

# Robotic Process Automation in Small Enterprises: An Investigation into Application Potential

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**Abstract.** Substantial application potential in enterprises is commonly attributed to Robotic Process Automation (RPA). This potential encompasses automation of routine tasks, improvement of data quality, improvement of process stability, or reduction of monotonous tasks. However, our observation from projects with enterprises is that this potential is visible in bigger companies, but not so obvious in small and medium-sized enterprises (SMEs). SMEs often show a lower readiness to invest time and resources in new technologies and, thus, hesitate to explore new technology applications unless they see a clear business case. This article investigates the application potential of RPA in SMEs by trying to identify typical application scenarios with potentially high benefits that SMEs should focus on. The application potential is primarily addressed from a qualitative perspective, i.e., the aim is not to quantify the potential but to qualify the application fields. The contributions of this article are (1) a structured literature review of the state of RPA use in SMEs, (2) RPA application scenarios visible in the literature and functionality of RPA platforms to support these scenarios, and (3) experiences from implementing three SME-focused use cases with off-the-shelf RPA tools and a concluding evaluation by experts.

**Keywords:** Robotic Process Automation, RPA, Small and Medium-Sized Enterprises, SME, Application Potential.

## 1 Introduction

The general trend of digitalization in industry and public authorities also is visible in small and medium-sized enterprises (SMEs). The increase of efficiency in all operational areas is gaining importance and contributes to the competitiveness SME. In this context, process automation is an important topic in the execution of IT-supported business processes in order to realize efficient as well as cost-effective business processes [1]. A frequent challenge to achieving automation is that

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legacy systems and stand-alone applications have to be integrated in process execution by realizing interfaces through which information can be exchanged between IT applications. However, the creation of interfaces or the reprogramming of applications leads to high IT costs, which means that automation often only makes sense for a few central business processes [2].

For business processes that cannot be economically automated with traditional automation technologies, the staff of a company has to complete the non-automatable tasks. To reduce the manually executed business processes and to enable increased automation in the enterprise, Robot Process Automation (RPA) technology can be used to complement traditional process automation. RPA technology automates structured and rule-based sub-processes of a business process by reproducing human actions on the user interface of an IT system through RPA software [3]. By interacting through the presentation layer of an IT system, automation with RPA can be achieved without extensive re-programming or interface development. There are many reports on RPA use in large companies active in the banking, finance and insurance sectors [4], but the number of studies in small and medium-sized companies (SMEs) is relatively low [5].

The potential of RPA for enterprises is undisputed and includes automation of routine tasks, improvement of data quality by elimination of manual entry, better work conditions for employees by reduction of monotonous tasks, and many more. However, our observation from projects with enterprises is that much of this potential is clearly visible in larger enterprises but not so obvious in small enterprises. SMEs often show a lower readiness to invest time and resources in new technologies. Thus, application fields requiring an investment, for example in APIs or training of human resources, are not exploited by SMEs. So, what is the real application potential of RPA in SMEs? Are there typical application scenarios with potentially high benefits that SMEs should focus on? How to introduce RPA without having extensive programming or IT-knowledge? This is the focus of this article. We will address the question of application potential primarily from a qualitative perspective, i.e., the aim is not to quantify the potential but to qualify the application fields.

The contributions of this article<sup>†</sup> are (1) a structured literature review of the state of RPA use in SME, (2) RPA application scenarios visible in the literature and functionality of RPA platforms to support these scenarios, and (3) experiences from implementing three SME-focused use cases with off-the-shelf RPA tools and a concluding evaluation by experts.

The article is structured as follows: Section 2 introduces the research methodology used in the article. Section 3 discusses the relevant background and related work. Section 4 identifies the functionality of RPA systems relevant for SMEs. Section 5 introduces RPA test cases composed of this functionality that are used for practical evaluation purposes of RPA tools for SMEs. Section 6 presents the results of expert interviews for evaluating practical relevance. Section 7 is dedicated to conclusions and future work.

## 2 Research Approach

The work presented in this article is part of a research project aimed at a decision framework for SMEs for selecting, configuring and introducing RPA solutions in the context of digitalization initiatives, i.e., what technological innovations based on RPA should be considered for what digitalization tasks in SMEs and in what organizational context? The work follows the paradigm of design science research [6]. This study concerns a step towards the explication of problems and elicitation of requirements for the envisioned design artefact, the RPA decision framework. The research method used is a combination of literature study, argumentative-deductive work, and expert interview.

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The literature study was conducted using methodical recommendations of Webster and Watson [7] and Kitchenham [8], i.e., it is a structured literature analysis. The intention is to investigate whether there is scientific work on RPA in SMEs and in which business areas RPA is applied. Furthermore, the literature analysis shall show in which concrete application scenarios RPA technology is used in SMEs. To find suitable studies, different keywords were identified and a query was created. The query can be divided into three sections, which, firstly, consists of the basic topic “Robotic Process Automation”; secondly, consists of various synonyms that cover use cases; and, thirdly, contains various terms to narrow down to small and medium enterprises. To find suitable studies in the literature analysis, the query was used in the digital databases “Scopus”, “IEEE Xplore Digital Library” and “AIS Electronic Library”. The results of the literature analysis showed that no relevant studies exist that match the query. Thus, a second search process was initiated to find studies regarding the application scenarios for small and medium-sized enterprises and the query was modified, which is shown in Table 1.

**Table 1.** Structure of the query

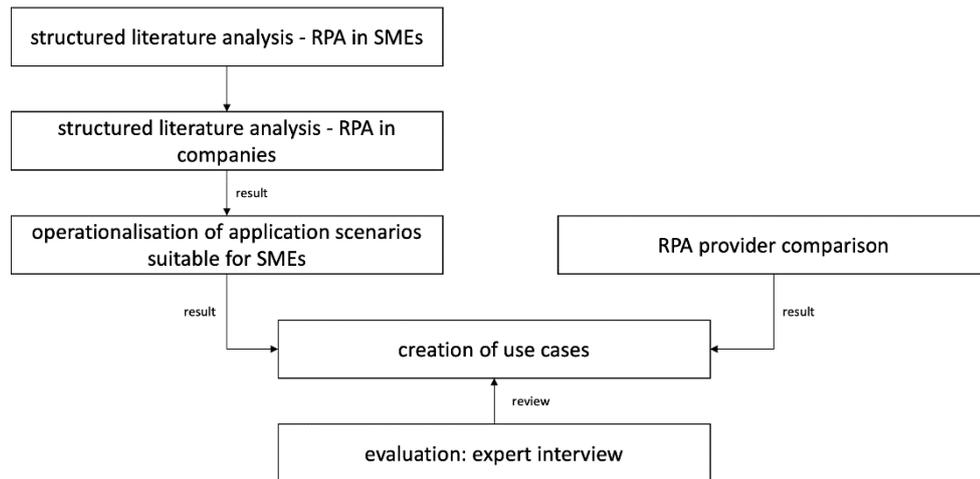
Theme	Keywords
Basic topic	Robotic Process Automation
Use cases	case study, example, framework, rollout, application

Compared to the first query, the basic topic and the application scenarios of the query remained, but the terms for small and medium-sized enterprises were removed. This resulted in a larger set of search result that also included large companies in the search and thus a possibility to find application scenarios that can also be transferred to small and medium-sized companies. The updated query was also used in the IEEE, Scopus, and AISEL databases. It turned out that, by searching in a larger search field, significantly more relevant results were found. In total 166 articles from the different databases were then evaluated with different inclusion and exclusion criteria. The following inclusion criteria were applied: a full text in English/German language, a description of an RPA application, a concrete RPA application which is described, and a lessons learned or experiences part available. The exclusion criteria included the following items: articles that report a general RPA implementation (application) but do not mention processes, RPA as a component of a program (cognitive-RPA/robotic process mining), and articles that do not focus primarily on RPA. The result of the literature analysis is presented in Section 3; it shows the current state of research on RPA in SMEs and the application scenarios observed.

In the next step of our research process, these application scenarios were operationalized in order to determine the basic functions of the scenarios, the implementation of which is carried out by RPA software (Section 4). The results of this step were applied in the following phase by combining the basic functions into self-constructed use cases. These were then implemented with an RPA tool and tested for their applicability for SMEs (Section 5). This is the argumentative-deductive part of our work. The selection of the RPA tool followed a comparison of RPA tool providers and tool features. This comparison is not in the scope of this article and is available in [9].

Finally, an expert interview was prepared for evaluation purposes. Supported by interview guidelines, the results of the individual phases were presented to the expert and the results were classified based on their practical relevance. The expert interview is covered in Section 6.

Figure 1 illustrates the steps of the research process.



**Figure 1.** Steps of the research process

### 3 Background and Related Work

#### 3.1 Robotic Process Automation

The term RPA draws its origin from the techniques of scripting, macros as well as screen scraping and has been used as a term since 2013 [10]. RPA serves as a collective term for software tools that operate on a computer user interface [11] and support humans in the execution of tasks or take over the execution of tasks completely [12]. The goal is to emulate repetitive human tasks with software that performs the same human transaction steps [13]. The emulating software is described as a script or bot, but the terms robot and software robot are also used in the literature [14].

The RPA software robot replaces a manual task performed by a human actor in a process. The RPA software uses the same user interface (presentation layer) as the human actor. Consequently, this automation solution does not require any profound changes to existing IT infrastructures, such as business application systems, which means that RPA can be described as a non-invasive technology [1]. An RPA robot follows standard rules to perform tasks [15] and consists of choreographed technological modules and control flow operators [16]. It should be noted that the interaction via the presentation layer is a defining feature of RPA compared to the other integration solutions, but some RPA providers can also interact with desktop applications via program interfaces [10].

RPA robots are suitable to replace a human actor when it comes to “swivel chair tasks”. These tasks take data from electronic inputs (email, spreadsheet), process it according to various rules, and finally transfer the data to a system or application. Consequently, swivel chair tasks are simple routine tasks that require little cognitive effort from an employee. By having an RPA robot take over swivel chair tasks, employees can focus on more difficult, non-routine tasks [15]. Thus, using a robot is recommended in processes involving simple repetitive, error-prone tasks [10] with a rule-based nature and structured data as input, for which employees are overqualified [17].

The basic architecture of RPA is always the same in the base but can differ in the naming of components or by additional components at the different RPA vendors. Three components form the basis, which includes the development environment, the RPA robots, and a monitoring and control component [2]. Developers can automate processes in a development environment and, as a result, create an RPA robot for the automated process, which is kept in a repository. This repository can be accessed by a monitoring and control component that is responsible for executing the created RPA robots. The monitoring and control component can automatically assign tasks to a robot, which is executed on a server without human assistance. These types of robots are called

“unattended robots”. Alternatively, there are “attended robots”, which are started by a user via the monitoring and control component and run on the user’s desktop computer [10].

RPA is mainly used in the literature as a synonym for unattended robots since a significant increase in efficiency is usually achieved with unattended robots rather than attended robots [17]. An unattended robot also allows to replace a human actor by its automation, whereas an attended robot rather supports a human [10]. Therefore, attended robots are considered by some researchers as a subcategory or separate from RPA. In this article, however, attended robots are considered as part of RPA, which is compatible with the given definition of RPA. In the course of the article, it will be discussed that attended robots are a more sensible use for small companies than unattended robots, which is why the term refers more to attended robots in this article.

Potential application areas for RPA are workflows and processes that are highly structured and contain little variance in the flow. Furthermore, the workflows should be executed very frequently. Thus, RPA offers a similar requirement profile for processes as BPM, but processes that would be too small for BPM can be automated due to the lower automation costs [10].

### **3.2 Literature Analysis on RPA in SME**

This subsection is intended to provide an overview of how the use of RPA in SMEs is considered in the scientific literature. The basis for this is a structured literature analysis, which follows the recommendations of Webster and Watson [7] and Kitchenham [8]. More information about the different steps of the analysis are available in Subsection 3.1. The structured literature analysis is intended to investigate whether there is scientific work on RPA in SMEs and in which business areas RPA is applied. Furthermore, the literature analysis shall show in which concrete application scenarios RPA technology is used at SMEs.

In total, 38 articles with 53 use cases were identified, among them 21 use cases that were considered as relevant to SMEs. The results of the structured literature search are presented in Table 2.

The structure of Table 2 is divided as follows. The reference for the respective article or white paper is stored in the column “Article”. The specific articles can be found in the bibliography. The column “Category” divides the different application scenarios into five different business areas. The last columns include “Concrete example”, “SME suitable”, and “RPA Software”. In the column “Concrete example”, the application scenarios are distinguished according to whether the scenario was described with exact and comprehensible process sections or whether it is a general description without concrete naming of process sections. Table 2 shows that concrete process sections are mentioned in only three of 21 articles. In the remaining articles, there is only a rough description of the application scenarios. The penultimate column “SME suitable”, evaluates the articles concerning their usefulness for use in SMEs. Here, 12 transferable scenarios could be identified and nine scenarios where a transfer is conceivable. The columns “Concrete example” and “SME suitable” were supplemented with green (applies), yellow (partially applies) and red (does not apply) colours for better visualisation. In the last column of the table, the RPA software is noted if it was mentioned in the articles. In the following section, the scenarios that are relevant for SMEs are highlighted.

## **4 Required Functionality of RPA Platforms**

This Section examines which functions the RPA software should fulfil in order to be used in the best possible way in SMEs. For this purpose, the use cases found in the literature analysis identified for small and medium-sized enterprises are used (see Table 2). It can be seen that the use cases with a concrete process description show many functions that an RPA software must provide. However, this only concerns three articles from the accounting category. The remaining 18 articles do not describe concrete processes, meaning only a few functions were identified for an RPA software. In order to also identify functions in other categories such as sales, controlling, and

human resources, an article by the Institute for Applied Work Science [4] and the book by Koch and Fedtke [32] were used to identify additional functions required for RPA software suitable for SMEs.

**Table 2.** Results of the structured literature review

Article	Category	Application scenario	Concrete example	SME suitable	RPA Software
[18]	Accounting	generation of a payment document to customers	✓	✓	X
[19]		invoice processing	✓	✓	UiPath Studio
[20]		automation of the confirmation process	✓	~	UiPath Studio
[21]		automatic correction of incorrect bookings	X	✓	X
[22]		create sales invoices	X	✓	X
[23]		posting journal entries	X	~	Redwood Software
[24]		validation of invoice data	X	~	Kryon Systems
[25]		preparation of tax returns	X	✓	X
[26]		verification of incoming supplier invoices	X	✓	X
[27]		payroll process	X	~	X
[21]		transfer of calculation data	X	✓	X
[17]		entries in the accounting system	X	✓	X
[28]		verification of double billing	X	✓	Claim Automation Engine
[24]	Distribution	verification and validation of customer return data	X	✓	Kryon Systems
[21]		processing of notices	X	✓	X
[29]		send a confirmation letter to the customer	X	~	Blue Prism Studio
[3]		updating the tax identification number	X	~	X
[30]	Controlling	automation of the standard cost comparison	X	✓	X
[17]		creation of quantitative reports	X	~	X
[31]	Personal	HR data transfer	X	~	Blue Prism Studio
[17]	Company	creation and validation of upload files	X	~	X

The identified functions from the structured literature analysis can be summarized in five upper categories. Table 3 shows which articles contain which functions. The upper categories include interaction with another system (CRM, ERP), interaction with a browser, interaction with an email client, handling data in a program or system, and mathematical calculations. The most important category with the most features is handling data in programs or systems. Six articles indicate that the RPA software needs to read data from an external document (PDF, Excel). In addition, matching data between programs or systems are relevant for five articles. Four articles expect a function to copy and paste data, and three articles each require the functions to change the data format through a conversion, send data to a predefined user, and have data monitored. Other functions mentioned include maintaining and downloading data, moving data to another folder, posting data, updating data, saving data to a system and detecting duplicates. The second category,

with four functions, is interaction with an email client. For this, an RPA software should provide functions to create as well as send an email and automatically open incoming emails and save any attachments contained in that email.

Another category with four functions is the interaction with other CRM or ERP systems. In five articles, RPA software is expected to automatically log on to a system with possibly encrypted credentials. Furthermore, four articles describe that status changes, bookings or closings should be made through the software. Other required functions include searching a system, pressing system buttons, and executing queries. In the category of interacting with a browser, three functions are required. These include logging into a web page, loading data from a web page or form, and searching as well as selecting on a web page. The last category is mathematical calculations such as determining the quantity or tax differences. In conclusion, the most common and therefore most important functions are extracting data from documents, matching data, copying and pasting data, and logging onto a system. These functions should definitely be present in an RPA software for use in SMEs in order to offer great implementation potential for typical SME use cases.

**Table 3.** Required functions of RPA tools

Category	Function	Number of nominations
Dealing with Data	read data from a document (PDF, Excel)	6
	change/convert data format	3
	send data to predefined users	3
	move data to other folders	2
	wait for files and download	1
	book data	2
	check data	3
	update data	2
	monitoring data	3
	save data to a system	1
	detect duplicates	1
	reconciliation of data between systems, programs	5
Interaction with an E-Mail-Client	copy and paste data	4
	create an email	1
	automatic e-mail dispatch	1
	open email	1
Interaction with other systems (CRM, ERP)	save attachments of an e-mail	1
	logging on to a system (encrypted access data)	5
	perform a search in the system	1
	run queries	1
	make status changes	4
Interaction with a browser	press system buttons	1
	logging in to a web page	2
	loading data from a web page	1
Mathematical calculations	search and select on a web page	1
	price and quantity difference	1
	calculation of tax differences	1

In the article of the Institute for Applied Work Science and the book by Koch and Fedtke, even more functions for an RPA software are mentioned, which are shown in Table 4. However, it can be seen that many functions have already been identified in the articles of the structured literature analysis. In the Institute for Applied Work Science article, other functions are mentioned that also concern data. These include the creation and analysis of data in systems or programs and the automatic input of data into a system. Furthermore, the automatic creation of documents and evaluation of documents are mentioned [4]. According to the book by Koch and Fedtke, functions such as the execution of if-then decisions in a process, the automatic filling of forms and the calling up of masks in systems and programs are also included [32]. In total, 35 functions were identified

that can also be found in the processes of small and medium-sized enterprises and should therefore be implemented with an RPA platform. All of the essential functions mentioned in the structured literature analysis, the article of the Institute for Applied Work Science and the book by Koch and Fedtke can be required and used in a wide variety of RPA use cases in all areas of SMEs

**Table 4.** Required functions of RPA tools

Article	Function
[4]	creating data in systems or programs
	analyse data in systems or programs
	automatic input of data into a system
	automatic creation of documents
	evaluate documents
[32]	performing if-then decisions in a process
	automatic filling of forms
	calling masks in systems and programs

## 5 Use Cases Scenarios with RPA

This Section is about the automation of subprocesses with the help of RPA. For this purpose, various identified functions from Section 4 are combined and assembled into three scenarios. Accordingly, the suitability of RPA for small business scenarios is examined, and an assessment is given as to whether citizen developers without programming knowledge can also create an automation. Furthermore, the benefits and lessons learned are noted, and existing limitations are pointed out. Before this, however, the final description of the provider selection is given.

### 5.1 Selection of the RPA Provider

The first step is to discuss which RPA provider is suitable for small and medium-sized enterprises. For this purpose, an RPA vendor comparison of the companies UiPath, Automation Anywhere, Blue Prism, Microsoft, Kryon, Servicetrace, HelpSystems, and OpenRPA was carried out in a first version. A detailed description of the comparison is available at [9]. The most important result of the comparison was that the community versions of the providers UiPath and Automation Anywhere offer a good entry point, as their software is free of charge as part of the community version, offers an extensive learning platform, and is particularly suitable for business users.

A short comparison will be used to select a final RPA provider to implement the application scenarios. Here, the point of easy use for creating an RPA robot by a business user/citizen developer will be highlighted again. As this work includes micro and small businesses, there is a greater focus on intuitive and straightforward development environments. With the no-code approach of the development environment, companies that do not have software developers as employees should also benefit from RPA. It is also assumed that micro and small businesses are predominantly Office users, so these programs are given special consideration in the use cases. It also explores, through the creation of use cases, the extent to which business users can create an RPA robot, the benefits of this robot, and the limitations of a simplified development environment. In order to give a possible procedure for selecting the provider, as well as for learning the software and creating an RPA robot, the completed steps by the first author of this article are documented below.

To find a suitable RPA provider for the automation scenario, the community versions of the providers UiPath and Automation Anywhere were downloaded from the providers' websites. This can be done for free after creating an account. Both providers then offer a guided tour of their platform and a video for the creation of the first RPA robot. The author created the first robot on both platforms and reviewed the providers' learning platforms. Both Automation Anywhere and UiPath offer an extensive range of courses, which are also available free of charge. However, it

should be noted that Automation Anywhere only offers an English version of its learning platform. This could be an exclusion criterion for employees in some micro and small companies. UiPath offers its courses in German as well as in other languages. Additional videos are only available in English, but German subtitles can be added. Furthermore, both providers offer various practical tasks to internalise the content described. UiPath scored points over Automation Anywhere because additional solutions, files to be used, and help are also provided in addition to videos.

Another difference in the development environments of the providers is that UiPath provides a development environment as a program for the desktop computer, whereas Automation Anywhere's development environment is fully integrated into the cloud. As a result, when an RPA robot is run, the code must first be loaded onto the computer before it can be executed. Consequently, there were unpleasant waiting times and forced pauses when creating an RPA robot, which was perceived as annoying. In addition, both development environments offer direct handling of Office products, but in the case of UiPath, add-ons can be used that enable direct work in an Office file.

A final difference between the development environments is the different versions of the RPA providers. Automation Anywhere offers a development environment in which automation can be created using functions. However, understanding how to create and use variables should be present, as these will be needed during creation. UiPath offers three different versions of development environments, although only two will be considered more specifically in this section. The "Studio" version is similar to the Automation Anywhere development environment and can be used similarly. The second version, "StudioX", is explicitly aimed at business users/ citizen developers and offers an even simpler version than Studio. All these aspects led to the selection of the provider UiPath, which is used for creating the use cases.

### **UiPath Studio vs. UiPath StudioX**

After selecting a suitable provider, the differences between the development environment Studio and StudioX were examined to select a suitable development environment for business users. The Studio development environment is aimed at RPA developers. However, it was explored whether business users could also work with it. This is doubtful, as a basic understanding of programming is required. Developers should know essential parts of the program, such as variables, assignments, loops and branches. There should also be an understanding and knowledge of different data types, array variables and UiPath-specific functions. Studio also provides well-known developer features such as a debugging mode and error/exception handling for variables/program errors that are missing in the StudioX development environment. Nevertheless, no code needs to be programmed in Studio, as an RPA robot is created with activities via a drag-and-drop system.

StudioX offers a much simpler development environment than Studio and should therefore be less overwhelming for business users. Activities are also used to create an RPA robot, but unlike Studio, they are much more general. This results in an activity of StudioX containing several activities of Studio in comparison, which allows for much more concrete modelling in Studio than in StudioX. In addition, StudioX misses certain activities, such as a join operation. However, this is a strength for business users as it reduces the complexity of creating an RPA robot and only provides frequently needed activities. Furthermore, StudioX offers a stronger focus on Office programs, but these are limited to the Microsoft ecosystem. Another advantage of StudioX is that no variables need to be assigned to the activities. This is achieved by nesting different activities within each other, thus creating links between the different activities. However, automation in StudioX only takes place by opening files and processing the data. In Studio, there is the possibility to realise data processing internally in memory, whereby a robot is executed in the background. In contrast, data processing in open files means that execution in StudioX takes place in the foreground, whereby the computer cannot be used for this time.

In summary, Studio has an extensive range of features, but this is at the expense of its complexity. In addition, basic technical knowledge is required, which is often not available in some micro and small enterprises. For this reason, the StudioX development environment, with an increased focus on business users, tends to be used to create use cases. Accordingly, it is to be

checked whether all the identified functions from Subsection 4.4 can also be implemented with a simplified development environment and whether this provides an effective tool for business users. After selecting the development environment, the author worked through all the teaching content on StudioX to build an understanding of the development environment.

## **5.2 Use Cases**

In order to check the extent to which RPA can be used in micro and small enterprises, three automation scenarios were designed. These scenarios were based on practical sub-processes, but were not used in practice. For each automation scenario, the process is described first, and then the structure of the RPA robot is discussed. Furthermore, each scenario describes which functions are included. Because business users/ citizen developers are in the foreground, a special/simplified development environment is used.

### **5.2.1 Use Case 1 - Collective Order**

The first use case involves creating collective orders and ordering in an online store. Various employees use a program to create a shopping list of needed materials. The program then outputs an Excel file (referred to below as an order file) containing the order number and the number of items. An employee of the purchasing department accesses these Excel files and copies all Excel files of all employees into a folder called “open order”. Subsequently, the co-worker in the purchasing department adds all orders together by copying all data of the different orders into a collective order. If there are duplicate order numbers, the items are added together. The collective order concerns an Excel file (in the following called “collective file”), which is stored in a folder called “order”. If all order numbers were copied and the number of articles added, the co-worker of the purchasing department calls the side of an online Shop and looks for the individual articles based on the order numbers. If all articles are in the shopping basket, it locks the order by registering with an account and placing the order. This scenario includes different and previously identified functions, which are listed below:

- Automatic creation of documents,
- Copy and paste the data,
- Move data to other folders,
- Mathematical calculations,
- Recognising identical data,
- Matching data between programs,
- Logging on to a web page,
- Searching and selecting on a web page,
- Making if-then decisions in a process,
- Changing/converting data format,
- Checking data.

The goal of automation is for an RPA robot to take over and automate the work of the purchasing employee. To do this, the RPA robot creates an Excel file in an “order” folder where all collective orders are created. The robot created the file as a purchase order with the current date, using the date as a reference point. In the Excel file, the robot will create two columns called “Order number” and “Quantity”. The robot then moves all the available order files from the various employees and saves them in an “open orders” folder. Since StudioX does not offer the possibility to take over the different files with one function and add them in case of duplicate values, these steps must be implemented with various other functions. Therefore, the first step is to insert additional columns into the Excel collective file, which adds the different article numbers if the order numbers are the same. Then each Excel file in the “open order” folder is opened in turn, and the following activities are carried out for each row in the file. First, a “vertical lookup” (VLookUp) is performed to built-in an Excel function. The VLookUp function compares each row in the order file with the rows in

the collection file. If the same value (word) is contained, the item number of the order file is stored in the auxiliary column of the collection file. Then the original value of the “Number” column in the collection file is added to the number value of the additional column and saved in the “Number” column. Next, the order numbers and item numbers that are not yet included must be copied from the order file into the collection file.

However, the development environment does not have an activity to copy only isolated values or to delete the rows that have already been used. This is the reason why a “Find and Replace” function is used to search for order numbers already contained in the collection file in the order file and overwrite them with the word “delete” if they match. Then an if-function is used to search for the word “delete” in the column “order number” and also to enter the word “delete” in the column “number”, which is in the same row. Consequently, in the order file, all the order numbers contained in the collective order are overwritten with the word “delete” and the corresponding number of items. Next, the entire table of the order file is copied into the first free line of the collection file, and the lines with the word “delete” are removed. The only activity available is “Delete Row”, which can only remove specific predefined rows. Filtering for a word to be deleted is not possible. However, this activity has the possibility to delete duplicate rows. This possibility is used by introducing additional lines with the words “delete” at the beginning of the table. This shows that the first row is always retained when deleting all duplicate rows. By adding in the first row, it can be ensured that the first row is always retained and all other rows with the word “delete” are removed. Then the activity “Delete Row” is carried out, which eliminates all lines with the word “delete”, as only these occur twice in the collection file. Subsequently, all additional rows and columns are deleted, resulting in a collective file with the columns “Order No.” and “Quantity” and all merged values of the order file in the collective file. Then the current order file is deleted from the “open order” folder, and the next order file in the folder is opened and processed according to the described procedure.

Once all Excel files from the folder “open orders” have been integrated into the collective file, an online shop’s website is called up by the RPA robot. The RPA robot then goes through all the lines of the collective order and enters the respective order number of a line into the search field. The robot then clicks on the search field, after which the article it is looking for opens. The RPA robot then writes the number of items from the current line of the collective order in the Quantity field and then clicks on “Add to shopping cart”. When all items have been placed in the shopping basket, the RPA robot clicks on the shopping basket and then selects the button “Checkout now”. The RPA robot then logs in with a stored username and password and places the order.

During the creation, the various click activities were recognised as a potential source of error, which is why the use case was to be expanded. For this purpose, the online shop allows uploading a template as an Excel file with the order number and the number of items. This option should be used, so fewer errors occur when entering data in the online shop. The use case is identical to the previous version until the data from the collective order is entered into the online shop. Since the structure is defined as a template by the online shop, the layout of the collective order must be changed. Knowing that the collective order is always structured similarly because of the previous steps, a column is inserted at the leading position. Afterwards, the column “Quantity” is copied to the newly inserted column, and then the column “Quantity” is deleted. Now the collective order contains the column with the required articles first and the order numbers as the next column. As these were written as a heading in the first line, which is not provided in the online shop template, the first line must be deleted. The collective order now corresponds to the template of the online shop and can be uploaded and processed. To do this, the online shop’s website is called up and then the RPA robot clicks on the shopping cart. Then the button “Upload xlsx” is selected, and the path of the collection file is entered in a window that opens. Next, the button “Checkout now” is pressed and the robot logs in with the stored user name and password and places the order.

### **5.2.2 Use Case 2 – Delivery Tracking**

In the second automation scenario, a parcel’s tracking and the package’s arrival are processed. An employee in the purchasing department receives an email from an online shop containing the order

number, tracking number of the parcel and the delivery date. He then copies the package's tracking number and enters it on the website of the parcel delivery company. He then selects the option to have an email with a specified subject sent to his email address when the parcel arrives. He then moves the email to the "Dispatch Confirmation" folder of the email client and sends an email to all employees telling them when the ordered goods will arrive. Finally, the employee opens an Excel file in which the order number, tracking number and arrival date are saved and writes them into the "Shipped" workbook. When an email arrives from the parcel service provider with the specified notification, the worker moves the order number, tracking number and arrival date to the "Received" workbook and deletes the email. The scenario contains the following functions listed in Section 4:

- Recognise email,
- Open email,
- Read email,
- Calling up a web page and entering data,
- Creating an email,
- Sending an email automatically,
- Updating data,
- Performing if-then decisions in a process,
- Sending data to predefined users.

Automation takes place for the activities of the employee in the purchasing department by the RPA robot carrying out his tasks. The RPA robot uses the employee's email account in the purchasing department for automation. Since the online shop sends a standardised message as a shipping confirmation, the RPA robot looks for specific characteristics in all emails. In this case, these characteristics are the name of the online shop as the sender of the email and the occurrence of the word "order number" in the body of the email. If these conditions are met, the robot copies the text of the main part of the email into an Excel file provided by UiPath. This Excel file is called "Project Notebook" by UiPath and provides a predefined set of formulas for the operation with date, text, number or files. In this way, various operations such as converting the date into different formats or extracting several values from a text can be carried out by using specific Excel commands. UiPath has already created these commands, so only data needs to be inserted to get the result of a particular operation. This Excel template is used to identify specific information from the text of the body of the email. To do this, the text of the email is written into an input cell of the Excel template. Since it is a standardised email, the words before and after the required information are always the same, which now offers an advantage. This allows the desired information to be identified in a specific row in the Excel spreadsheet that can be accessed in further automation. Through the 'Project Notebook' function, the order number, tracking number and arrival date of the parcel were identified and stored in the excel file. The parcel tracking website of the parcel service provider is then opened, and the previously identified tracking number from the Excel table is written into the search field. This opens a web page with various information about the parcel. Next, the robot clicks the button "Activate notifications" and selects the entry "Notify of successful delivery of the parcel" by clicking on it. The robot then writes the word "order" and the tracking number of the parcel in the field for the name of the consignment and writes the email address of the employee in the field for the email address. The RPA robot then clicks on the "Save" button and closes the browser. Afterwards, the email from the online shop is moved to the email folder "Shipping confirmation" and marked as read. Furthermore, the RPA robot sends an email to a defined group of employees with the package's arrival date. In the last step, an Excel file "Merchandise Management" is opened with the workbook "Shipping", a new line is inserted below the heading, and the values order number, tracking number and arrival date from the Excel file "Project Notebook" are entered. The system then searches for a new email in the mailbox that meets the criteria described above.

When an email arrives from the parcel service, the RPA robot opens the excel file “Merchandise Management” with the columns order number, tracking number and day of arrival. For each row, the robot performs the following steps. First, the robot opens the employee’s email client and searches through all emails in the inbox. If an email is detected that has the parcel service as the sender and the same tracking number in the subject as the tracking number of the current row in the “Merchandise Management” Excel file, all the rows are inserted into the “Received” workbook and deleted from the “Sent” workbook. The email from the parcel service provider is then deleted, and the scenario is completed.

### **5.2.3 Use Case 3 – Automatic Processing of E-Mail Attachments**

The last use case deals with the reading of a PDF document and the automatic creation of requests. An employee in the company receives an email, which he identifies using a defined subject. The user saves the email’s attachment in an archive folder and opens the PDF files to copy specific values from the PDF file into a program. Once the employee has entered the data into the program, they receive a number from the program (e.g., a customer number), which is attributed to the email sender. The employee then opens a Word template and copies specific values from the PDF file into the Word file. Finally, he saves the Word file as a PDF and sends it back to the sender. The functions listed in Section 4 and used in this scenario are listed below:

- Recognise email,
- Open an email,
- Saving attachments to an email,
- Move data to other folders,
- Reading data from a document (PDF, Excel),
- Entering data into a program,
- Delete files,
- Create an email,
- Sending an email automatically,
- Performing if-then decisions in a process,
- Filling forms automatically,
- Calling up masks in systems and programs,
- Creating data in systems or programs,
- Automatically entering data into a system or program,
- Automatically creating documents,
- Evaluating documents,
- Posting data.

In this automation scenario, the described tasks of the employee are also automated by an RPA robot. To do this, the robot accesses the employee’s email client and searches all emails for specified keywords in the subject. If an email is found, the robot saves the email’s attachment to a specified folder, checking that the attachment is in PDF format. Then the folder with the saved attachment is opened by the RPA robot, and the following activities are performed for the file. First, the data of the PDF file is read out by an activity, which, however, is not included in the standard packages of StudioX and must be added subsequently by the package administration. This package offers various activities for handling PDFs, including text recognition with and without OCR recognition. OCR recognition is unnecessary in this use case because the data is in Unicode. After all, the data has been read by the “Read PDF Text” activity and saved in the “Project Notebook” as in the previous scenario. This causes information to be extracted by specifying preceding and following words for delimitation. Since the PDF file is a form, the delimiting words are always the same and reliable identification of the required information becomes possible. A program is then opened, and the identified data from the “Project Notebook” is entered into specific fields of the program. The information is saved by clicking on the save

button, and a number is created. This is copied by the robot and saved in a variable. Subsequently, a predefined Word template is copied into the folder and renamed with the name and first name from the “Project Notebook” and the previously saved number. Afterwards, the renamed Word document is opened, which contains word placeholders at certain places where certain information is to be written. Through this structure, a “Replace Text” activity can be used to replace the word placeholders with the information from the “Project Notebook” at the correct positions. Once all positions have been replaced with the correct information, the Word document is saved as a PDF file and sent back to the contact as an attachment in an email. Finally, the created PDF, the Word-file, and the sent email are deleted. Afterwards, the next email is searched for with the specified keywords in the subject.

### **5.3 Benefits and Experiences**

Many identified functions from Section 4 of this article were combined and implemented in the use cases. The resulting scenarios serve as examples of possible subprocesses in practice, but the functions can also be combined in any other way. However, it is clear from the implemented use cases that all the functions used could be implemented with the StudioX development environment, thus enabling business users to create automation for their processes. However, a check should be made to see whether a benefit is derived from the automation. For this reason, a quantitative benefit is then collected and measured regarding the time required to implement the scenario. To obtain a benchmark, all use cases are run manually three times, using the mean value as the time required. Subsequently, each use case is implemented by the RPA robot and the time required is also measured.

The first use case takes an average of 3:56 minutes to execute the scenario manually. The RPA robot processes the task in 1:53 minutes and thus achieves a time saving of 52.1%. It is noticeable that the time advantage occurs when comparing duplicate order numbers from different order files and not when entering values in the online shop. Entering the order numbers in the online shop takes about the same amount of time for humans and robots since the web browser acts as a limiting factor, and there is no time gain due to the slow loading of the website. For the automation scenario, two order files were used, each containing five items, with two duplicate order numbers in both order files. Since the comparison of order numbers results in a significant time gain between humans and the RPA robot in favour of the robot, this will increase with an increased number of items in the order file as well as with an increased number of order files. The time gained by comparing items can also be reproduced in the extended scenario. By transmitting the items to be ordered through a template, there is no need to enter the values in the online shop, and the time gained between humans and robots can be significantly emphasised. On average, the manual execution of the extended use case takes 2:20 minutes. On the other hand, the robot needed 36 seconds, resulting in a time gain of 74.3%. The number of order files and the items contained are identical to the initial automation scenario.

In the second automation scenario, a high time gain can also be achieved. For the manual execution of the scenario, the human needs an average of 2 minutes. The RPA robot needs 24 seconds for execution and thus achieves a time saving of 80%. The time saved can be attributed to the fact that searching for the correct emails is no longer necessary, which can take different lengths of time depending on the volume. However, there was no need to search for emails in the executed scenario. Furthermore, the RPA robot’s time is saved by the faster copying of data into text fields and emails that a human must first write. When an email from the parcel service provider arrives, the human needs an average of 39 seconds and the RPA robot eight seconds to process this scenario. The result is a time saving of 80%, which can be justified by comparing the tracking figures for emails and Excel files. This scenario also shows that the time saved by using the RPA robot is more significant the more values have to be compared.

The last use case is carried out by the RPA robot in 36 seconds and achieves a time gain of 84%, as the human needs an average of 3:45 minutes for manual execution. The time gain is thus the

highest of all use cases, which can be justified by copying individual values between the PDF and Word documents. In addition, the text is not recognised correctly in some places in the PDF document, which is why the text has to be transferred by hand by the user. In the automation scenario, 12 positions were replaced by the contents of the PDF file. If more positions were replaced by information, this would lead to an even higher time gain. In addition, creating the email again took longer than using the RPA robot.

The measured time gain also leads to potential cost savings, as the employee has to spend less time on these activities. However, the exact potential cannot be quantified because the use cases only concern small and short business subprocesses. However, the employee can concentrate on more value-added activities because of the time saved. Another quantitative benefit is a low time needed to create the RPA robot. This was two working days for the first use case and one working day for the other use cases. Furthermore, at least two weeks are needed to learn the software components.

In addition to a quantitative benefit, a qualitative benefit is also achieved in the use cases. The highest qualitative benefit is the increase in quality, which has the most significant impact in the first and third use cases. Many values must be compared and copied in these scenarios, which can easily lead to processing errors. Especially the first scenario is predestined for this, as long numerical sequences have to be compared. The robot minimises processing errors towards zero, which results in increased quality. Furthermore, it should be noted that the scenarios can also be processed by the RPA robot when the employee is not present.

### **Experiences and limits from the use cases**

Through the creation and implementation of the various use cases, different experiences were collected and limitations were discovered, which will be highlighted below. StudioX is a suitable development environment for business users who are inexperienced in programming, as the interface is self-explanatory and structured. For each activity, the respective function is described and through the nested structure, a logical structure of the RPA robot takes place. In addition, activities such as text recognition or input are highlighted by visual fields, which offer intuitive use for a business user. A further simplification is the Excel file “Project Notebook”, which is provided for each project development. A conversion or recognition of values takes place through various operations, which offers a perfect traceability through the direct implementation in the Excel file. However, this increases the probability of errors since an intermediate step must be carried out to process values and obtain the desired information. In the “Studio” development environment, this intermediate step would be omitted and direct value recognition would occur. A potential source of error is the delimiting words for extracting the required information in scenarios two and three. If the delimiting words change, erroneous information is detected, which causes the automation to abort. In addition, it was found that paragraphs that may be contained between the delimiting words are copied along. This can lead to format changes in other files. To prevent this, an extra activity must be used that takes the raw value without format.

Furthermore, various experiences were made with PDF processing in StudioX. As described in the third automation scenario, an extra package must be installed for PDF use in StudioX, as PDF processing is not provided in the original state. This is why the teaching content for the included activities in this package is not included under StudioX, but Studio. Therefore, business users who want to use PDF processing should also consider the teaching content for PDF use in the Studio section. In addition, the PDF activities require variables that serve as output for the activities. However, the required output variable is not indicated and must be set independently via a properties window for the activity. In StudioX, it is possible to optionally work with variables that store specific data and output it when required. This is done via two activities and is easy for business users to implement. If working with variables is rejected, it is possible to waive this, but no PDF activities can be used.

In addition, the record function was used to record several user actions in the development environments StudioX and Studio. The record function turned out to be very restrictive, as only simple commands such as copy or paste are possible. In addition, only actions of a user that always

follow the same pattern can be recorded. Therefore, it was impossible to record the above use cases using the record function. This is because the use cases require more complex commands and the number of output data (number of items to be ordered) can differ for each process. This is why, the record function is only recommended for very short and highly structured scenarios.

Another experience is that when creating the activities for the RPA robot, the processes are very easy for the business user to understand. Because changes are made directly in a file, the way an activity works could be easy to understand, making it easier for business users to create RPA robots. A final experience represents the frequent source of errors due to websites. In the first automation scenario, an online shop website was used, which frequently contains irregular windows popping up. This can cause the automation to abort, as the RPA robot cannot follow its predefined flow in this situation. Therefore, different exception handlings have to be created for these situations, which leads to an increased creation effort.

In summary, it can be shown that the development environment “StudioX” is very well suited for business users and the activities available offer a large scope. This enables business users to automate all scenarios that can be created with the given activities. However, there is a clear focus on Excel, as this is where most activities are available. StudioX always reaches its limits when the given activities are not available. Two Excel files had to be connected for the first use case and different positions were added. Since no activity was available, other activities had to be taken as substitutes. If this is not possible, implementation in StudioX is not feasible. As described in the first automation scenario, alternative activities could replace the needed but unavailable activity. However, this results in a speed disadvantage absent with a direct implementation. In the “Studio” development environment, more and more elementary activities are available for creating an RPA robot, so a “Join” activity would be applied in the first automation scenario. Furthermore, unattended robots and automations in the background cannot be created in StudioX, as work is done directly in documents and, in contrast, internally in memory in Studio.

## **6 Expert Interview**

In the previous sections of this article, different theoretical results were elaborated and the first practical experiences in implementation were gathered. This includes the operationalization of application scenarios from the literature into concrete functions, selecting an RPA provider and the implementation of use cases with an RPA platform. Finally, this section will classify the theoretical results through a practical evaluation. For this purpose, a semi-standardised guideline interview is conducted with an expert to assess the practical suitability of the results. For this purpose, three topic blocks were prepared, which concern aspects of the company background, the use cases, and the development environment. The interview structure was chosen to focus first on the presentation of a topic block and then on questions to the expert. Questions and suggestions could be asked at any time during the presentation of the results. The selected expert was a managing director of a company that had expressed an interest in RPA technology. As a managing director, the expert was able to assess the benefits and possible applications of RPA technology for his company. The interview took place in the form of an online meeting.

After an introduction and explanation of the interview process, the first block of topics was addressed. This included an analysis of the company's background to gain an impression of the company's business activities. The company is active in the electrical industry and is engaged in the manufacture of control cabinets and cable assembly. According to the existing definitions, the size of the enterprise corresponds to a small enterprise that manufactures its products mainly in individual production or small series. The company uses an ERP system for automation, but this system is designed for mass production, which results in a discrepancy. In order to close this discrepancy, various special solutions have been developed over time, which have been implemented in the form of Excel tables. This results in the company's high use of Office-programs and typical problems such as the non-targeted provision of documents or moving data back and forth. The company sees automation as an opportunity to increase the efficiency of its processes

and to minimise the typical problems of many Excel files. The expert also states that the industry's automation trend is also noticeable.

After the first topic block had given an impression of the company, the RPA technology and architecture were explained to the expert and the research methodology of this work was presented. This was followed by the second topic block, which included the use cases and the identified functions from the application scenarios of the literature analysis. For this purpose, the 35 identified functions from the fourth section with the operationalised application scenarios from the literature were presented to the expert and discussed. The aim was to assess which functions are particularly relevant in practice from the expert's point of view. For this purpose, the expert briefly discussed and assessed all functions as irrelevant or relevant. Various functions in the category "handling data" were especially relevant. In particular, the reading of data from documents, the saving of data in systems and the comparison of data between systems or programs were rated as significant by the expert. Other functions that are frequently used in the company are converting data, moving data into folders, updating data, creating data and copying data. Furthermore, all functions from the category "interaction with an email client" were classified as relevant. All functions from the other categories such as "interaction with other systems", "interaction with the browser" and "mathematical calculations" were rated as less relevant for the company. Functions such as sending data to predefined users, monitoring data and detecting duplicates from the category "handling data" were also rated as irrelevant. It should be emphasised that the expert's functions from the category "dealing with data" assessed as relevant correspond to the increased number of functions mentioned in the literature. Consequently, these functions can be assessed as especially relevant for practice.

Next, the various use cases from Section 5 were explained to the expert in order to obtain an assessment of their practicality. In order for the expert to develop an understanding of the scenarios, the individual execution steps of the robot with programs, files, and data were demonstrated and then the RPA robot was executed. The expert assessed the first use case and the extension as relevant and practical, as significantly reducing workload, especially for companies with a single supplier. The expert saw difficulties for companies that purchase goods from many different suppliers, as the process has to be adapted for each individual online shop. Furthermore, the expert pointed out that the solution is especially helpful for online shops where the item selection can only be made via the search field, which is the case with many suppliers and poses a problem. Furthermore, during the robot execution, the expert asked how the functionality of a click on a certain field works, as it brings possible errors in case of design changes on the website. In response, the researcher explained that a click is not executed based on screen coordinates but that a reference point (UiPath calls it an anchor) is set for the click using computer vision. The reference point can minimise incorrect clicks on changed web pages as a source of error.

The second use case was also classified by the expert as practicable, whereby an implementation and use in his company would also be conceivable after minor adjustments. Furthermore, the individual functions in this use case can be used in a different order for other sub-processes in the company, which results in a high degree of practical relevance for the functions. The expert mentioned sending a delivery tracking link as a possible sub-process so that the customer can inform himself about the arrival of his goods. According to the expert, the third use case is practical and suitable for companies with many of the same processes. Therefore, the scenario may be suitable for a dental practice, which often has to take over customer data. For the expert's company, however, this automation would be challenging to implement because of a high degree of unstructuredness in the feedback from his suppliers, since in his company, for instance, suppliers use different keywords in the emails for their orders. The author then explained the customisability of the email recognition activity, where it is possible to search for many different keywords in a subject or body of an email. This means that even unstructured and more complex sub-processes can be automated. Afterwards, the expert named a sub-process for transferring delivery dates to an ERP system, where the use case can be transferred.

After assessing the practical suitability of the use cases, the benefits of automation for sub-processes in practice were discussed. The expert saw a high benefit here for practice and in his company since a lot of information is available in different places and only needs to be compiled. This could also be programmed by a special solution with various interfaces, but the expert saw too high a cost factor in the special solutions, which is why such automation could only be considered to a limited extent for his company. In RPA, the expert saw an automation solution with which small partial solutions could be created and implemented themselves, which would result in a lower cost factor for the automations. Furthermore, the interview pointed out that the automation solutions shown correspond to an attended RPA robot and not an unattended robot running in the background. However, the expert did not see any disadvantage in the attended robot compared to the unattended robot, since he saw the application area for an unattended robot only in simple and negligible subprocesses. The expert would prefer an attended robot for critical subprocesses, such as sensitive pricing information or the manual transfer of time-recording data to the accounting department. This is because the robot's process and the result can be checked by a human and a reaction can be made if errors occur. Since an unattended robot is also associated with higher costs, it would have to be examined in each individual case whether the use of an unattended robot makes sense for a subprocess or whether the short waiting time of the attended robot is acceptable.

The last aspect of the topic block "use cases" addresses the RPA software and criteria for a possible introduction in companies. Initially, the expert would not fully trust sub-processes automation with RPA and would use a human as a control function for essential sub-processes. For this purpose, the automation is carried out until the last step and then checked by a human. However, the expert could imagine having critical subprocesses fully automated with RPA if the RPA software was used for a more extended time. However, experience with the software would have to be gathered first. The cost of the RPA software was the subject of another question from the expert. Essential criteria for the expert were how long did it take to create the automation and whether it had a tangible benefit or a superficial improvement. He stated that the RPA software would not be useful to him and he would not spend money on it if it took ten hours to create an RPA robot and it only automated simple processes of two minutes. However, if the creation were easy and fast, he could imagine investing in RPA software. In the end, it would always have to be weighed up how many and which processes can be automated and whether automation increases efficiency and turnover. Then the expert would be willing to spend several thousand euros on an RPA software. For the expert, cost-effectiveness was the most essential aspect of RPA to increase process flow efficiency. A final question in this topic block was the possible implementation of an RPA software by company employees. The expert would first hand over the creation of an RPA robot to the internal programmers. However, if the creation of an RPA robot would not be possible with the knowledge of the programmers, the expert would hire external companies for critical processes.

After the use cases were discussed in the second topic block, the third topic block dealt with the development environment for creating the RPA robot. The development environments "StudioX" and "Studio" were presented and explained to the expert. Furthermore, the focus was on a simplified identical scenario in both development environments to clarify existing differences between the development environments and to show where basic programming knowledge is required for the "Studio" development environment. In addition, an activity was added to the scenario in both development environments to illustrate the creation process for an RPA robot. Afterwards, a question about the presented contents was placed. The expert stated that he had no programming experience but had a technical interest. The expert found the development environment "StudioX" intuitive, and he would be confident in creating an RPA robot via this development environment. However, it would be necessary for the expert that teaching content for the software was made available by the provider. In his view, the teaching content could be in English, but for many employees in the company, this would be a criterion for excluding the software. The expert finds the development environment "Studio" too technical and complicated,

which is why he would not use this development environment. If it were only possible to develop RPA robots with the Studio development environment, the expert would commission an external company as a reseller with technical implementation to create the RPA automations.

In summary, the interview showed that the operationalisation of scenarios from the literature identified essential functions that could also be used in the expert's company. The expert considered the use cases developed from the functions to be practical and was able to extract aspects from the use cases that could be implemented in his company. The most important aspect for the expert was the necessary increase in efficiency through RPA, which should improve the profitability of processes. If the RPA software offered a positive cost-benefit ratio, an investment of several thousand euros would be conceivable for the expert. For the expert, essential criteria that the RPA provider would have to serve would be a simplified development environment for business users/citizen developers, supporting teaching content, and the presence of an attended robot in the RPA software.

## 7 Discussion and Conclusions

The article investigated to what extent the aspect of RPA in SMEs is reflected in scientific literature and what application scenarios for RPA in SMEs were identified. A structured literature analysis revealed that no relevant articles were found with specific focus on application scenarios of RPA in SME. Thus, so far this topic seems not to have received much interest in scientific research. This motivated an extension of the structured literature analysis to RPA application scenarios in general, i.e., independent of company size, in order to find application scenarios that can be transferred to small and medium-sized companies. As a result, 38 relevant articles were identified, which contain a total of 59 application scenarios for the use of RPA in processes. In 21 of the 59 application scenarios, a transfer of subprocesses to SMEs was conceivable. It should be noted that of 21 scenarios, only three scenarios contained concrete process descriptions for the use of RPA in a business process. The remaining articles only specified processes in which RPA is used without describing the integration in more detail.

Through operationalisation, it was possible to identify elementary functions from the application scenarios suitable for SMEs, whereby these are basic actions such as copy, reading out, comparing, etc. The most common functions were from the business process. Most of the extracted functions came from the concretely described processes, but important functions could also be extracted from the remaining processes that were not described in detail. A total of 27 functions were identified from the application scenarios of the literature analysis and eight more from two other sources that also named example application scenarios for SMEs. A total of 35 functions were thus extracted, which showed which functionalities the RPA platforms must provide so that they can be used for SMEs.

To identify suitable RPA providers for SMEs, the RPA providers "UiPath" and "Automation Anywhere" were investigated for the development of use cases. "UiPath" was chosen because of its better teaching offer and the available on-premise development environment. Furthermore, the decision was made in favour of the "StudioX" development environment for the "UiPath" provider, as this has a better focus on business users/citizen developer compared to "Studio" and ultimately offers a simpler development environment. The most essential functions identified were combined in three use cases and then an attended RPA robot was created for these use cases with the "StudioX" development environment. By comparing the time spent between the RPA robot and the human, it was possible to determine a quantitative benefit, which, depending on the automation scenario, was shown by a time saving of approx. 50% to 84%. In addition, a qualitative benefit was registered, which resulted from a lower error rate and improved process quality. Furthermore, important experiences from the creation process of the RPA robots with the development environment "StudioX" could be worked out.

An expert interview was carried out for evaluation purposes. The expert confirmed high practical suitability for the use cases created and found many partial aspects of the use cases in his

company. Furthermore, the expert assessed the 35 identified functions, rating the categories “handling data” and “interaction with an email client” as particularly important. In addition, the expert highlighted the presence of an attended RPA robot, the provision of educational content, and a suitable development environment for business users as particularly important criteria in an RPA provider selection. These criteria, mentioned by the expert, coincide with the criteria of the RPA provider comparison carried out in the article.

The findings, obtained as a result of the research in this article, have shown that the use of RPA technology in SMEs is possible, although in this article the focus was primarily on attended RPA robots, as these can also be created by business users. With an attended RPA robot, even employees of small and medium-sized companies who do not have basic technical knowledge can develop and implement RPA implementations. An attended RPA robot primarily enables business users to automate office applications, which may be common in SMEs. For the use of unattended RPA robots in SMEs, the work shows that the creation is not suitable for the business users predominantly found in SMEs and therefore requires employees who have basic technical knowledge. Therefore, unattended RPA robots were not considered further in this work. In summary, the quantitative benefits of using attended RPA robots in use cases are a significant time gain in the subprocesses and a short development time for creating the attended RPA robots. In addition, various qualitative benefits were registered, such as avoiding processing errors and increased process quality. With the identification of 35 essential functions, process activities were further identified in which attended RPA robots can be used. These process activities can occur in different combinations in different subprocesses in SMEs.

Based on the results of the research presented in this article, a recommendation for using RPA technology can be made for SMEs. The use of RPA makes sense in these companies if a community or free version of an RPA platform is used. This increases the process quality without additional costs and results in a qualitative benefit. However, only partial processes are automated by attended RPA robots, which only offer low-cost savings potential. Therefore, it can be assumed that, especially in the smallest and small companies, no ROI can be achieved for a purchased RPA platform. The attended RPA robot generates mainly advantages in the avoidance of processing errors and in the saving of processing time. For a high-cost savings potential to be realized, an unattended RPA robot would have to be deployed in the company, which automates entire business processes. Through the resulting cost savings, an ROI can be achieved that justifies the purchase of an RPA platform.

One of the most important limitations of our work is that only a single expert was included in the evaluation process who had a background from manufacturing and small series production. This limitation basically means that we cannot assume transferability of the results to other application domains. However, the main evaluation objective was to show applicability and relevance of the results in a SME domain, which was successful for the area of expertise of the expert. Future work will have to extend this investigation to other application areas and other enterprises which ideally should pose additional requirements to RPA use.

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