on the one hand, a perspective that is too business-oriented creates too high expectations of the software robots and that, on the other hand, a perspective that is too IT-oriented overlooks any potential for optimization in the processes and the implementation is handled purely functionally. It is also crucial that the selection of processes for automation is carried out thoroughly and guided by expertise. Since the selection of overly complex processes for automation can result in high costs, it should be weighed up which processes are actually suitable (Lamberton et al. 2017).

In conclusion, a lack of acceptance or resistance within the organizations combined with an inadequate change management strategy, overly high expectations of the potential of RPA, which ultimately lead to disappointment, inadequate process selection and process optimization, and a lack of understanding and support at management level can jeopardize the successful use of RPA. It is therefore important to pay particular attention to these aspects during implementation.

1.3.The Public Sector

There are a number of different definitions of the public sector. The term can be interpreted differently depending on the context, and the unclear definition subsequently sometimes leads to people using the same term to refer to different things (Vebrova and Rybáček 2018). A common concise definition is that the public sector includes those organizations that are publicly funded, as opposed to the private sector (Baarspul and Wilderom 2011). According to this definition, the only criterion that matters is the source of financial resources. Compared to the private sector, however, there are other differences besides funding in terms of ownership and governance of the respective organizations. While public sector organizations are explicitly rule-governed and owned by the public hand, private sector organizations are more market-governed in their actions and privately owned. It should be emphasized here, that this classification describes the ideal pure form of the two sectors and that the distinction

is not always completely clear-cut (Baarspul and Wilderom 2011). Moreover, the public sector can be seen as a unique entity that has no comparable equivalent (Johnson 2020).

1.3.1. The Public Sector in Germany and Austria

Germany is a federal state with 16 federal regions, each of which has a comparatively large degree of decision-making freedom and political scope. In line with the federal structure, public administration also has a three-tier structure: national at the federal level, regional at the state level and local at the municipal level (Wagner and Radujkovic 2022). Historically, the architecture of public administration in Germany is characterized by pronounced autonomy at lower levels of government and administration, a comparatively small federal administration, and a division of responsibilities between the federal and state levels and is generally seen as a prime example of multilevel administration (Sommermann 2021).

Like Germany, Austria is a federal state and has nine federal states, which have some decision-making powers. Although the federal structure in Austria is less pronounced than in Germany and clearly pronounced centralist tendencies are apparent (Erk 2004), both countries are very similar in an international comparison and with regard to their administrative structures. Both countries have declared the rule-of-law principle to be the guiding principle of the public sector, which carries out its obligations guided exclusively by the respective laws. Both Austria and Germany are described as traditionalist states in terms of their public administration and, in international comparison, partly considered equivalent despite their existing differences (Hammerschmid and Meyer 2005).

1.3.2. Role and perception of the public sector

The tendency toward a skeptical attitude toward government and administrative institutions that prevails in other countries, especially in the Anglo-Saxon region, according to which the state is expected to play a restrained role in line with the neoliberal ideology that dominates there, contrasts with the role of the administration and the state in Germany and Austria as well as in most parts of continental Europe. In this context, public administration takes a stronger and more dominant role in continental Europe, where the guiding principles of the

welfare state and the rule of law largely determine the actions of public institutions (Kuhlmann and Wollmann 2019). In line with these models, goodwill toward and trust in public institutions is comparatively high in continental Europe and thus also in German-speaking countries (Cordes and Vogel 2022). The values shared by PSO employees usually differ from those shared by employees in the private sector. It is apparent that as a result of numerous reforms in the public sector, a reorientation toward more business-like values such as efficiency and competitiveness is evident, but traditional values such as reliability and incorruptibility continue to be weighty guiding values. (Van der Wal, Z., Pevekur, A. and Vrangbaek, K. 2008). The predominant identified values that are shared for PSO employees in Germany are expertise, professionalism, integrity, trust, and teamwork (Capell et al. 2013). These findings suggest that in Germany and Austria, on the one hand, public administration is given a lot of trust and a strong role by citizens, and, on the other hand, administration tries to live up to this role and deliver satisfactory results as a service provider. Even though the public sector here is generally rated quite well and most citizens have a thoroughly positive image of it (Cordes and Vogel 2022), there are shortcomings in some areas. This concerns, for example, transparency and citizen participation (Siebenlist, T., Mainka, A. 2018) or in the management of major projects (Wagner and Radujkovic 2022). In order to operate satisfactorily as a service provider for citizens, it will be necessary to overcome a number of challenges and reforms in the coming years.

As in other countries, principles of New Public Management (NPM) have been integrated into administration in Germany and Austria in the past. NPM refers to a modernization movement within public administration that encompasses various reforms and is characterized more by output orientation than input orientation (McLaughlin et al. 2002). In the context of public administration in Germany, these reforms include, for example, renewals of the accounting and controlling system, outsourcing of certain tasks (Sommermann 2021), the introduction of e-billing in administration (Mensching, S., Bergner, S., Rebs, M., & Adam, T. 2019), reforms to increase citizen participation in the sense of open government (Siebenlist, T., Mainka, A. 2018), or the introduction of IPSAS (Turyna and Koeppl-Turyna 2018). They pose major and minor challenges to PSO, which will be explained below.

1.3.3. Challenges and Reforms in the Public Sector

For many citizens, the public sector is first and foremost a service provider. In order to fulfill this role vis-à-vis one of its most important stakeholder groups, the public sector must respond adequately to a wide range of societal, economic and technological changes (Pūraitė et al. 2020). In addition, the public sector has faced increasing pressure to innovate in recent years. Higher expectations for productivity, efficiency, service delivery, and citizen satisfaction have led to the need for restructuring and reorganization measures (Demircioglu 2020).

Changes in the population structure and demographic change represent a challenge for society as a whole that is also increasingly affecting PSO (Sommermann 2021). The aging population means that employees are becoming increasingly scarce and public administration is more often finding itself competing for workers with competitors from private sector organizations. Due to the service provider role that the public sector occupies, sufficient staffing levels are particularly important for public institutions to successfully accomplish their tasks (Cordes and Vogel 2022). Since sufficient staffing in PSO has long ceased to be a matter of course, technological solutions must also be considered to compensate for the staff shortage, which will become more acute in the coming years.

As already described, citizens represent one of the most important stakeholder groups of PSO. They are becoming increasingly aware of their power to influence public administration and are therefore expressing their demands in different ways. Dealing with increasing pressure and growing quality demands on the part of citizens requires a more conscious approach to action risks that arise, for example, in restructuring or reform projects, since increased expectations are accompanied by a lower tolerance for errors. To cope with this, PSO need to adapt and drive the use of goal-oriented risk management strategies. This is still often not the case in PSO in German-speaking countries, which is why adaptations to the increased quality requirements must be proactively tackled (Schäfer et al. 2022).

Governments and administrations are becoming more open in many countries. There is a shift away from closed institutions towards open, inclusive and collaborative administrations (Siebenlist, T., Mainka, A. 2018). These efforts to modernize administration are summarized under the term Open Government and describe a trend in the exercise of government and administrative functions, which is characterized by participation, collaboration, and

transparency (McDermott 2010). The prerequisites for achieving these characteristics are a modern and digital administration. Public administration in Germany is not yet in a state where the criteria for open government are met. The reasons for this are a lack of digital capacities to ensure transparency and, as a result, insufficient citizen participation (Siebenlist, T., Mainka, A. 2018). In Austria, Open Government has also only been partially achieved. Although the concept is largely welcomed by those in positions of responsibility in public administrations, there is still a need to catch up, particularly with regard to citizen participation (Schmidthuber et al. 2018).

The above examples of reforms that public administrations in Germany and Austria have to cope with show that a targeted digitization strategy is indispensable for mastering them. PSO must be equipped with digital infrastructure both to compensate for demographically induced staff shortages and to provide high-quality services. Digitization is the starting point, prerequisite, and target for many of the reforms currently underway.

1.3.4. Digitization in the Public Sector

Digitization in the public sector can be seen as a process of social change and transformation, in the course of which citizens, administration, and decision-makers are increasingly influenced and guided by technological changes and opportunities (Houy et al. 2019). In Europe, the digitization of public administration is largely shaped by the European Commission's digital strategy. Through innovative and digital strategies of the public sector, the aim is to ensure that citizens can benefit from excellent service. To achieve a well-developed and satisfactory eGovernment infrastructure, which should provide digital services such as electronic ID, signature or health records, most countries have formulated their own national digitization strategy based on the EU requirements (Pantiru 2019).

In Germany, the Digital Agenda aims to offer easy-to-use and secure digital services. Efficient interfaces between citizens or companies and the administration, simple and secure communication channels, the reduction of necessary administrative procedures, the cross-border possibility of carrying out administrative matters and modernized administrative processes are among the goals mentioned. To achieve these goals, a strategy is to be pursued that explicitly includes the use of innovative technologies (German Federal Government

2014). In Austria, the digitization strategy is defined in the Digital Roadmap. This sets out twelve guiding principles, that define the framework conditions for the digitization of public administration. On the one hand, these include clear formulations that guarantee citizens a right to secure and convenient digital administration and a fight against the digital divide. On the other hand, they include points that emphasize the innovative character of the digital strategy and the role model function vis-à-vis other organizations that results from the digitization of the public sector (Bundeskanzleramt and Bundesministerium für Wissenschaft 2016). What most national agendas for the digitization of public administration have in common is that they cite the development and management of digital solutions as a goal, aim to achieve this with as high a user orientation as possible, emphasize the involvement of citizens in this process (co-creation), and strive to use innovative digital technologies (Edelmann and Mergel 2021).

The digitization of public administration thus offers numerous opportunities for improving the services and outputs of PSO. Due to the different framework conditions of the public sector compared to the private sector, a number of additional factors must be taken into account in order to achieve successful implementation. Internal as well as external stakeholders are challenged to manage the associated change process in a way that actually generates added value. Skepticism and mistrust of new technologies on the part of citizens, e.g., due to data protection concerns, can hinder the adaptation of new technologies. Concerns about the "digital divide," which occurs when only part of the population can benefit from improved digital infrastructure, are also critical external issues that must be taken into account in order to achieve successful reform (Papavasiliou et al. 2020).

The internal administrative perspective on the introduction of new technologies is characterized by other challenges than the external. Digital transformation often entails fundamental changes within PSO, which are not limited to technical aspects but may also involve organizational or structural changes (Ylinen 2021). The rather hierarchical structure of PSO as well as, compared to the private sector, more rule-based specifications regarding financial resources make the transition to new technologies more difficult, as the successful handling of these usually requires adaptive control, which is often not easily possible in the public sector (Janssen and van der Voort 2016). In addition, above a certain project volume, competitive bidding is required by law. This can lead to delays in the event of unforeseen

adaptations and the resulting additional work within a project. Furthermore, internal resistance to change and entrenched operational structures can make transformation more difficult and hinder successful digitization (Ylinen 2021).

1.3.5. RPA in the Public Sector

Among other innovative technologies used in the course of the digitalization of the public sector, RPA is also spreading in PSO (Ranerup and Henriksen 2020). As part of the technologization of the public sector, the automation of suitable processes also plays an important role. At this stage, the use of RPA in the public sector has not yet been sufficiently researched, but some insights already exist.

As in other areas, RPA is mainly used in PSO for administrative, simple back-office activities. Since many documents are still processed in paper form, especially in Germany, the combination of RPA with optical character recognition (OCR) programs can make this cost-intensive work more effective and efficient than it would be if performed by humans. Even when integrating data from many different sources, which is common in PSO, RPA can help make centralized data storage more efficient while improving data consistency. In addition, automated process integration can be improved with RPA. Where workflow management systems cannot be used due to different underlying application systems or certain process components are executed without any support by an information system, RPA can help integrate the process steps (Houy et al. 2019). Last, AI-powered RPA tools can support decision-making and more complex tasks in the public sector to increase efficiency and improve quality (Ranerup and Henriksen 2020).

It can be assumed that the use of RPA in public administration will lead to a reduction in face-to-face encounters, as more tasks will be carried out by machines instead of classically by administrative staff. As already described, however, this tends to mostly cover administrative back-office activities. In some cases, more complex tasks such as rule-based decision-making are delegated to RPA. However, this should only happen in selected cases, as at least hybrid decision-making in which humans continue to have "the last word" is currently still indispensable from an ethical and democratic perspective (Ranerup and Henriksen 2020). RPA, which has been empowered by AI to perform more far-reaching tasks, can help PSO

reduce costs, improve scalability, and increase quality in certain non-trivial, decision-requiring task areas (Young et al. 2019).

All in all, there are a number of conceivable use cases for RPA in the public sector. Given the digitization initiatives of numerous countries, it is conceivable that RPA will increasingly be used in PSO as a result.

1.4.Related Work

As described earlier, the state of research into RPA, which is still a relatively new technology, is lagging behind in comparison with actual practice. In the case of the public sector, the existing knowledge about RPA is even less than in general. In addition to the findings already mentioned, there are nevertheless some studies in which RPA has been investigated in the public sector and which provide a knowledge base that this study aims to expand. These studies will be discussed in more detail in this chapter.

Houy et al. (2019) have investigated the potential and challenges of using RPA in PSO. They draw on use cases and tasks that play a relevant role in the public sector and discuss the application opportunities that RPA offers here. The main uses are seen in the area of data reading, transfer and integration. Accordingly, RPA can also improve the work of PSO around process integration and - with a corresponding existing data basis - for decision support. Adequate process selection is seen as the biggest challenge here. Since Houy et al. (2019) only use a literature-analytical approach to discuss what possible applications there may be for RPA in the public sector and there is no data collection, the findings only have limited informative value. The use-case of RPA for decision support in the public sector is examined in more detail by Ranerup et al. (2020). In doing so, they conclude that RPA, compared to AI or other more complex approaches, is suitable as a straightforward decision support option. Since handing over authority to automation tools is problematic from an ethical and democratic point of view, they suggest limiting the use of RPA in this context to simple decisions and using a hybrid model in which the decision-making process is shared between humans and RPA. Flechsig et al. (2019) conducted an interview study to investigate the impact of RPA on purchase and supply-management in public sector organizations. They found that both, qualitative and quantitative improvements, as well as efficiency gains and cost savings, could be achieved

when RPA was implemented. Typical obstacles were of a technical nature (lack of infrastructure and personnel), unsuitable organizational conditions (lack of support at management level, expectations that were too high, lack of financial resources) and regulations that hindered the targeted use of RPA. Due to the restriction to purchase and supply management, and the mixture of private and public sector, generalizations for the public sector are only possible to a limited extent. Juell-Skielse et al. (2022) show that a number of benefits can be realized in the public sector through RPA use. Time and cost savings, improved working conditions and service quality, and increased data quality are named. In public institutions, the attention for RPA is therefore high, but the actual usage is comparatively low. At the same time, there are significant differences depending on the organization, i.e., between city, country & state levels. However, these findings are limited to the public sector in Sweden, a generalization to other European countries is not possible without restrictions. The low uptake of RPA may also be due to difficulties associated with implementation. Lindgren et al. (2022) write that a lack of grassroots involvement and too strong a top-down approach, too little process and IT expertise, too much reliance on external consultants, and difficulties in process selection in municipalities slow down RPA use. Here too, however, the findings are limited to the Swedish public sector, which is why generalizations to the German-speaking world are only possible to a limited extent.

Overall, there are already some research approaches, but only limited findings, especially concerning the German-speaking public sector. Therefore, this study tries to take a first holistic look at the situation and potential of RPA in the public sector in Austria and Germany.

2. Motivation & Research Questions

As already explained, digitization is currently a major task for the German and Austrian public sector. RPA is viewed by some authors as one of the most important technological innovations at the moment and is expected to play a very present role in the coming years (Sobczak 2021). Since it is already being used in some public sector organizations and is expected to become more prevalent in the near future, an expansion of knowledge is essential. Due to the fact that research on RPA in general is still in an early phase and that there is only scarce knowledge available in the German-speaking countries, especially with regard to the public sector, an

analysis of the potential for RPA in the public sector was carried out within the scope of this work and the existing knowledge was structured in order to provide indications for further research.

Based on the experiences of PSO representatives, exploratory research was conducted into the areas of public administration in which RPA can be applied, whether it is recommended to use RPA, how the processes to be automated are selected, and how the automation is implemented. The aim was to highlight the potential of RPA for public administration, how it can best be used, and what improvements and benefits can be derived from it. In addition, the study aimed to shed light on the special features of public administration with regard to RPA and to identify problems, resistance or limits to RPA here. Overall, the study also had the goal of gaining the most holistic knowledge possible and highlighting the areas in which there is a need for further research and how public administration can benefit most from the use of RPA.

3. Methods

3.1. Research Approach

A qualitative research design was chosen to address the early stage of research on RPA in the public sector in Germany and Austria and to enable explorative findings. Semi-structured expert interviews were conducted to answer the research questions described above, as well as to obtain more in-depth, including subjective, views of the interviewees and to identify further possible starting points for more detailed research. In the context of the existing research question, the open data format, which qualitative research holds, is an argument for this research approach. Hereby, an increased gain of knowledge can be achieved in this comparatively new research field. In contrast to quantitative research, which uses questionnaires, for example, the open approach leaves more room for new insights, since the response options are not restricted from the outset and are not fixed to a particular format (Meyer et al. 2012).

3.2.Semi-Structured Expert Interviews

Data collection was carried out by means of semi-structured, guideline-based expert interviews. The interviews were based on a previously prepared interview guideline. This guide contained topic blocks or categories, each of which in turn contained questions and follow-up questions. Semi-structured interviews are characterized by the fact that the content and sequence of questions are predetermined, but not the form of answers as in the standardized interview (Loosen 2016). In this form of interview, the focus is on the interviewee being able to talk freely and yet a structure frames the interview and steers it in the right direction. If necessary, more depth in the answers can be achieved by specific follow-up questions from the interviewer. Thus, the guideline serves as a basic framework for the interview to follow, while at the same time leaving enough freedom for the interviewee to gain as much insight as possible (Loosen 2016). Expert interviews represent a special form of the guided interview. Here, the interviewee is interviewed not so much as a person, but in his or her role as an expert for the field of action in question. Expert interviews refer to a specific section of reality in which the interviewee acts as a representative of a group of people. Here, the guide additionally assumes a controlling role in which it is intended to exclude irrelevant topics (Mayer 2013).

3.3.Interview Guide and Execution

Four categories were used as the basis for the interview guide: RPA benefits and advantages, process selection, resistance to RPA, and special rules and legal conditions for RPA in the public sector. Within each question category, there were a few questions about the category concerned, as well as follow-up questions if the particular question was not adequately answered. Two interview guides were prepared. One guide was formulated to address individuals who already had experience implementing RPA and one guide was formulated to address individuals who had expertise but had not yet been involved in using or implementing RPA. Interviewees were first informed of the purpose of the study, briefed on the framework, and informed of their rights. They were then advised that the recording would now begin, and the interview started. Before the actual questions, the participants were asked about their organization, the position they hold within the organization, and their previous points of

contact with RPA, and the appropriate interview guide was selected for further questioning. As the interview progressed, the questions from the interview guide were asked, followed up as needed, and the questions were adjusted depending on the situation. The order of the questions was flexibly adapted to the answers, if necessary, for example, if an interviewee had already answered a certain subsequent question earlier. At the end of the interview, participants were informed that the interview was now over, and the recording would be stopped. Participants were informed that any recordings would be deleted after the interviews were transcribed. Furthermore, participants were given the opportunity to ask questions about the interview or contact the interviewer with concerns afterward. Interviews were conducted between May and August 2022. The interviews were all conducted online using Webex or MS Teams and audio recordings were made in the process.

3.4.Sample

The interviews were conducted with individuals who had varying degrees of knowledge about RPA. All interviewees had work relations to PSO, either as direct members or as employees of digital service providers for PSO. A more detailed list of interviewees is provided in Table 1. All interviewees had in-depth knowledge of RPA. All but one of the interviewees had an administrative or managing role in a PSO; for this person, the public sector specifics category was not asked. The participants were all from Germany or Austria. There were six men and one woman interviewed. The interviews lasted between 18 and 40 minutes. The interview partners were acquired through different channels. On the one hand, contacts were established through the employer of the author of the paper on the other hand, contacts were arranged through the supervising professor of the paper. In addition, the author of the paper contacted several representatives of PSO, some of whom agreed to participate in the study.

3.5. Analysis

The interviews were transcribed using the transcription software f4x. All transcripts were then manually checked and incorrect transcripts were corrected. All information, such as names, organizations, cities or other mentions, which would have allowed conclusions to be drawn about the interview partners, were anonymized (for example, Cologne by city). Filler words

(hm/ehm etc.) and repeated words were removed from the transcripts for the sake of better readability, as they had no relevance for interpretation or understanding. Emotions ("laughs") were not included in the transcript.

Table 1

Sample description

Position	Organization	Prior expierience with RPA	Category
Head of IT	Federal State in Austria	Yes	State agency
Product Owner RPA	Service provider german city	Yes	City agency
IT Project Manager	German Retirement Inscurance	No	Inscurance
Consultant for new technologies	German city	Yes	City agency
Head of IT	Austrian City	Yes	City agency
RPA researcher	Austrian University	no	Universities
Digital Service Provider	Austrian City	yes	City Agency

3.6.Content Analysis after Mayring with MAXQDA

The data were subsequently subjected to a structuring content analysis according to Mayring (Mayring and Fenzl 2019), which was conducted using MAXQDA software. MAXQDA is a qualitative data analysis software that assists in reducing, coding, and categorizing (VERBI software, 2020). The goal of the analysis was to code the content of the interviews and assign categories according to a predetermined category system. For this purpose, a category system was developed that would enable the results of the survey to be clearly presented and thus answer the research questions. This involved first defining the categories, enriching them with

anchor examples, and finally drawing clear dividing lines between the individual categories (Mayring 1994). The following six general categories were formed, each of which had a number of subcategories assigned to it: applications of RPA, reasons for RPA, reasons against RPA, public sector peculiarities, quality assurance and process selection. The entire category system is shown in Table 2. In accordance with Mayring's (1994) specifications, the coding guide was subjected to critical revision during the categorization process.

3.7.Categories

The category applications of RPA includes all statements in which potential or actual fields of application of RPA were mentioned by the interview partners. Subcategories here were clerical tasks, interface replacement, searching tool, interim solution, test automation and digitization of paper processes.

„Exactly, so now I would have actually related it to simpler tasks, respectively mainly for standardized things.“ (3, Pos. 5)

The category reasons for RPA includes all statements that positively evaluate the use of RPA, giving reasons why the use of RPA or RPA per se is seen as positive, useful or purposeful for the respective use-case. Subcategories in this category were workload reduction, compensation for staff shortages, quantitative improvements, cost advantages, qualitative improvements, capacities for more demanding tasks and simplicity of use.

„I would also hope that this would make us faster. By RPA, I mean that a computer completes certain steps much faster than a human being.“ (2, Pos. 9)

The category reasons against RPA represents the counterpart of category two and includes those statements that evaluate the use of RPA or RPA per se negatively and thereby include reasons for this evaluation. Subcategories were internal resistance, high expenditure, insufficient capabilities, lack of quality, data/IT-security, lack of use cases and diffusion of responsibilities.

„And I believe that this must not get out of hand, that people now think RPA is a panacea. We no longer need to optimize processes, we simply use bots everywhere.“ (6, Pos. 15)

The public sector peculiarities category includes all statements, that highlight the areas, in which the use of RPA in the public sector differs from that in the private sector. This includes not only the application itself, but a holistic view including all upstream and downstream processes that differ with the use of RPA in a public sector organization. Subcategories of the public sector peculiarities category were security/data, implementation, application, and product choice.

„It's sometimes not so easy to explain personal opinions or, especially with new technologies, the benefits to other parts of the administration, I'll say." (2, Pos. 15)

The quality assurance category refers to those statements, that explain how it is checked or ensured that, on the one hand, the objectives that accompanied the use of RPA were fulfilled and, on the other hand, the work of RPA is satisfactory in terms of its quality. Here the category measurands with the subcategories accuracy, rentability, output amount, need for correction as well as the category approach with the subcategories measuring output/time und controlling the output for errors were used.

„So I could imagine the quality assurance like this: I then look at the target data; do I have any outliers or unexpected values in here.“ (4 Pos. 48)

The Process Selection category includes all statements that explain how to select the processes that will be automated using RPA. For process selection, a distinction was made between parties involved with the subcategories customers, IT, department, provider, and organization, and criteria with the subcategories technical suitability, regularity of execution, and rule-based process.

„So I could imagine the quality assurance like this: I then look at the target data; do I have any outliers or unexpected values in here.“ (4, Pos. 53)

4. Results

A total of 230 statements were categorized from the seven interviews into the six categories mentioned before. Results for each category are described in more detail in the following section. A quantification of the individual categories can be found in Table 2.

Table 2

Categories

Category	Additional Subcategory	Subcategory	Count	Total count
Applications of RPA		Clerical Tasks	14	41
		Interface Replacement	14	
		Searching Tool	4	
		Interim Solution	4	
		Test-Automation	3	
		Digitizing paper-based processes	2	
Reasons for RPA		Workload Reduction	8	38
		Compensation for Staff Shortage	7	
		Quantitative improvements	7	
		Cost advantage	7	
		Qualtitative improvements	4	
		Capacities for demanding tasks	3	
		Simplicity of use	2	
Reasons against RPA		Internal resistance	14	69
		High expenditure	13	
		Insufficient capabilities	12	
		Lack of quality	9	
		Data/IT-security	8	
		Lack of use cases	7	
		Diffusion of responsibilities	6	
Public Sector Particularities		Security/Data	*12*	*29*
		Implementation	*6*	
		Application	*6*	
		Product choice	*5*	
Quality Assurcance	Measurand	Accuracy	6	19
		Rentability	5	
		Output amount	3	
		Need for correction	2	
	Approach	Measuring Output/Time	2	3
		Controlling the output	1	
Process selection	Parties involved	Department	6	15
		Organization-wide	4	
		IT	3	
		Customers	1	
		Provider	1	
	Criteria	Regularity of exectution	6	1
		Rule-based process	6	
		Technical suitability	4	

4.1.Applications of RPA

Potential for using RPA existed in a number of different application areas. In most cases, the goal was to replace humans in the execution of specific tasks. In addition, application opportunities were also seen, where RPA was intended to replace specific technology or software. In some cases, the goal of RPA use was to enable the results of comprehensive IT solutions in a straightforward and uncomplicated manner.

The automation of simple tasks was one of the main areas of application for RPA. There were a number of different tasks for which RPA was suitable, which had in common that they were undemanding, simple routine office tasks that did not require any intellectual input, decisions or creativity.

> *"So that would be the target picture that I would imagine, actually all the routine activities. Simply that they are eliminated." (3, Pos. 3).*

In addition to the automated execution of simple and less demanding tasks, which were a significant area of application for RPA, the possibility of automating certain parts of a larger task was also an approach for RPA use. The focus here was on a division of tasks in which employees only perform part of these tasks, and the undemanding part is performed by machines.

Examples of clerical tasks that typically require a high level of time but are generally low level were application processing, letter sorting, and checking certain fields on forms. There were a number of possible candidate processes here.

> *"[…] for example, we have the processing of applications […]" (3, Pos. 11)*

The routine nature of these tasks was a typical characteristic of activities that were considered suitable for automated execution.

> *„[…] relieve from routine tasks […]" (2, Pos 10.)*

Another form of routine activity, which differs from classic clerical tasks but is a rule-based activity, was the use of RPA as a searching tool. In this function, potential was seen for RPA in various kinds of searches: in supporting citizens who are looking for information on the websites of public institutions and cannot find their way around, and also as a searching tool

for route planning or as a general search assistant. Here, for example, it was a question of finding specific institutions or public facilities such as waste collection points on complexly structured websites.

> *"But if you enter something like that into an intelligent assistant, automated via RPA, then it finds the right disposal point, so to speak, with an automated link." (7, Pos. 11)*

Another possible use for RPA was test automation. Since tests often have a repetitive character and are strongly rule-driven, RPA-supported tests of in-house developments from PSO were a potential use case.

> *„[…] And the second example I would see more in the test area." (4, Pos. 4)*

The use of RPA as an interface replacement was another relevant application area of RPA. Data transfers, which are often still required in PSO from paper to IT systems, are generally labor-intensive and undemanding activities for which RPA can provide support. Here, the ability to network existing systems in an uncomplicated manner was of particular importance, as the use of RPA was seen as less demanding than the implementation of extensive interfaces or back-end solutions.

> *„From my point of view, I need RPA when I want to technically overcome existing systems or individual interfaces from existing systems. If I need to write something in from the left to the right screen, then I think it would be a candidate for RPA." (1, Pos. 17)*

In addition to the use of RPA as an interface for performative reasons and for substantial employee relief, potential was also seen for using RPA to bypass more comprehensive and costly technical conversions and achieve similar effects with comparatively little effort.

> *„Ultimately, it was what also the expectation to quickly, quickly create interfaces between systems somehow in between, which otherwise actually, where otherwise a classic interface is not worthwhile." (2, Pos. 12)*

The potential of RPA to create an interim solution for certain problems was not limited to interfaces but was seen in general. If higher-quality back-end solutions could not be implemented for various reasons, RPA was a possible solution approach to conceal the existing problems, at least temporarily.

„We have fought these symptoms, or we have put a band-aid over the wound there now. Let's use RPA for a while now." (6, Pos. 10)

A fringe benefit of using RPA has been the digitization of paper processes through RPA.

„[…] be it to partially digitize paper-based processes […]" (5, Pos. 11)

Overall, there was a diverse range of uses for RPA in the public sector. The execution of simple standardized tasks, both in supporting employees and in supporting citizens in their role as a customer of the public administration were a main field of application for RPA. In addition, the possibility of using RPA as an interface - sometimes only transitionally - was mentioned several times and thus represents the second main aspect in the possible application areas.

4.2. Reasons for RPA

The reasons for RPA-use focused on the one hand, on employee relief, where there was potential for RPA for several reasons, and, on the other hand, on improved output, both qualitatively and quantitatively. This was also linked to hopes for cost savings through RPA.

The reduction of the high workload often faced by employees in public administration was a main argument for the use of RPA. By automating certain tasks, employees were to be systematically relieved of workload and generally given more time.

„[…] our main goal is to relieve the burden on time. Definitely, because we relieve the workload of the specialist departments there." (5, Pos 30)

Since PSO employees had already frequently reached their workload limits, RPA support for appropriate tasks was seen as a promising way to counteract their overload.

„[…]It's employees at their limits, so they'd love to see that go away." (3, Pos. 26)

Here, it was pointed out that employees burdened by an excessive workload were under additional pressure due to existing and worsening staff shortages. RPA could contribute to compensate a lack of staff. Since the already low staff resources would become even scarcer in the coming years due to demographic upheavals and an accompanying wave of retirements, PSO had to contend with drastically declining staff numbers in the medium term. It became

clear that RPA was not necessarily seen as a means to improve the situation, but as a necessity to prevent it from getting worse.

> *„[…] This does not mean replacement, but cushioning the upcoming wave of retirements with it." (7, Pos 18)*

The use of RPA should also help to compensate for the lack of qualified employees. The remaining employees would thus be given the opportunity to deal with more demanding tasks and create capacities for challenging work, as certain work would be eliminated.

> *"Like all cities in Germany, we have a shortage of skilled workers and a wave of retirements on the horizon. This means that the primary goal is to provide employees with time relief through the use of RPA." (5, Pos 11).*

Fears that RPA could make jobs obsolete and lead to employees being laid off were considered unfounded. In view of scarce capacities, employees should therefore not only be relieved of time, but their areas of responsibility should be qualitatively enriched so that more demanding and thus also more fulfilling activities can be performed. RPA should take over repetitive and boring tasks and allow employees to devote themselves to more valuable activities.

> *„Well, the hope would be to relieve someone who sits in front of a screen and makes the same clicking motion thousands of times every day, so to speak, and to give them more meaningful activities." (4, Pos. 8)*

In addition to reducing the workload of employees, RPA should help to improve employee output. In some statements, this referred to quantitative improvements being achieved and more work being able to be done in a given amount of time.

> *„I would also hope that this would make us faster. By RPA, I mean that a computer completes certain steps much faster than a human being." (3, Pos. 8)*

Another opportunity for quantitative improvement was seen compared to other technologies, as RPA was seen as a technology that is comparatively straightforward and quick to implement.

> *„[…] because RPA is faster to implement than other automation options." (6, Pos. 11)*

In addition to quantitative improvements, some of the interviewees also cited cost advantages as a reason for using RPA. Since some activities could be performed more quickly through automation and thus deliver more output or save on personnel costs, it was assumed that some tasks could be implemented more cost-effectively using RPA.

> *„[…] So I think it would pay off in certain use cases […]" (3, Pos. 15)*

However, it was also pointed out that RPA only pays off above a certain dimension, as the associated costs can only be offset by scaling.

> *„So, RPA is worthwhile when you scale it, because you also have infrastructure costs." (5, Pos. 30)*

In addition to quantitative improvements, qualitative improvements were an argument for RPA. The aim was that process execution with RPA is less error-prone than manual execution. Especially in the case of monotonous work such as data transfer, when RPA is used as an interface replacement, RPA was mentioned as a solution approach that can alleviate this problem.

> *„At the same time, we also expect RPA to improve data quality, especially at interfaces." (2, Pos. 11)*

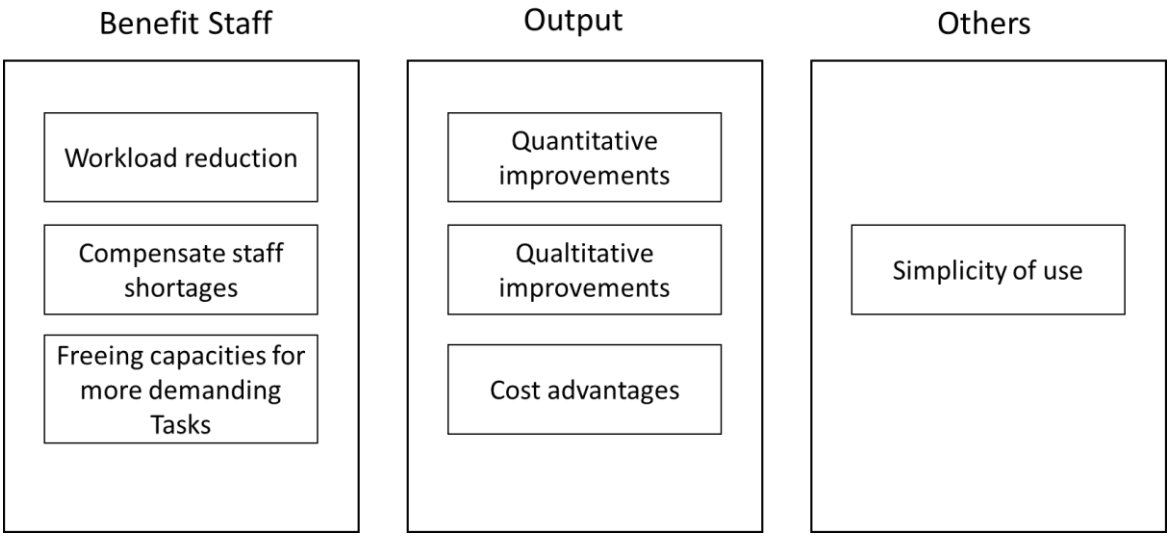
Finally, the simplicity to use and the possibility to easily implement RPA was a reason for RPA. Since usually no major programming efforts are required and work is done in the front-end, comparable results could be achieved with less effort.

> *„It's probably easier, too. Often these third-party providers have simple platforms where I can train myself with drag-and-drop bots. And then even employees who don't have any programming experience can do that." (6, Pos. 11)*

In summary, it can be stated that the main reason for using RPA was to reduce the workload of the employees. In addition, when used correctly, RPA could lead to performance improvements on the one hand and, on the other, improved results were hoped for in some cases. As seen in figure 4, the main reasons for RPA were of some kind relevant to either benefit the employees or to improve the output.

Figure 4:

Reasons for RPA



4.3.Reasons against RPA

A number of different arguments were made against the use of RPA. Overall, arguments against RPA were more frequent than arguments in favor of it. The reasons against the use of RPA were partly organizational, such as internal resistance, regulations whose compliance could no longer be guaranteed when using RPA or lack of clarification of responsibilities, and on the other hand technical, such as doubts about the quality of RPA, as shown in figure 5.

In many organizations, internal resistance made the implementation and use of RPA immensely difficult. The reasons for this varied. In some cases, organizational structures, which make the introduction of technical innovations or automation tools in general difficult, were the main problem. Responsible persons who opposed the introduction of RPA were a problem in some PSO.

„So, we also already have staff councils that simply reject this on principle." (2, Pos 29)

In addition, employees and works councils often expressed fears that RPA could make jobs superfluous and that jobs would be cut as a consequence of RPA use. The name "Robotic" also gave rise to fears that people would be replaced.

„There is the works council, and you have to be very careful that you don't replace people with it [RPA].” (7, Pos. 18)

Reference was also made to the high effort and costs associated with RPA use and it was emphasized that these are regularly underestimated. The frequently conveyed impression that RPA implementations are completely unproblematic was countered. They represent more than the mere automation of a process and in many cases require a great deal of preparatory work, such as the remodeling of certain processes. In addition, they sometimes entailed major organizational changes. The maintenance effort for existing bots, as well as the adaptation of such bots to changing organizational conditions, were also mentioned.

„But RPA, at the point is more than just a bit of automation. RPA is an overall change in the process in many places in the company.” (1, Pos 49)

Furthermore, the capabilities of RPA were seen as too limited in some aspects, and therefore use was not considered. The high expectations placed on RPA which were present sometimes would be disappointed in some cases and RPA was by no means to be seen as a universal remedy. It was mentioned that RPA would only automate processes and that expectations beyond this, such as process improvements, would generally not be met. Moreover, with basic RPA equipment, the automation potential was limited to rudimentary processes. In addition, when it came to interface replacement, for example, there were already technical solutions that went far beyond the capabilities of RPA, making its use unnecessary if the corresponding budgets were available.

„And I believe that this must not get out of hand, that people now think RPA is a panacea. We no longer need to optimize processes; we simply use bots everywhere.” (6, Pos 14)

A similar reason for rejecting RPA was the lack of existing use cases for which RPA could be considered. Some interviewees pointed out that they had no use for RPA in their organization, because they either work with other technologies or the cases for which RPA would have been applicable in principle were subject to rules that were difficult to comply with using RPA and therefore refrained from using it. Here, for example, data transfers were mentioned that could either already be implemented with REST APIs or similar, or for which there were quality

requirements that, according to the interviewees, did not allow them to be executed by unattended bots, as a manual quality check would have to be performed.

> *„If you connect the processes directly with each other on the data side and link them via JSON files, REST APIs and other technologies that are available. Then the potential for use cases for process automation is limited." (1, Pos 6)*

In some cases, there were doubts that RPA could deliver high-quality results, and feared quality deficiencies were cited as a reason against RPA. In particular, the issue of data quality and integrity was a problem for some interview partners. In some cases, there was no confidence in RPA tools. Furthermore, it was criticized that robots, if given the wrong commands, generated large amounts of erroneous data in a short time. Manual data quality checks were seen as the only way to ensure data integrity, which in turn would make the use of RPA obsolete, since the data transfer could be performed directly manually here.

> *„But I already have the problem of the integrity of the data. So that would be the only thing that I would have noticed. If no one looks over it anymore, we humans can also make mistakes, the danger of this is that a robot could then quickly produce a lot of incorrect data." (4, Pos 37)*

Another point that argued against the use of RPA was strict data protection regulations or compliance which could not be guaranteed when using RPA. On the one hand, cloud-based services, which were considered superior to on-premise solutions, were seen as problematic. Here, it was often not possible to ensure that citizen data was processed within the EU, which was a problem for PSO due to the GDPR. On the other hand, these regulations often resulted in cumbersome and lengthy procedures involving the respective data protection officers in the organizations. This was aggravated by the fact that there were different progressions in the approval procedures depending on the technology and automation affinity of the responsible persons, which made it difficult to plan RPA projects.

> *„As with the staff councils, it's always a bit of good luck who the data protection officer is and how IT-savvy he is and what kind of attitude he has toward RPA and what he might already know about it. We have simply not been able to get one or the other process through." (2, Pos. 34)*

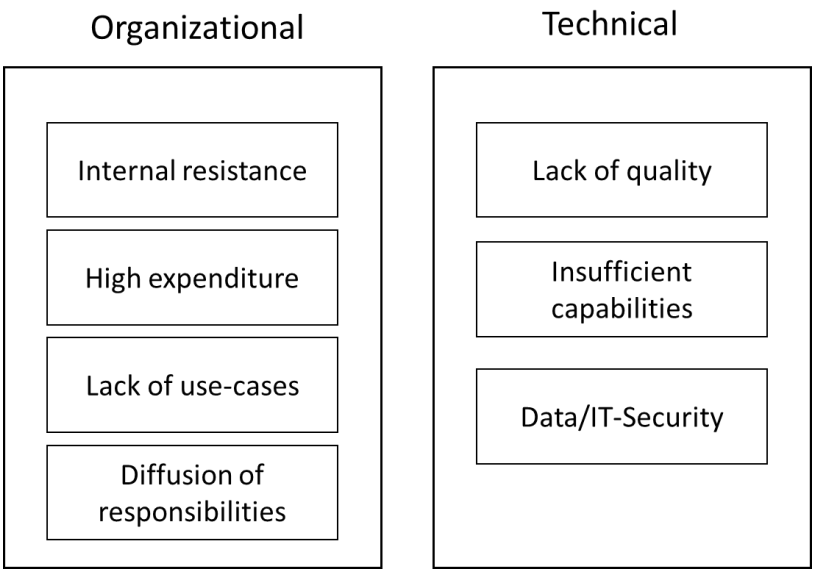
In addition, an organizational factor cited against RPA use was that clearly defined responsibilities were often required in PSO, which could not be implemented with RPA and thus responsibility diffusion existed. For example, if certain applications required final approval, this could not be executed by an unattended bot. There was also criticism of the issuance of certain notices, as these were generally not allowed to be issued in an automated manner. Shifting responsibility to the RPA tool programmer was seen as unworkable, so the diffusion of responsibility that comes with RPA use was cited as an argument against RPA.

> *„But there is always someone who does it manually, that is, who once again, sees the notice at the end, reads it through and then clicks on "Approve". I honestly don't find anything that is so irrelevant that it can happen unattended. (4, Pos. 19)*

In summary, the arguments against RPA were often stronger than those in favor of it, mainly due to organizational realities in PSO but also due to a lack of confidence in the technology itself.

Figure 5:

Reasons against RPA



4.4. Public Sector Peculiarities

The special conditions of the public sector with regard to RPA use included regulations for the application itself, which often related to data protection and security issues. But also, the

product selection and the implementation of RPA is partly different in PSO than in private sector organizations.

Security concerns regarding data protection were one of the main aspects in which PSO differed from other organizations. PSO often process sensitive, personal data, such as occurs in asylum procedures or public health topics and are subject to special protection. Concerns about the misuse of data were prevalent in PSO and required particularly careful handling, especially in institutions such as the police, which necessitated far-reaching security measures and the corresponding infrastructure. Regardless of applicable rules, a mentality of overcaution also prevailed in PSO in some places, limiting the use of RPA. Complicated regulations, which were not always fully understood by those in charge, led to RPA projects that were actually compliant with the rules being rejected from the outset out of concern that data protection rules would be violated.

> *„We have the topic of data protection, which must be observed. We have the topic of information security, which must be observed, and the regulations that are relevant to the basic infrastructure setup." (5, Pos. 53 – 54).*

The product selection was subject to special rules regardless of what products were purchased by PSO, since above a certain price limit every purchased service had to be put out to EU-wide tender. This also applies to software and RPA products. The effort involved slowed down RPA projects in PSO. In some cases, such tenders had to be repeated at regular intervals, which severely hampered operational performance. In some cases, cost effectiveness analyses were also necessary in advance, which represented a considerable additional effort for those involved if these had to be set up individually for each bot that was working.

> *„Before that, of course, due to the fact that we are in public administration, tender and all that kind of thing is relatively large." (2, Pos 6.)*

The introduction of RPA was also governed by special rules that were not always conducive to the use of RPA. Some of the prevailing rules required approvals at a micro level, which significantly slowed down the introduction of RPA. In some cases, individual bots had to go through approval processes and justify RPA use on a case-by-case basis. In other cases, RPA implementations were hindered by the need for a legal basis for each step that was automated, which often did not exist. Finally, the personal views of those in positions of

responsibility had a strong influence on whether and how RPA was implemented, which meant that no objective implementation process could be guaranteed.

> *„The current situation in XY is that for every robot we develop, we have to obtain a "go" from a staff council in every authority." (2, Pos 29)*

The application of RPA was subject to additional regulations. Here, the aforementioned problem with cloud use hindered technically possible optimizations. The fact that certain bots required an account also led to problems. On the one hand, this was due to regulations on regular password changes, which had to be implemented for each bot, and on the other hand, because there was internal resistance to giving accounts to bots. The rule "data only once", according to which the data query against citizens could only be carried out once, made use difficult in part because it had to be ensured that other systems also had access to this data after the initial query. There were also concerns that it had to be clearly ensured by law that certain work was carried out by robots.

> *„Sometimes there are minor differences in the implementation, when you no longer have the human being on the screen, but the technical user on the screen, where you can then decide in individual cases whether to access data differently because it's faster. So he pulls a file from somewhere, from a program, because it works, and doesn't work via the user interface, but of course does the same thing in terms of content. (5, Pos. 56).*

Thus, there were a number of dimensions in which RPA use in PSOs differed from that in the private sector. In most cases, the characteristics were such that they tended to make use more difficult.

4.5. Quality Assurance

In order to check whether satisfactory results were delivered or for quality assurance purposes, on the one hand the metrics were asked, which are used to determine whether the delivered results meet the expectations, and on the other hand the procedure.

Among the metrics, the output quantity and, related to this, the profitability of RPA use were mentioned. Additionally, the correctness of the delivered results and the extent to which corrective actions were necessary, were relevant factors.

The main metric for quality assurance in the strict sense of the term was accuracy, i.e., how many defects RPA produced.

> *„Then regarding metrics quality assurance maybe also errors that the bots have, so looking at the number of errors." (6, Pos 20)*

Furthermore, the number of times the output or work of the RPA tool needed to be corrected was cited as a metric by which quality was judged.

> *„ We also look at where we can further improve the robot? For example, in which cases does it hang up or is unable to process variations?" (2, Pos 21)*

Output quantity was also an important metric, and related to that, how profitable it is to use RPA, or how much better the performance is, compared to that of a human.

> *„[…] is that also our biggest and most important metric, that we evaluate beforehand how many runs there are in a year? How long does a run take?" (3, Pos 25).*

Hardly any information was given on the procedure, but manual determination of the number of defects or manual time measurement during the process run was an approach here.

> *„It was also qualitatively checked whether the results, but that, of course, from the human side." (7, Pos 25)*

In summary, it can be stated that the quality assurance process was oriented towards correctness and quantity, but that no systematic procedures were discernible for checking these parameters.

4.6. Process Selection

The process selection category was divided into two subcategories. One of the subcategories, "people involved", refers to which persons, departments or institutions within the PSO are involved in the selection of processes. The other subcategory "criteria" refers to the

characteristics of processes according to which it is judged whether a process is suitable for RPA or not.

4.6.1. Parties Involved

There were no uniform standards across the organization for the persons and departments involved in process selection. In many cases, the respective department was involved in the process selection. Here it became apparent that a pronounced involvement of the respective department concerned was considered important. Since these employees usually have the best knowledge of the existing processes, they were seen as an important source of information in process selection.

> *„Talking to the employees in the respective departments, what ideas would you have, and then already checking is this process really suitable now, is it profitable?" (6, Pos. 26)*

In addition, the IT department was also a group to be included, as expertise from a technical perspective was available here and the criteria such as feasibility could be better assessed.

> *„As an IT service provider, we are also consulted. That's where our opinion comes in." (2, Pos. 43)*

In individual cases, suppliers of RPA products and customers were also included in the process selection.

4.6.2. Process Criteria

The selection of processes to be automated was guided by various criteria. With regard to the profitability of using RPA, it was important that the regularity of execution of the processes to be automated was a process characteristic. For processes that are executed infrequently, RPA was viewed critically because it does not scale.

> *„It is once the economic efficiency, so how often does the process run through?" (2, Pos. 43)*

Furthermore, processes were suitable for RPA if they had a high degree of standardization and were subject to clearly defined rules.

> *„So, we basically check according to the criteria that it should be a manual process that also occurs frequently and is rule-based." (5, Pos. 32)*

In addition, the technical feasibility of process automation was a criterion for process selection. This relatively general formulation was in some organizations the only requirement for process selection.

> *„Plus, then of course the technical suitability to implement this process with RPA." (2, Pos. 43)*

In total, the criteria for processes to be automated were rather vague. There was no clear strategy or approach to be recognized.

5. Discussion

This study investigated the potential for the use of RPA in public administration in German-speaking countries. For this purpose, seven expert interviews were conducted with representatives of various public institutions between May and August 2022, and they were asked about their assessment of RPA use. The aim was to shed light on the areas in which RPA can be used, how RPA use is assessed, what special aspects need to be taken into account with regard to RPA in the public sector, and what the procedure looks like in terms of quality assurance and process selection.

It is important to note that the interviewees and their respective organizations were at different stages regarding RPA use. While some organizations had been using RPA for a number of years, other organizations were just beginning or had not yet considered the use of RPA in their organization in any detail.

Overall, the results suggested that there are a number of different application possibilities for RPA, in which the public sector hardly differs from the ones described in the literature, which mainly refers to the private sector. Here, the adoption of simple, low-demand, and routine office tasks, the use of RPA in data transfer in the sense of an interface, and test automation were possible or actual uses of RPA, confirming proposed use-cases by Houy et al., (2019),

who saw data-integration, -transformation and -transfer as major application areas of RPA in PSO. In addition, RPA was seen as a simple, transitional approach to solving certain problems that would otherwise require more extensive measures, which was also proposed in previous studies (Ranerup et al., 2020). The use of RPA as a decision support tool for simple decisions, as suggested (Houy et al., 2019; Ranerup et al. 2020), received a rather subordinate consideration.

The use of RPA was motivated by the fact that there is a severe shortage of personnel in the public sector, which will likely become even more pressing in the coming years. Faster, more efficient, and thus more cost-effective execution of certain jobs also spoke in favor of using RPA. Problematic were the reservations about technical innovations, some of which were still prevalent, and the associated fear that RPA would make certain jobs obsolete and thus ultimately lead to job losses. There were also reservations about whether the capabilities of RPA were sufficient, whether there were enough areas of application, and about data protection issues. Particularly regarding security and data protection issues, the public sector faced special challenges, as it is usually subject to comparatively strict rules.

Differences were also apparent in the area of product selection and implementation due to the special rules for tenders in the public sector, which made the use of RPA more difficult, although these were not always limited to RPA but also applied to other IT projects. To check the RPA output and for quality assurance, quantitative measures were used on the one hand, whereby it was checked which workload could be handled by RPA and which cost advantages resulted from it, and qualitative measures on the other hand, such as the number of errors in the output or the necessary manual corrections. In some cases, the entire organization was involved in the selection of suitable processes, as were the specialist departments in most cases. In addition, IT was consulted to check the feasibility of implementation, whereby different approaches were found in the respective organizations. Important criteria were that the processes to be automated were rule-based and executed frequently with a view to cost-effectiveness. In addition, technical feasibility was an important criterion for process selection.

Based on the insights gained from the interviews, hypotheses were formulated to summarize the findings, which are presented and justified below.

5.1.Hypothesis

5.1.1. Hypothesis 1

Robotic Process Automation can make a significant contribution to solving current problems and challenges in public administration.

In many organizations, there were problems with staff shortages. This led to a further increase in the already very high workload of employees. Due to the age structure within the organizations, a retirement wave was also imminent in numerous places, which would further exacerbate the already existing staff shortage. This problem is not limited to Germany and Austria but exists in most OECD countries with the situation in PSO usually being even more severe than in the private sector (Colley 2014), RPA offers the possibility to automate a large number of time-intensive, undemanding tasks and thus relieve staff, free up time for more valuable tasks and save costs (Mohamed et al. 2022). As a result, there is great potential for public administration in terms of RPA use. RPA has already been used in part to address this issue. A more efficient and resource-saving handling of business processes was seen as inevitable, which also included automation measures. As described earlier, efficiency improvements and cost savings, along with qualitative improvements in output, are seen as major benefits of RPA in the public sector, which was confirmed in this study (Flechsig et al, 2019). Through the increased use of process automation, the organizations hoped to be able to relieve their employees and to manage the existing tasks even against the background of declining resources or to be able to deploy employees for more demanding activities. This would in turn lead to improved service for citizens on the one hand and more positive working conditions on the other, as postulated by Juell-Skielse et al. (2022). At the same time, the challenge was pointed out that while RPA can replace simple work, it also requires a certain number of highly skilled personnel to do so. Indeed, RPA can help overcome staff shortages and lead to a saving of needed full-time equivalents (Wewerka and Reichert 2020) but goes hand in hand with an increased need for highly skilled labor (Fernandez and Aman 2018). The relief that can result from RPA use is generally limited to support processes or assistance in specific subareas of more complex processes (Mohamed et al. 2022), and especially for more demanding task areas, the use of RPA to mitigate staff shortages must also be viewed critically or at least recognize, that it only helps in certain cases. A purposeful use of RPA to ensure task execution should therefore take into account that personnel resources released for clerical

tasks do not automatically result in sufficient resources being freed up for more demanding activities, a difficulty already acknowledged by Lindgren et al. (2022), who pointed out the need for additional qualified employees or external consultants. Therefore, RPA cannot be seen as the sole solution for this, but merely as a supporting component for cushioning the personnel shortage, whereby further-reaching conversions, such as adapted recruiting measures and additional technical innovations, must also be implemented. Due to the comparatively low-effort implementation of RPA, the use of RPA as an interim solution for various purposes such as interfaces was seen as a promising application option in some organizations. Since the formulated goals for the digitization of the administration in the respective countries are very extensive and include a large number of changes (Federal Chancellery and Federal Ministry of Science 2016; German Federal Government 2014), the conversions associated with achieving the digitization goals adopted by the respective governments can be a major challenge for PSO (van der Voet et al. 2016). Here, too, RPA can play a supporting role. On the one hand, there were legal requirements whose implementation had to be ensured by certain deadlines. In cases where a comprehensive implementation of these requirements could not be ensured for various reasons, the use of RPA could at least create an interim solution and give PSO time to realize the objectives that had not been implemented before due to capacity constraints. RPA offered a way to deliver satisfactory results comparatively quickly and thus take pressure off the already overburdened organizations. Again, it must be caveated that RPA implementations still generate a certain amount of effort that should not be underestimated, which is why the time benefit is limited to those projects that would otherwise be very extensive. The organizations were aware that the implementation effort was not to be underestimated. In total, it can be summarized that RPA offers a broad range of approaches, where it can help PSO to tackle upcoming or already present problems with scarce personnel resources due to aging and high efforts linked to digitization. PSO in which RPA has not been used to date should consider the use of it, but should not limit themselves to RPA; rather, they should see RPA as one of several components that help address existing problems.

5.1.2. Hypothesis 2

Public Sector Organizations have a need to revise their process selection approach, to ensure an efficient and targeted RPA use.

It is undisputed that process selection is a major challenge for organizations that use RPA and not only PSO often find themselves in a challenging situation when it comes to automating the right processes (Leopold et al. 2018). In PSO, there was room for improvement in this regard. This confirmed the findings from other studies, according to which process selection was identified as a significant difficulty in the introduction of RPA (Houy et al., 2019; Lindgren et al., 2020). The organizations had different approaches and methods to process selection, with differences in the ways of proceeding as well as the criteria applied, on the one hand, and the parties involved, on the other. It was apparent here that the current approach in some organizations was not optimal, and that a more structured and well-founded methodology for selection could result in quality gains and increase the volume of automation. Overall, the requirements for RPA candidate processes were very vague. Rule-based processes, frequent process runs, and technical feasibility were the criteria for process selection, that were mentioned by the interviewees. However, these criteria did not go beyond the basic requirements for RPA use or did not meet them in their entirety and therefore made it clear that there was not yet a sufficient idea of the areas in which RPA could be used in a targeted manner. Other important factors from the literature such as execution time, stability, failure rate, and automation rate were not considered (Wanner et al., 2019). The non-consideration of crucial factors in process selection showed that the previous examination of this topic was deficient. This also created the risk that inadequate consideration of selection criteria would result in the automation of unsuitable processes, which could lead to insufficient exploitation of the RPA potential, increased costs, and possibly consequently also to RPA fatigue, thus jeopardizing the goal-oriented use of RPA. A positive aspect was the participation of different stakeholder groups in the process selection. In those organizations that were already actively using RPA, open formats in which different stakeholders could introduce possible RPA candidates were often available. Overall, a picture emerged in which the participation of different interest groups in the process selection was given and therefore neither a purely technical or IT view nor a purely process-related business view was too dominant. This aspect of process selection was to be evaluated positively, because thereby a wholistic automation approach became possible within the organizations and all departments could bring in candidate processes. In contrast, the selection criteria used to evaluate the proposed processes in terms of their suitability were inadequate. This meant that numerous process proposals could be received whose suitability was not sufficiently assessed. This finding

suggests that PSO need to revise their procedure for process selection. One possible process selection approach model is provided by Axmann & Harmoko (2022). This approach continues to provide for brainstorming and observations in process selection and therefore confirms the method that has been used in some PSO. In further process suitability testing, a benefit-value analysis is used to determine which of the brainstormed processes are the most suitable for RPA based on the selection criteria formulated by Wanner et al. (2019), cited above. Using this procedure model as an example, it can be illustrated that PSO can perform an improved process selection with comparatively little effort and thus significantly increase the benefits of RPA. The problem described in 1.2.2., according to which organizations are often faced with the task of determining their current degree of automation (Leopold et al. 2018), tends to be smaller in public administration organizations, as this is even more manageable due to the lower prevalence of RPA.

5.1.3. Hypothesis 3

The use of RPA in the public sector is hindered by organizational characteristics and existing rules.

It became clear in the study that RPA was seen in many ways as a useful technology for which there are enough use-cases and which can make a significant contribution to solving a number of problems in public administration. However, it also became apparent that the surrounding conditions in public administration hindered the use of RPA more than they encouraged it, which is already seen critically by Flechsig et al. (2019). Like the findings of Juell-Skielse et al. (2022), RPA has already received the appropriate attention, but is not yet as widespread as the stated benefits would suggest. In some organizations, the organizational structure was such that certain individuals held a relatively large amount of power and the decision to adopt some IT technologies depended heavily on their preferences. Personnel and works councils in particular, but also data protection officers, were often in critical positions and were able to play a decisive role in deciding whether RPA was used and to what extent. Participation on the part of management or the staff council has already been identified as an important factor for the success of IT projects in public administration (Ben Rehouma, 2020). Staff councils have many opportunities to influence IT projects across all project phases and therefore represent an important stakeholder group (Ben Rehouma et al. 2020). These findings are echoed by the statements made by some interviewees according to which staff councils who take a critical view of RPA are an obstacle. The dependence on the goodwill of these individuals, which was

present in some organizations, posed a problem, as it did not ensure an objective assessment of the situation and the possible potential of RPA use. Organizational restructuring would be required to ensure an implementation process that focused on professional criteria rather than personal opinions of individual decision makers. Since this problem is not limited to RPA, but to IT projects in general, changes here would be all the more necessary. Thereby, the lack of support from management described and criticized by Flechsig et al. (2019) was not confirmed, but the obstruction by key decision makers was.

Furthermore, data protection regulations in particular were an obstacle to the use of RPA. Data protection plays an important role in public administration due to the high volume of data requiring protection, such as sensitive personal data or data on critical infrastructure. Data leaks have particularly serious consequences for such data (Wu 2014). However, data protection regulations often posed a challenge in the use of RPA. For example, it was criticized that the use of cloud solutions, which are often superior to on-premise solutions (Rai et al. 2015), was practically excluded because data processing outside the EU was not allowed due to the GDPR. The required extensive involvement of data protection officers in the organizations, even in the automation of sub-processes, was also an obstacle to the introduction of RPA. In some cases, a lack of understanding of the data protection regulations to which organizations were subject was a reason why certain digitization initiatives, which included RPA, were not implemented without actual necessity. Responsible parties had rejected RPA out of fear of breaking data protection regulations, as they were not prepared to take the risk. Here, public administration confirmed the finding that the actual circumstances regarding data privacy often differ from the subjective perception of the situation. While many citizens are justifiably concerned about data privacy, they often lack an adequate understanding of it. There is frequently a discrepancy between subjective views on data privacy and actual technical as well as legal facts relating to data privacy (Pleger et al. 2021). This factor can also be an explanatory approach here as to why RPA initiatives have been blocked by those in positions of responsibility without necessity.

Another problem was that the organizations often did not provide for any technical user roles or that these were not compatible with a robot account. It was also seen as problematic here that when robots executed processes, it was unclear who would ultimately bear responsibility for the output.

When it came to product selection, the organizations were bound by fixed specifications on tendering procedures. In some cases, this slowed down automation projects, but overall, tendering procedures were not perceived as a complete hindrance, but rather as a slowing factor. More serious, however, was the fact that in some organizations tenders had to be repeated after a few years, meaning that established programs had to be renewed in some cases. The requirement to prepare a cost effectiveness analysis in advance also led to RPA being viewed critically, as this generated further effort, making it more difficult to use RPA economically. In fact, procurement in public administration is very complex and is seen as in need of reform. The existing structure is inefficient and complicated (Oertzen & Becker 2013). Therefore, revisions in procurement law are also needed for scalable RPA use.

The fact that legislation and regulations in public administration often lag behind technological progress in the context of digitization or are otherwise inadequate (Wu 2014) was also confirmed with regard to RPA use. Effective scalable use of RPA requires revisions that enable more straightforward use. Some of these were already being implemented in the organizations, but the extent of the adjustments was still too small for target-oriented RPA use. Overall, a picture emerged in which organizational conditions and rules were more of a problem for RPA use than poor technical infrastructure, which only partly confirmed prior studies that focused on both factors equally (Flechsig et al., 2019).

5.1.4. Hypothesis 4

There are doubts about the quality and capabilities of RPA, some of which are unfounded, that hinder the use of RPA

One of the arguments against RPA use was existing doubts about the quality of the output. In many cases, this related to data quality or integrity, especially when using RPA as an interface. Concerns existed about whether RPA would provide accurate data. Since large amounts of data would usually be processed, a high potential risk was seen that incorrect RPA use could result in a correspondingly large volume of errors. In part, RPA was seen as not a fully mature product, the use of which could lead to serious consequences due to the lack of data integrity. These views contradict findings that RPA can help improve data quality. In different contexts, it has been demonstrated that data quality improves with the use of RPA and that process output is almost always superior to that from manual processing (Radke et al. 2020; Chugh et

al. 2022). However, it is important to mention that concerns about systematic errors are not unwarranted. While RPA can almost certainly eliminate unsystematic errors such as those that occur due to carelessness, systematic errors that occur due to misconfiguration are still possible (Smeets et al. 2019). Extensive preparation and thorough planning can eliminate such errors, but in some cases, this has been seen as unviable.

At the same time, it became apparent that concerns about RPA use in the public sector tended to go in the wrong direction. While improved output quality through RPA occurred in most cases and error rates declined to varying degrees, expectations of faster process throughputs often turned out to be exaggerated and were present to a lesser extent than expected (Wewerka and Reichert 2020). The aspect of potentially erroneous data was also viewed critically in terms of costly quality assurance measures. Manual checking for correctness was a method of verifying that correct data had been produced that was very time-consuming. The need for human review of certain notices or expenditures in public administration meant that RPA use was seen as unprofitable.

In addition to concerns about quality deficiencies, there was also criticism that there was simply too little capability for RPA to generate significant added value by using it. On the one hand, there were technological possibilities that already went beyond the capabilities of RPA, and therefore made RPA obsolete in many cases. For another, no suitable task areas were seen for RPA. However, since RPA is seen as operational across industries (Smeets et al. 2019), this argument should also be critically questioned.

5.2.Implications

Robotic Process Automation can help public sector organizations to reduce existing problems such as workforce obsolescence or excessive workloads, while improving performance through faster processing times and higher quality or more accurate results. Overall, the findings revealed that RPA is already being used, but still on a comparatively small scale. Against the background of the upcoming waves of retirements in many organizations, the use of RPA in public administration should currently be promoted in order to counteract acute problems in timely fashion. Since, contrary to the assumption that RPA implementations can always be implemented quickly and without problems, a certain amount of effort is to be

expected, and since public administration organizations hinder implementation due to their structure and existing regulations, a thorough examination of the topic should not be delayed any further. To enable efficient use, the process selection procedure should also be revised, and a more structured and informed approach taken. In general, public administration is characterized by a set of rules that hinders the use of RPA. Therefore, rule adjustments, some of which are already being implemented, should be intensified. Organizational structures, in particular, in which individual decision-makers without pronounced IT expertise can stop the expansion of the digital infrastructure, must be questioned. This is not to say that data protection rules and other regulations should be sacrificed entirely to technological progress, but adjustments must also be made with regard to other IT projects so as not to slow down digital progress too much. Procedures for introducing new technologies should be reconsidered and simplified where possible.

The skepticism towards RPA that exists in parts of public administration is often unfounded in its manifestation, since it is primarily the quality of the RPA output that is doubted, while unrealistic expectations are placed on the output quantity. It would be necessary for those in positions of responsibility to take a closer look at the subject of RPA in order to draw up a realistic picture of expectations that can also proactively counter any disappointments that may arise and thereby dispel unfounded skepticism. Further research should address the question, which benefits can be achieved in the public sector by using RPA and take an approach, that allows the quantification of such benefits.

5.3.Practical Contributions

Organizations considering the introduction of RPA can usually look forward to numerous improvements. However, several factors must be taken into account during implementation, which are indispensable for purposeful use. In terms of implementation, process selection plays a crucial role. For RPA to achieve the desired benefits, the right processes must be selected. Since rather vague criteria have so far been considered in the selection process, it is advisable to make greater use of the interdisciplinary approach that is already widespread in some cases and involves IT and process experts as well as the people directly affected in the departments. An empirically based definition of the criteria for process selection should be

strived for and should replace the rather intuitive criteria used to date. To be able to counteract internal resistance at an early stage, which can arise from organizational structures and rules, and which can be forced by individual decision-makers, the objectives pursued, and benefits sought should be clearly defined. Even before any implementation initiatives, these should be communicated within the organizations, along with clarification of certain myths (e.g., loss of jobs). This must also be accompanied by a firm definition of the metrics applied when reviewing the achievement of objectives, in order to create a basis of argumentation for further implementations. Overall, the public sector must make organizational adjustments in many areas to keep pace with technical innovations.

5.4.Limitations

The limitations of the present work should also be discussed. First of all, it must be acknowledged that the results are limited to public administration in Germany and Austria only, as all interview partners came from these countries. Another limitation lies in the sample and the selection of the interview partners. As already described, a convenience sampling approach was conducted, in which the interview partners were either acquired through the mediation of the employer or the author's supervisor or were requested by e-mail whether there was a willingness to participate in the study. Some of the interviewees responded that they would not be able to participate in the study because the topic of RPA had not yet played a role within their organization. Ultimately, this led to the situation that mainly representatives of administrations, which are comparatively innovative, participated in the study. Furthermore, all participants were representatives of relatively large organizations. Therefore, the extent to which RPA can be used in smaller organizations and the potential in organizations where new technologies are implemented more slowly can only be assessed to a limited extent. Although it is customary in qualitative studies with expert interviews not to conduct randomized participant selection (Soest 2022), the generalizability of the results is nevertheless limited, due to the described selection bias.

Some of the interviewees had no direct experience with RPA in their organizations, so their assessment was partly limited to indirect knowledge. As was shown in other interviews with directly affected persons, their experiences partly differed from the information in the

literature. It must therefore be questioned here whether the assessments of the persons without direct experience were authentic and to what extent the opinions of third parties, with whom the interviewees were in exchange, influenced the views of the interviewees here.

Another significant limitation is the small number of interview partners. Since only seven experts were interviewed, it can be assumed that some aspects regarding the situation of RPA in the public sector were not considered. For example, no interviews were conducted with representatives of federal authorities or German state authorities. Schaefer & Alvesson (2020) emphasize the importance of representing a population within the sample in its entirety, as otherwise the strength of the findings is significantly weakened. With respect to the present study, it is likely that differences exist between the circumstances of different institutions. These have not been adequately appreciated in this study. Also, to obtain a coherent picture of institutions considered in this study, further interviews would be needed. Since the interviews revealed that there are considerable differences in practices between different city agencies already, the findings from the interviews cannot be seen as universally applicable to all PSO. The results only provide indications that serve as a basis for more in-depth research on RPA in the public sector. Further, all interviews were conducted by the author of the paper. Possible biases or tendencies caused by the interview style are therefore not ruled out.

6. Conclusion

This study investigated the potential for Robotic Process Automation in the public sector. More specifically, the questions what areas of application are possible, what speaks for and against RPA use, what the procedure for RPA use and control looks like, and what special features exist within the public sector. It became clear that RPA can help to solve current challenges in the public sector. The acute staff shortage PSO are suffering from, and which will intensify in the coming years as well as existing pressure for digitalization create the need in PSO to consider automation. Due to the comparatively simple implementation and numerous use cases, RPA offers a high potential to support PSO in solving existing problems. However, it must be taken into account that RPA alone cannot solve all problems but should always be seen as one of many components of a comprehensive solution strategy.

To ensure effective use, the process selection procedure should follow a clear methodology based on scientific findings. Currently, there is still room for improvement in this aspect, as the selection criteria for processes are inadequate in some cases. Furthermore, it became apparent that the structure and rules of PSO tend to hinder rather than promote the use of RPA. Cumbersome approval procedures and very high data protection requirements, as well as skepticism within the organizations and dependencies on individual managers, make widespread automation difficult. To use RPA in a targeted manner, PSO must be adapted more closely to new technologies, as this problem is not limited to RPA. Furthermore, there is sometimes great skepticism towards RPA, which is expressed in doubts about the quality, accuracy, and capabilities of RPA. The study thus showed that there is a high potential for RPA use and that there are promising opportunities to solve existing problems and challenges. Nevertheless, the use of RPA in PSO is difficult and encounters varying degrees of resistance.

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