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How to conduct successful business process automation projects? An analysis of key factors in the context of robotic process automation

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Abstract

Purpose – In recent years, the robotic process automation (RPA) technology, a software-based method to automate routine tasks in business processes, has gained significant interest and adoption. However, many implementation projects fail and current literature lacks a synthesis and comprehensive overview of factors that challenge the implementation of RPA, have an impact on success or failure of projects, or, play an enabling role in an RPA project. Hence, the purpose of this research is to identify key factors that should be considered by organizations when conducting an RPA project.

Design/methodology/approach – The paper adopts a qualitative methodology based on data collected in a systematic literature review (SLR) and interviews with 10 RPA experts. Using inductive coding, an integrated framework of key factors is developed.

Findings – The results suggest that the key factors for a successful RPA introduction can be divided into human, organizational and technical factors. Important aspects include for example project management techniques, capabilities and skills of employees, as well as data security considerations.

Originality/value – The paper contributes to knowledge by synthesizing previously dispersed knowledge into an integrated framework, as well as by complementing previous results with new qualitative, empirical data. Additionally, the RPA-specific factors are put into the perspective of persistent problems in information systems development.

Keywords Robotic process automation, RPA, Business process automation, Challenges, Success factors, Enablers, Success, Failure, Barriers, Prerequisites, Robotics, Bots

Paper type Research paper

1. Introduction

In the course of digital transformation, companies are facing new strategic, organizational and cultural challenges that force business process management to adapt to the requirements of digitization. These requirements can be summarized under the term "process digitization." Process digitization pursues the goal of coupling processes quickly and flexibly with new technologies. This is intended to support a digital business model that allows processes to be aligned with digital structures with the highest possible degree of automation (Czarnecki and Auth, 2018). The technology trend toward process automation promises cost savings and

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quality as the driving means. With the use of robotic components or bots, tasks mediated by humans should be processed more easily and quickly automated (Ghose *et al.*, 2021).

While older process-related information systems such as enterprise resource planning (ERP) systems, customer relationship management (CRM) systems and business process management systems (BPMS) still required manual input, this step is now taken over by robotic process automation (RPA) technology (Gartner, 2022). Here, robotic components can take over routine and manual tasks, creating more time and efficiency for value-added activities of knowledge workers (Aguirre and Rodriguez, 2017).

RPA promises a number of important benefits to organization, including increase of employee productivity, cost and time savings and reduction of errors (Devarajan, 2018). Furthermore, with the RPA technology, automation does not require a large budget to be invested in interfaces or (re)programming (Ghose *et al.*, 2021; Smeets *et al.*, 2019). However, there are many barriers and challenges that may lead to companies' expectations of RPA not being met (Kulisiewicz and Sobczak, 2018). According to some sources, approximately 30–50% of all RPA projects fail due to various reasons (Smeets *et al.*, 2019), which raises the question what companies can do to ensure effective project execution.

In recent years, the scientific body of literature on RPA has improved after the topic had initially been largely driven by commercial vendors and neglected by academia (Schlegel and Wallner, 2022). However, as previously noted by Syed *et al.* (2020), "a clear framework on what the critical success (or failure) factors are" has still been missing in the literature. Hence, the aim of this work has been to identify key factors of an RPA project, i.e. elements that play a crucial role in achieving a successful project outcome, and categorize them into an integrated framework. In doing so, we use a broad definition of key factors, providing a comprehensive synthesis and overview of factors that challenge the implementation of RPA projects, have an impact on success or failure, or, play an enabling role in an RPA project.

To do so, we have conducted a systematic literature review (SLR) (Webster and Watson, 2002; Kitchenham and Charters, 2007), as well as, qualitative expert interviews (Bogner *et al.*, 2014; Pfadenhauer, 2009; Wassermann and Niederberger, 2015; Hildebrandt *et al.*, 2015).

The rest of the paper is structured as follows. The next section provides the background of RPA. In the third section, methodology and research design, the qualitative approach taken in conducting the research is explained, including details on the SLR and interviews. Section 4 presents an overview of the research findings on human, organizational and technical factors affecting RPA projects. Section 5, discussion, synthesizes the results with recent related work in the field (Plattfaut *et al.*, 2022; Šperka and Halaška, 2023) and integrates them into a larger theoretical context (Kautz *et al.*, 2007; Kautz and Nørbjerg, 2003; Kautz and Madsen, 2004). Finally, the conclusion section summarizes the paper's contribution to knowledge and offers recommendations for practice and further research.

2. Background

2.1 Definition of robotic process automation

RPA has its origins in technologies such as scripting, macros and screen scraping that can automatically extract data from a graphical user interface (GUI). While related products were already in use in 2010 the term "RPA" was first mentioned in the literature around 2013. Currently, there is no unified definition for Robotic Process Automation in the literature (Scheppler and Weber, 2020).

For example, the Institute For Robotic Process Automation & Artificial Intelligence (IRPAAI, 2019) defines RPA as "… the application of technology that allows employees in a company to configure computer software or a 'robot' to capture and interpret existing applications for processing a transaction, manipulating data, triggering responses and communicating with other digital systems." Another example of a definition comes from van der Aalst *et al.* (2018). They describe RPA as "an umbrella term for tools that operate on the user interface of other computer systems in the way a human would do." The market research company Gartner (2022), which analyzes developments in IT, defines RPA as a tool for executing "if, then, else statements on structured data, typically using a combination of user interface (UI) interactions, or by connecting to APIs to drive client servers, mainframes or HTML code. An RPA tool operates by mapping a process in the RPA tool language for the software 'robot' to follow, with runtime allocated to execute the script by a control dashboard."

Numerous other definitions exist in the literature. Nevertheless, it can be summarized that RPA can be understood as a software program with which it is possible to program (software) robots. These are able to handle rule-based business processes or process sections independently and automatically (Langmann and Turi, 2021).

2.2 Benefits of robotic process automation

RPA technology promises both economic and technological benefits. From an economic point of view, there are several important benefits of the RPA technology. For example, automation with RPA reduces the time spent on manual tasks to a fraction of the regular time. Experts estimate that time savings of up to 90% are possible here (Reich and Braasch, 2019). It should be noted that the speed of RPA robots depends on the IT application, as well as the respective response time. This means that an RPA robot is bound to the waiting times for booting up a system or loading a web page just as a human is (Koch and Fedtke, 2020).

The increased speed also results from the fact that RPA robots are continuously available (24/7 availability). The robots do not get distracted, tired or sick and can work continuously without a break (Reich and Braasch, 2019). To this is added the easier scalability of resources due to the robots used. As process volumes fluctuate, costs and time spent are adjustable. This ensures an optimal throughput time of the robots compared to manual processing by employees (Allweyer, 2016). This has the advantage that necessary process steps can be completed by RPA exactly when employees are dependent on them in the next work step (Koch and Fedtke, 2020). In addition, human error is minimized (Reich and Braasch, 2019). Not only is quality increased, but employee satisfaction is also promoted (Birrer and Schreiber, 2020). With the help of RPA technology, trivial repetitive tasks can be processed and completed with RPA robots. The time thus gained is henceforth used by employees for value-adding activities in different areas (Birrer and Schreiber, 2020; Reich and Braasch, 2019). Especially in the areas of insurance companies, banks and other financial service providers, RPA technology scores with the advantages of complete verifiability and a high degree of accuracy. This makes it possible to meet the high demands of auditability, testability and data security on processes (Reich and Braasch, 2019). With the help of RPA, the increase in quality is to be combined with stagnating costs. For example, in the insurance industry, cost savings of 40–75% through RPA projects are expected (Reich and Braasch, 2019). At the same time, the use of RPA is associated with a relatively short payback period. Practice shows that an investment in RPA technology amortizes in most use cases after just twelve months. It should be noted, however, that depending on the project, the return on investment can vary (Brettschneider, 2020).

Besides the aforementioned economic advantages, RPA technology has technological advantages. In practice, process flows consist of different functions that are usually distributed over several systems that are separate from each other. The RPA application can act as a bridging technology that supplements missing interfaces. This has the advantage that no expensive modifications have to be made to the IT infrastructure (Langmann and Turi, 2021). In addition, the software robots can be managed centrally via the RPA application. This allows a company's IT department to easily monitor and scale the robots

(Devarajan, 2018). Another technological advantage of RPA is the reusability of the software robots and their modules/software components. As a result, modules of RPA software that have already been created can be used in comparable processes (Willcocks *et al.*, 2015). Modern RPA platforms such as Blue Prism already offer integrated libraries for this purpose, which cover standard processes such as "retrieve e-mails" or "read Excel files" with pre-developed modules. The respective modules are adaptable and are reused for different processes as required (Langmann and Turi, 2021). For the implementation of an RPA application and its modules, only limited software development expertise is required. Often, RPA robots are implemented with visual programming. IT-savvy employees in business departments are able to understand RPA programming through the visual representation and to carry out programming, maintenance and further development themselves to a certain extent (Krüger and Helmers, 2020). The dependency on IT and specialist departments is minimized here. As a result, processes can be automated more quickly and at lower cost directly on site. At the same time, the communication problems between the business and IT departments are eliminated and the IT department is relieved by the elimination of additional tasks (Scheppler and Weber, 2020).

2.3 Weaknesses of robotic process automation

In the literature, not only are the advantages of RPA discussed and reported, but the technology is also critically scrutinized. Companies must consider a variety of disadvantages and limitations related to RPA (Santos *et al.*, 2020).

The fact that RPA technology is only suitable for processes with rule-based tasks is an obvious disadvantage. As a result, only a limited selection of processes that can be automated exists. Without the addition of AI, robots are unable to develop cognitive capabilities on their own (Santos *et al.*, 2020).

Decisions within the process must therefore be made by human employees. As a result, a bot (compared to an employee) may execute individual process steps faster and in higher quality, but the cycle time of the overall process is limited (Brettschneider, 2020). Here, the cycle time on the number of exceptions that occur in the form of decision requirements. If a process has a large number of exceptions, many of the process steps must be processed by an employee. In order to ensure an error-free process flow, human and machine must be synchronized. This not only minimizes the speed of the process, but also increases its complexity (Santos *et al.*, 2020).

Another major point contributing to the increase in complexity is the maintenance of the robots. Small changes are often made in the form of updates to user interfaces and applications. As a result, the RPA robots encounter errors and adjustments have to be made. Particularly in more complex processes with many changes and decisions, there is an increased susceptibility to errors, which are very time-consuming and costly to remedy (Langmann and Turi, 2021).

Once a suitable process for automation has been found, the next challenge is to check the supposedly suitable process for feasibility. This involves weighing up whether the UI automation makes more sense than reprogramming the underlying IT system (Koch and Fedtke, 2020). Compared to interfaces, RPA technology generally offers more unstable solutions. As a result, given an existing choice under the same conditions (effort and implementation time), the optimization of an interface should be preferred to automation by RPA (Smeets *et al.*, 2019). In principle, automation by RPA only makes sense if the programming effort in legacy systems would no longer be economical for cost reasons (Koch and Fedtke, 2020). This leads to software robots being deployed in antiquated IT infrastructure. As a result, outdated IT systems can be overhauled quickly and inexpensively, and the pressure on management to make decisions regarding the IT landscape is reduced. This has the disadvantage that obsolete IT systems remain in companies much longer than would make economic sense (Koch and Fedtke, 2020).

With regard to the disadvantages and challenges posed by RPA, data security/data protection and the loss of process knowledge also play an essential role (Arnautovic *et al.*, 2021). By covering and interconnecting business-critical areas, RPA implementation in enterprise processes poses a growing risk (Taulli, 2020).

3. Methodology and research design

3.1 Methodology and overall research design

Our research is based on a qualitative methodology, using qualitative content analysis as the main approach (Mayring and Brunner, 2007; Saldaña, 2009). To collect relevant qualitative data, both systematic literature review (SLR) (Webster and Watson, 2002; Kitchenham and Charters, 2007) and expert interviews (Bogner *et al.*, 2014; Pfadenhauer, 2009; Wassermann and Niederberger, 2015; Hildebrandt *et al.*, 2015) were conducted, as outlined in Figure 1. The extracted content from the research papers, as well as the interview transcripts were summarized according to the techniques of qualitative content analysis and inductive coding to derive relevant factors was carried out. In this process, two levels of superordinate categories were formed to abstract the content to a higher level to derive our integrated framework (Saldaña, 2009).

The SLR methodology is particularly well suited as a basis for research because its goal is to use a clear compilation of existing empirical evidence and scientific information to show the current state of research on a particular topic (Kitchenham and Charters, 2007). In the case of this research, the SLR was used to collect and evaluate scientific information regarding the key factors of RPA projects.

Expert interviews were chosen as a second method of data collection for this research. This research method is helpful for our aims because it allows complex bodies of knowledge to be reconstructed and then presented in a practical context of use (Liebold and Trinczek, 2009). Typically, this method involves one-on-one interviews with experts or stakeholders, which are conducted on the basis of a guideline (Wassermann and Niederberger, 2015). The experts interviewed include individuals who have extensive specialized knowledge in a particular field (Bogner *et al.*, 2014). This knowledge should lead to new insights with regard to the research question and is used as a basis for problem solving (Pfadenhauer, 2009).

To steer both the literature search and interviews, a diverse set of guiding questions was devised, spanning a wide range of themes to elicit comprehensive insights into the various factors that may impact an RPA project:

Guiding question 1: What are the prerequisites for a company to successfully implement RPA?

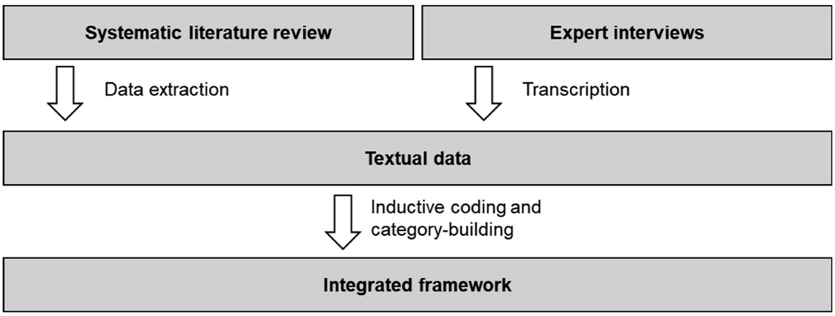

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Figure 1. Overall research design

Guiding question 2: Which maturity criteria should a company meet before undertaking RPA projects?

Guiding question 3: What are the challenges of implementing RPA in a company?

Guiding question 4: What are the barriers that may prevent the adoption of RPA?

Guiding question 5: What factors contribute to the failure of an RPA project?

Guiding question 6: What factors contribute to the success of an RPA project?

3.2 Systematic literature review

The SLR was conducted based on procedures adapted from Webster and Watson (2002) and Kitchenham and Charters (2007).

For the execution of the SLR, suitable databases needed to be selected. Google Scholar and the Web of Science were chosen, since these databases have a large selection of scientific publications concerning the RPA technology. The Google Scholar database was also consulted due to the large amount of grey literature included. Grey literature is literature published by a source that does not have publication as its primary activity (Rothstein and Hopewell, 2009). This includes, but is not limited to, newsletters, reports, journals, working papers, dissertations, government documents and conference proceedings published by professionals and experts in government, academia, business and industry (Rothstein and Hopewell, 2009; Schöpfel and Farace, 2010). In the case of this SLR, the grey literature is crucial, as current literature on RPA is often published by practice-oriented consulting firms and RPA vendors. In addition, the comprehensive search (including the grey literature) helps to counteract bias in the SRL result (Rothstein and Hopewell, 2009).

During the literature search, specific search strings were created for the respective databases. The keywords were extracted from the research questions presented in the introductory section, encompassing a diverse array of constructs associated with factors that could potentially influence an RPA project, including challenges and success factors. The search string was adapted to the different structure of the two databases, as shown in Figure 2. The limited number of filter functions of Google Scholar and the extensive analysis mode of the Web of Science was the main rationale for the different procedure for each database. A less restrictive search string was used for Google Scholar, however, searching in titles only. In Web of Science, on the other hand, the search string was more restrictive with additional words and operators for more precise results. However, it was executed to titles, abstracts and keywords of articles. A total of 237 publications were identified which were then reviewed for relevance to this work according to the following criteria:

(1) The publication includes at least one answer to one of the above sub-questions

(2) The language is German or English

(3) The publication is accessible and persistently available

(4) The publication is not a literature review (in order to use only primary sources)

(5) The publication is not a bachelor's or master's thesis

In addition to the applied criteria, duplicate publications in both databases and citations that were displayed as publications were not considered and sorted out. Subsequently, the publications were sequentially reviewed by title, abstract, full text and extended by three publications from the backward search. The result of the SLR was thus 29 relevant publications for this work (12 from Google Scholar and 17 from Web of Science) (see Figure 2).

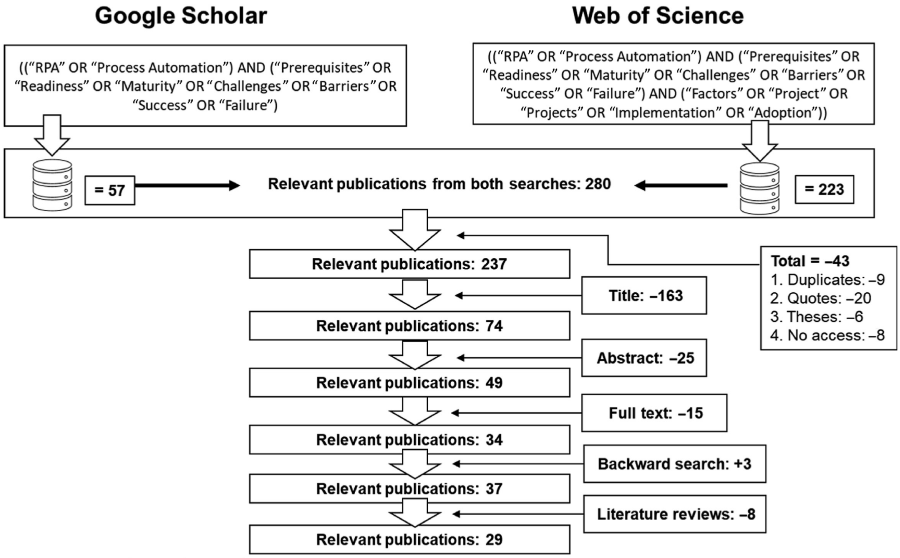

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Figure 2. Procedure of systematic literature review

3.3 Interviews

The systematizing expert interview was chosen as the research design, since a comprehensive survey of expert knowledge regarding RPA technology was necessary. The interview served as a systematic means of gathering information. In this way, the experts were to convey both technical and organizational RPA knowledge in order to close the knowledge gaps in this research (Bogner *et al.*, 2014).

In this context, an interview guideline (Hildebrandt *et al.*, 2015) was designed based on the previously defined RQs, as presented in the introductory section of this paper. In the first four interview questions, the company, the RPA software used and the experience in the field of RPA were to be enquired. Questions 5–8 then dealt with the objectives, the prerequisites and the procedure for RPA implementation in the company (RQ1). This was further elaborated by questions 9–10, which mainly dealt with the challenges of RPA implementation (RQ3). Subsequently, questions 11–12 were intended to address hurdles in RPA implementation (RQ4). Questions 13–14 addressed factors for successful implementation of process automation projects (RQ2, RQ5, RQ6). Finally, questions 15–16 were intended to stimulate further discussion and conclusions on the topic, asking about implementation methodologies and the suitability of different types of firms for process automation in general.

The selection of experts was limited to process managers, consultants, IT specialists and people who deal with the topic of RPA (Hildebrandt *et al.*, 2015). First, the possible target persons were searched for and contacted on the social media platforms Xing and LinkedIn in various RPA groups. Additionally, a process management event was visited where personal contacts could be made with experts in the field of RPA. It is also worth mentioning that no specific sample size was set, but conducting new interviews was discontinued at the point when there was an indication for data saturation (Corbin and Strauss, 2008). Overall, 10 experts were interviewed, as shown in Table 1, which can also be considered as a sample size comparable to similar studies (Diefenbach, 2009; Schneider and Kokshagina, 2021). The interviews were conducted as video conferences via different online conferencing tools such as Zoom, and recorded with a screen recoding tool. Subsequently, a verbatim transcription was done, aided by an AI-based transcription software.

Table 1.
Overview of interviewees

Code	Industry sector	Position/job title
P1	Trade fairs	RPA developer
P2	Industrial manufacturing	Business and IT automation manager
P3	Technical services	Process and project vendor
P4	Banking	RPA manager
P5	IT & consulting services	RPA growth manager
P6	IT & consulting services	Team leader and RPA developer
P7	IT & consulting services	Automation and digitalization Manager
P8	Technical services	Head of department for customer processes
P9	Insurance	Head of process and organizational management
P10	Banking	RPA supervisor

Data were analyzed by an iterative thematic coding process (Braun and Clarke, 2006; Saldaña, 2009) which included detailed listening to the audio recordings and reading of the transcripts (Rubin and Rubin, 2012). Thematic coding allowed us to identify important patterns and key factors in data, which could be grouped in main themes, subthemes and codes (King, 2012), as also illustrated in Figure 3. To support the identification of novel and fresh patterns in data, our data analysis approach was not relying on too strict protocols and procedures (Harley and Cornelissen, 2020). In terms of ensuring quality, the author team

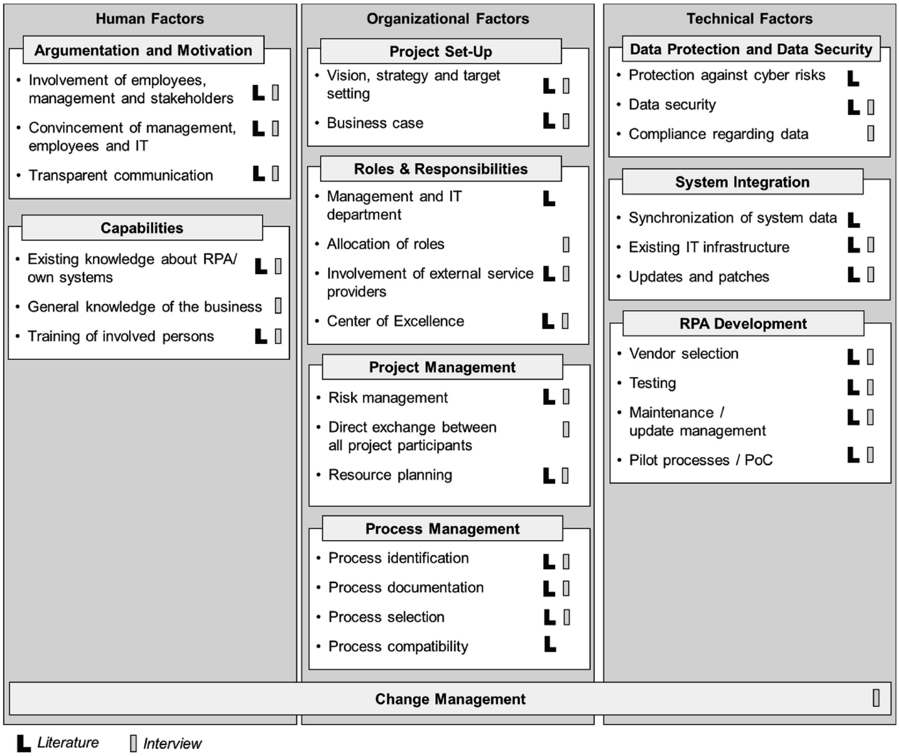

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Figure 3.
Integrated framework

implemented phases of critical reflections and discussion of the data analysis procedures and results throughout the research process and writing up of the research report (Cunliffe, 2003; Kraus *et al.*, 2023).

4. Results on key factors of RPA projects

4.1 Overview

Based on the coding approach as explained in the prior section, taking into account both, the findings from the SLR and the expert interviews, the following framework was developed that consists of three levels (see Figure 3). On the highest level, the factors can be classified as "human factors," "organization factors" or "technical factors" depending on the general nature of the factors. On the lowest level, the specific factors are depicted in bullet point form. They are again grouped into the categories on level 2. The "L" and "I" icons indicate whether the factor results from the literature, from the expert interviews, or, both. In the subsequent sections, the categories and individual factors will be discussed more in detail.

As an additional overarching factor, "change management" has been identified in the interviews (P1, P6, P7, P8 and P9). The introduction of RPA requires refined change management programs and skills capable of governing the interdependencies between the many human, organizational and technical factors. To reflect the comprehensive and multidimensional nature of change management, the factor spans all three areas of the framework.

4.2 Human factors

4.2.1 Argumentation and motivation. When introducing RPA technology, all affected employees, management and stakeholders should be involved at an early stage (Gotthardt *et al.*, 2020; Patri, 2020; Anagnoste, 2018). This makes it easier for stakeholders and management to access and understand information about the current project status (Ekren, 2018).

Also convincing employees, management and IT about RPA can be a challenge (Sarilo-Kankaanranta and Frank, 2022; Figueiredo and Pinto, 2021; Anagnoste, 2018) and (P1, P2, P3, P4, P5, P6, P7, P8, P9 and P10). Data indicate that illustrating the benefits for stakeholders and the success of prior projects can be a key aspect to initiate further automation projects. This is also emphasized by the following interview quote: "Once you have successfully realized a few projects, the so-called success stories are also another success factor that communicates the project's success" (P8). Sufficient communication should also be used to guide and expand the view of employees. It is important to make it clear to the employees that the software robot will not eliminate jobs, but rather should be recognized as a support in the daily business (P7 and P9). Uncertainty and anxiety are phenomena, which can be frequently observed in changing environments. This was also recognized by interviewee P9, who thoughtfully reflects that "especially here, in an increasingly abstract technological world, it is becoming harder to grasp things. And what can hardly be grasped can potentially instill fear in people" (P9). Obviously, this has implications for the success of RPA projects and another interviewee importantly emphasizes that " . . ., if you are open and communicate a lot with people, involving them early on and integrating them, then that simplifies a lot" (P10).

The basis for achieving the previous factor is open and, above all, transparent communication (Schmitz *et al.*, 2019; Katke *et al.*, 2019; Fernandez and Aman, 2021; Anagnoste, 2018; Ekren, 2018). The experts from our interviews also place special significance on this factor (P2, P4, P6, P7, P8 and P10). This factor can prevent a lack of acceptance by the technical departments, for instance (P1 and P10).

4.2.2 Capabilities. In order to implement RPA at all, all project participants should figuratively speak the same language (Sarilo-Kankaanranta and Frank, 2022). However, this is only achievable if each of them is familiar with the technology and has thoroughly analyzed it beforehand. In addition, there should be knowledge of the systems and data involved (Gotthardt *et al.*, 2020; Flechsig *et al.*, 2022; Kulisiewicz and Sobczak, 2018; Katke *et al.*, 2019; Anagnoste, 2018) and (P4). By combining the knowledge about RPA and other involved information systems, the later communication and implementation can be significantly more efficient (P1, P2, P4, P5, P7 and P8).

No less important than the previous point is knowledge of the business processes within the company (P2, P4, P5, P6, P7 and P9). To get the best possible output from RPA implementation, knowledge about the company's own processes must be available. This provides a more efficient way of implementing RPA and adapting it to the business processes (P6).

Depending on the extent of existing knowledge, it is necessary to train the employees and specialize them in RPA (Lamberton *et al.*, 2017; Teunissen, 2019; Wewerka *et al.*, 2020; Ekren, 2018; Figueiredo and Pinto, 2021) (P1, P2, P3, P4, P5, P6, P7, P8, P9 and P10). With the help of the acquired knowledge, the RPA developers and company departments will have the ability to react correctly to system failures and system errors (Fernandez and Aman, 2021). Furthermore, RPA development has a significant impact on the future job activities, this in turn requires a certain level of expertise from the project participants (Schlegel and Kraus, 2023).

4.3 Organizational factors

4.3.1 Project set-up. In order to successfully introduce RPA in companies, all the project participants, and the company management must be convinced beforehand. It is therefore necessary to have a clear and well-defined vision (Lamberton *et al.*, 2017; Schmitz *et al.*, 2019; Gotthardt *et al.*, 2020; Zaharia-Rădulescu *et al.*, 2017; Wallace *et al.*, 2017; Koch and Fedtke, 2020). Another factor that should be considered for a successful implementation of RPA is the development of a clear strategy and target setting (Lamberton *et al.*, 2017; Teunissen, 2019; Figueiredo and Pinto, 2021; Newgen, 2017). As a result, before the start of the project, a well-considered and clear explanation of the objectives should be established. This is one of the fundamental aspects for further steps (Lamberton *et al.*, 2017). All experts from the conducted Interviews confirmed this factor (P1, P2, P3, P4, P5, P6, P7, P8, P9 and P10). This can be vividly illustrated by the following interview quote. For instance, an interviewee very clearly expresses the objectives of RPA projects: "Exclusively saving working time. That was also established right from the beginning. We proceed solely based on how much working time a bot can save. That is the key metric we work with" (P10).

Furthermore, a clearly defined business case is important (Teunissen, 2019; Kulisiewicz and Sobczak, 2018; Anagnoste, 2018). This includes both clear planning and clear objectives (Teunissen, 2019). Benefits through RPA should be seen from the business perspective and not from the one of the IT (Gotthardt *et al.*, 2020). After a process has been automated by the RPA project, relevant metrics such as savings (costs) and service improvements (customer feedback) should be reviewed. The main idea of this is to determine if the ongoing investments for the software robots are profitable or if a high ROI has been achieved (Lamberton *et al.*, 2017; Katke *et al.*, 2019). This factor has been confirmed by several experts who were interviewed (P3, P4, P6 and P7).

4.3.2 Roles and responsibilities. For the successful implementation of an RPA project, the responsible parties in each department involved should be clearly determined. With the help of a clear role allocation, an attempt is made to avoid inconsistency and redundancy in order to ensure secure and stable project operation (Schmitz *et al.*, 2019). Overall guiding principles and the specifications of the project should clearly be defined by the project managers (Lamberton *et al.*, 2017; Flechsig *et al.*, 2022; Teunissen, 2019; Kulisiewicz and Sobczak, 2018; Zaharia-Rădulescu *et al.*, 2017).

The distribution of roles must be considered at different points in time (P1, P2, P3 and P8). On the one hand, once the project objectives and strategy are set, a project team with the appropriate project members should be established. However, it is also important to assign clear roles after the RPA implementation to successfully continue the further development of the RPA solution (P2 and P8). The collaboration between the different involved parties is essential, especially between internal and external ones, as they naturally have different views and levels of knowledge. From the consultant perspective, an interviewee usefully reflects on the following: "The biggest challenge for me is to understand the department and the processes. That is simply the biggest challenge because we understand the technology and have knowledge about automation. However, we have no idea about the specific business processes. On the other hand, there is the department, which has limited understanding of the technology but knows its processes well. The biggest challenge is actually to form a good symbiosis in order to achieve the maximum value in the end" (P6).

There is often the situation in companies where the knowledge about RPA is not existing or not sufficient to successfully carry out an RPA implementation by the company itself. For this purpose, external RPA service providers are contracted. They support the companies by providing RPA knowledge and with the implementation (P4). Having the access to such external knowledge can be a major key factor, as the provided support can be pivotal for the project success. This is nicely described by the following quote: "It is also possible that, in the end, the customer needs to be guided and simply shown how it should be done correctly" (P5). In connection with this, it is crucial to have up-to-date and clean process documentations in order to facilitate the involvement of external service providers (P2, P5 and P6). This factor has been confirmed by almost all the experts who have been interviewed (P1, P2, P3, P4, P5, P6, P7, P8 and P9).

Also establishing a dedicated RPA Center of Excellence can be an important factor in RPA implementation (Lamberton *et al.*, 2017; Sobczak, 2021; Anagnoste, 2018) (P2, P5, P8 and P9).

4.3.3 Project management. One of the factors that is seen as a safeguarding measure is risk management (Ubert and Alcala, 2020; Wallace *et al.*, 2017). The disregard of risk management can be a problem because the risks for the RPA cannot be identified in time and the preventive measures cannot be planned (P7, P9 and P10). This would in turn lead to delays in the project (P2).

According to the experts, a direct exchange and cooperation between all project participants leads to a successful implementation. It is especially important to communicate regularly about the open topics and to exchange information and new findings (P1, P3, P5, P6, P8, P9 and P10).

Another factor concerns resources and resource planning (Schmitz *et al.*, 2019; Gotthardt *et al.*, 2020; Teunissen, 2019; Axmann and Harmoko, 2020; Wewerka *et al.*, 2020; Figueiredo and Pinto, 2021). Incorrect planning of resources such as time, budget or personnel can cause immense costs and delays (Lamberton *et al.*, 2017) and (P1, P2 and P9). This may break the project budget and scope and ultimately lead to the failure of the project. The prevention of this event requires a good planning approach. However, with a good organizational structure, it is possible to exploit the full potential of RPA (Sobczak, 2021; Gotthardt *et al.*, 2020). Also in the interviews, nearly all the experts mentioned this factor (P1, P2, P3, P4, P5, P6, P7, P8 and P9).

4.3.4 Process management. Before RPA is implemented in a company, the key processes should first be identified (Lamberton *et al.*, 2017; Flechsig *et al.*, 2022; Teunissen, 2019; Patri, 2020; Andrade, 2020; Kulisiewicz and Sobczak, 2018; Katke *et al.*, 2019; Axmann and Harmoko, 2020; Fernandez and Aman, 2021; Zaharia-Rădulescu *et al.*, 2017). This establishes the fundament for the decision, which processes will be automated in order to achieve the highest possible benefit from the project (Patri, 2020) (P2, P6 and P7).

Process documentation has an important role to play in the implementation of RPA (Fernandez and Aman, 2021; Sarilo-Kankaanranta and Frank, 2022; Zaharia-Rădulescu *et al.*, 2017; Ekren, 2018). Existing process documentation will facilitate later process selection and thus also RPA implementation (Fernandez and Aman, 2021). A lack of documentation can in turn have a negative impact on costs and effort (Lamberton *et al.*, 2017) and (P1 and P5). Furthermore, a well-maintained process documentation simplifies the onboarding of internal, as well as, external stakeholders (Schlegel and Kraus, 2023) and (P1 and P6). Regarding this aspect, an interviewee emphasizes that " . . . ideally, one would request some kind of process documentation beforehand, whether be that through video, Word, Excel . . . ". (P6).

Many studies indicate that process selection is a component of RPA implementation that needs to be considered (Patri, 2020; Teunissen, 2019; Ubert and Alcala, 2020; Pomffyová *et al.*, 2017; Arias-Pérez and Vélez-Jaramillo, 2021). According to Lamberton and Andrade, the most important thing is to first identify the simplest and most valuable parts of a process and then automate them (Lamberton *et al.*, 2017). The importance of process selection was also confirmed through the expert interviews (P1, P2, P4, P6 and P7). Data show that metrics such as the automation potential, the potential of cost reduction or the saving of working time can be used as selection criteria. An interviewee describes his approach as follows: "We then overlay these [metrics] and determine a respective score between zero and one. The higher the value, the greater the potential" (P7). These metrics are then also frequently being used in internal communications, which has been earlier identified as a key factor.

Another factor is the process compatibility (Ubert and Alcala, 2020; Rutschi and Dibbern, 2019). In this case, it is significant to ensure that the applications and system are compatible with RPA Technology, otherwise the benefits through RPA cannot be realized (Axmann and Harmoko, 2020).

4.4 Technical factors

4.4.1 Data protection and data security. When implementing RPA, companies must be aware that an RPA system is not automatically protected from cyber risks and misuse, and that data can be leaked (Gotthardt *et al.*, 2020; Patri, 2020; Flechsig *et al.*, 2022). This could be, for example, misuse of privileged access, exposure of sensitive data, or system security vulnerabilities (Gotthardt *et al.*, 2020).

Furthermore, when considering the factors that affect the field of data, the main problem with RPA implementation is data security (Gotthardt *et al.*, 2020; Patri, 2020; Katke *et al.*, 2019). If problems are expected in this sphere, the management might no longer consider RPA implementation and corporate IT may block the RPA project (P5). Therefore, to ensure data security, it is crucial to monitor and track all elements of an RPA robot from the beginning (Newgen, 2017). The experts also indicate the importance of this factor (P2, P3, P4 and P10).

It is necessary to be careful while processing the data (P4, P5 and P7). The reason for this is that sensitive data of a company or another customer can be processed to the wrong customer (P4). This can also lead to legal consequences. At this point, the exchange with the legal department takes on a whole new and high level of importance. Data protection should also be reviewed in detail by the legal department (P2, P3 and P10).

4.4.2 System integration. Another technical factor is the synchronization of the system data (Åkerberg *et al.*, 2021; Pomffyová *et al.*, 2017). It is important to note that the complexity of multiple enterprise systems increases with their interoperability (Flechsig *et al.*, 2022). Thus, it is crucial here to synchronize the different data formats in order to ensure correct processing on the part of the system (Åkerberg *et al.*, 2021; Pomffyová *et al.*, 2017).

The existing IT infrastructure in the company and its complexity may lead to the rejection of RPA (Lamberton *et al.*, 2017; Flechsig *et al.*, 2022; Kulisiewicz and Sobczak, 2018; Katke *et al.*, 2019; Axmann and Harmoko, 2020; Zaharia-Rădulescu *et al.*, 2017). The main reason for this is the high cost for improving or optimizing the existing IT infrastructure (Flechsig *et al.*, 2022). Another reason are old systems, where the RPA implementation could lead to system breakdown (Katke *et al.*, 2019). Outdated database systems and inappropriate system interface can also be a challenge for the companies, as the interconnection to the other system becomes much more difficult. In summary, this factor has an important contribution in the implementation of RPA (P2, P4, P6, P8 and P9). It is also important to not see an IT infrastructure as a static phenomenon, systems are characterized by different positions in its lifecycle and may be replaced by succeeding systems. Concerning this interviewee P9 reminds us of the following: "Especially when there is a system, which is in the process of being replaced, you really have to think carefully about what you are exactly going to do now" (P9).

In general, system and programming errors are a challenge from a technological point of view. These issues can lead to errors when RPA is deployed in later phases (Fernandez and Aman, 2021). Therefore, it is even more important to ensure the necessary configuration of the bots through regular updates (Flechsig *et al.*, 2022) and (P1, P2, P3 and P10).

4.4.3 RPA development. Especially important before the RPA implementation is the vendor selection, and there are a few different aspects to consider when choosing an RPA vendor (Alison and Caitlin, 2019; Newgen, 2017). First of all, it is crucial to determine the necessary solution for the existing needs of the company (P3). It should also be noted that not all RPA providers are compatible with the company-wide infrastructure (Katke *et al.*, 2019). Another, more cost-related point is selecting the right pricing model or one that suits the company's own requirements (Axmann and Harmoko, 2020). One factor that was identified in the expert interviews refers to the selection or purchase of the suitable RPA software package (P5). Here it is important to compare and match the RPA software package with the company's own needs. According to the expert P5, an unsuitable RPA software package can lead to the fact that only a part of the functions can be used (P5).

A mandatory and significant step before the final RPA implementation, like in all software development projects, is proper testing (Andrade, 2020; Fernandez and Aman, 2021; Sarilo-Kankaanranta and Frank, 2022; Figueiredo and Pinto, 2021) (P2, P5 and P10). The testing methods are used to check the software solution for software or system errors before the deployment (Rutschi and Dibbern, 2019) and (P2 and P5). This also refers to the relationship of test and productive systems to minimize the risk of encountering errors. Here, importantly an interviewee reflects that "from a fundamental configuration perspective, test system must match the productive system one-to-one. The only aspect, where it may differ is the data contained within" (P6).

The maintenance and update management mainly refers to the continuation and further development of RPA (Andrade, 2020; Fernandez and Aman, 2021). In other words, it takes place after the RPA deployment. Nevertheless, the resources for this should already be planned at the beginning of the RPA project in order to avoid unexpected costs later (Axmann and Harmoko, 2020) (P2, P8 and P9).

A proof-of-concept (PoC) can be used as an argumentation support towards the management and stakeholders of the process automation (Lamberton *et al.*, 2017; Gotthardt *et al.*, 2020; Andrade, 2020; Kulisiewicz and Sobczak, 2018; Zaharia-Rădulescu *et al.*, 2017). The PoC can be linked to a business case that describes the deployment method, costs and ROI (Lamberton *et al.*, 2017). Furthermore, the PoC indicates to the stakeholders which process data must be made available for the project. If the specified data is not supplied or approved, there is a risk of a bottleneck in the development of the entire project (Peoples, 2021). The importance of this factor was also confirmed by the expert interviews (P2, P3, P4, P7, P8, P9 and P10). Data also usefully refers to the impact the very first automated processes and PoC can have to serve as catalyst. Here interviewee P7 vividly explains: "You have to understand, the very first PoC, the very first process you want to automate in the company; it has to be impactful. It has to work; it needs to have a wow-effect. It must shake everyone up, everyone must be happy with it in the end. Because only if we achieve this success, it is a successful start." (P7). Importantly, these success stories can then be used as an argument to automate further processes, as indicated in section 4.2.1.

5. Discussion

To summarize the results, it can be said that there are a large number of factors that organizations must consider when implementing RPA. In interpreting and applying the factors, a relationship and dependency of the mentioned factors must be taken into account. For example, good goal setting also has an impact on how convincingly RPA technology can later be communicated to management and employees. In turn, they may approve resources for the RPA project. This requires, among other things, appropriate knowledge on the part of the RPA representatives. But also the required knowledge about the existing system interfaces in the company is linked to the later vendor selection for the RPA project.

Our findings add to prior work by other authors that have conducted related research. Plattfaut *et al.* (2022) follow a comparable research design and deliver interesting insights into critical success factors for RPA. In contrary to our thematic clustering of factors, they present a framework of factors grouped into contextual clusters: development structures, change management and strategy and organizational setup. Besides triangulating their results and confirming most of their findings, our paper contributes by providing additional factors and considerations: First, we have identified risk management as an important separate consideration in the organizational category. Second, we complement the findings by adding additional technological considerations such as system integration, which can be critical for RPA success and thus should also be considered from a managerial perspective. Other recently published frameworks that intend to guide RPA implementation have a more narrow focus, such as the performance assessment framework by Šperka and Halaška (2023) which presents as data-driven approach for the selection of business processes and can be seen as a specific technological approach to address the factor "process selection" from our framework.

Although RPA itself is a relatively new phenomenon, the results should also be interpreted with reference to established knowledge from a broader context. As critically pointed out by Kautz and Nørbjerg (2003), researchers often tend to erroneously perceive challenges in emerging technologies as unique and novel phenomena, even though problems that are experienced might be persistent in information systems development in general. While Plattfaut *et al.* (2022) usefully differentiate between RPA-specific and non-RPA-specific factors in their research, we are going to adopt a broader perspective with the intention to increase the scope of the discussion by comparing similarities and differences between RPA-related results and prior work in a broader context, as well as putting the results in a larger theoretical perspective. We will do so by examining one classic paper from the historical context of information systems development (ISD) in general (Kautz *et al.*, 2007), as well as, recent previous results on other specific types of information systems. For the latter, we use artificial intelligence (AI) as another example of a recent emerging technology (Schuler and Schlegel, 2021). After briefly discussing the two papers, we will derive general conclusions from the comparison and integrate these into the wider body of literature.

Kautz *et al.* (2007) have conducted a study on persistent problems in information systems development. In the context of Internet technology, which was an emerging phenomenon in the 2000s, they analyze claims that web development revolutionizes traditional ISD. Based on a literature review and detailed comparison of four empirical studies (Nørbjerg, 1994; Kautz and Madsen, 2004; Curtis *et al.*, 1988; Baskerville and Pries-Heje, 2004), they find that the observable changes are a continuation of historic trends, i.e. an evolution rather than a revolution. According to the authors, there are three inherent and interrelated problems:

diversity, knowledge and structure. They find that there are three types of practices that organizations use to cope with these challenges, which are "(1) organization and specialization; (2) constant verbal communication and negotiation; and (3) pragmatic application of certain development methods and methodical concepts" (Kautz *et al.*, 2007).

Schuler and Schlegel (2021) adopt a more narrow focus in their research and outline important aspects that should be considered when formulating an AI strategy. Their framework is based on an analysis of 57 papers that were identified in an SLR. According to their research, important factors for an AI strategy are data, organizational aspects, infrastructure, capabilities, legal and ethical constraints, use cases and managerial processes.

When comparing the results of the related studies with our results, one also has to be aware of the related, but different themes or constructs that have been used. While Kautz *et al.* (2007) analyze "problems" or "challenges," Schuler and Schlegel (2021) talk of "strategic factors." Other common themes in information systems literature, using the example of research on AI projects, include "enablers and success factors" (Bauer *et al.*, 2020), "readiness factors" (Jöhnk *et al.*, 2021) or "failure factors" (Westenberger *et al.*, 2022). In this paper, we have analyzed "key factors" to consider which we define as elements that play a crucial role in achieving a successful project outcome. In that sense, key factors may have the nature of a challenge, as well as, a solution to a challenge or an enabling factor.

Based on the comparison of our results with the prior literature, we derive the following observations. On the one hand, our analysis does support the argument of persistent and inherent problems in ISD (Kautz *et al.*, 2007; Kautz and Nørbjerg, 2003). This aspect will be discussed in the subsequent paragraphs. On the other hand, relevant differences from the comparison are shown that highlight the need and contribution of domain- and technology-specific research, which will be discussed in the final paragraph of this section.

Indeed, as suggested by Kautz and Nørbjerg (2003), many aspects that need to be considered in RPA are not unique to RPA and can be rooted back to the underlying generic phenomena. Therefore, it can be concluded that RPA extends ISD into new domains and may change the roles of users, developers and the IT function, but many of the key factors we have known in the past persist (Kautz *et al.*, 2007). This includes for example the following key aspects that can be mapped into Kautz *et al.*'s (2007) framework and supported with additional previous work:

First, the important and overarching role of knowledge has to be emphasized. According to our research, project members must have knowledge about RPA, but also knowledge of the firm from a business perspective. Also Schuler and Schlegel (2021) emphasize the role of capabilities on the organizational, as well as, individual level of employees. According to Kautz *et al.* (2007), system developers need knowledge about "the three areas of technology, applications and people." It is worth noting that the required knowledge obviously does include technical skills; however, business and soft skills seem to be at least equally important (Schlegel and Kraus, 2023).

Second, communication is a recurring theme in the various pieces of research. It is important as a coping mechanism to deal with uncertain customer requirements. Also constant verbal interaction in non-written form to align different stakeholders is recommended (Baskerville and Pries-Heje, 2004; Kautz *et al.*, 2007). This is in line with our findings that suggest direct exchange between all project participants. Besides the important role communication plays in requirements and expectations management, it is also important to convince different stakeholders of the project's benefits and get their support. Schuler and Schlegel (2021) especially emphasize the required top management support for a successful adoption of AI.

On the other hand, the comparison between the papers on AI and our research on RPA shows that different types of information systems do have different specific challenges when looking on a more detailed level. For instance in the case of AI, having relevant data in the right quantity and quality is of utmost importance (Schuler and Schlegel, 2021; Westenberger *et al.*, 2022), whereas this aspect is of minor importance in the case of RPA. In contrast, the methodological consideration of process management aspects is a key factor in RPA. While this finding does not contradict the perspective that many issues in ISD have the same underlying root phenomena, it does show that there are differences when analyzing practical aspects on a lower level of abstraction than the perspective taken by other work (Kautz *et al.*, 2007; Kautz and Nørbjerg, 2003). Therefore, we argue that domain-specific and system-type-specific research does provide valuable insights and especially practical guidance.

6. Conclusion

In our research, we have identified and classified key factors that play an important role for the successful adoption of RPA. The research has also shown that many of the factors mentioned have already been addressed in different studies in the literature. However, our research contributes to knowledge by synthesizing previously dispersed knowledge and providing a comprehensive framework of what is known today, as well as, by complementing existing knowledge with new empirical findings from extensive interviews with practitioners.

In sum, RPA technology has the potential to bring significant benefits to businesses, but it is important to consider the potential challenges that may arise when implementing it. It emerged from the results that non-technological factors, in particular, take on a more prominent role compared to technological factors in RPA implementation. It should also be noted that all the factors mentioned are interrelated and interdependent. Thus, it is especially important for stakeholders involved in RPA projects to pay attention to the connections between these factors. The implications of our findings are multifaceted and particularly relevant for the implementation of RPA in organizations. For executives and decision-makers, our research provides valuable insights into the critical factors affecting successful RPA implementation, enabling them to make informed decisions, devise effective strategies and ensure the alignment of RPA initiatives with organizational goals. Project managers, on the other hand, can benefit from a clearer understanding of the intricate interdependencies between these factors. This deeper comprehension allows them to enhance project management practices, allocate resources more efficiently and proactively mitigate risks. Furthermore, our research is also a valuable resource for technical and business consultants. Technical consultants can gain a deeper understanding of the non-technological aspects that are pivotal in RPA projects, enabling them to provide more effective guidance and support. Similarly, business consultants can leverage our research to offer comprehensive advice to organizations aiming to adopt RPA.

Besides these practical implications, we have provided a theoretical contribution by discussing our results in the light of the debate concerning the uniqueness or generic nature of challenges that accompany emerging technologies. We have shown that our results support both, the idea of persistent problems in ISD (Kautz and Nørbjerg, 2003; Kautz *et al.*, 2007) and the perspective that technology-specific research on key factors provides an important contribution. Moreover, our research importantly extends already existing, recently developed conceptual models, such as the one presented by Plattfaut *et al.* (2022) by identifying additional key factors in the organizational and technological domains.

As every research, our work also clearly has its limitations. In our qualitative research design, we have taken measures to reduce subjectivity and bias, such as critical reflection and repeated discussion within the team of authors. However, due to the nature and sample size of the empirical research, the results might not allow for generalization to all organizations. Additionally, due to the conscious selection of databases and filter criteria in our SLR, some previous findings may have been missed out. By conducting a backward search, we have intended to mitigate this risk.

Based on this work, exciting avenues for further research have emerged. First, it was suggested by the interview participants that future research could deal with the factors after the RPA implementation to ensure sustainable value within the information system lifecycle. Second, a quantitative methodology might be interesting to corroborate our findings. Thus, our framework could be further tested and refined, the relative importance of the key factors could be evaluated and representative or generalizable results might be achieved. Third, the research could be expanded to the topic of hyperautomation, i.e. the connection of multiple systems and technologies such as RPA and AI to automate business processes. Here, it would be particularly interesting to see what factors would need to be considered to successfully connect multiple systems and how these factors differ from the RPA context. Finally, future research could focus more on the technical factors identified in this research and develop a process model to guide the technical implementation of RPA.

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