Robotic Process Automation: Hype or Hope?

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Abstract. Robotic Process Automation (RPA) is a fast-emerging process automation technology suited for high-volume, repetitive, and rule-based tasks. The promises of rising RPA vendors and the lack of documented track records leave researchers and practitioners with the challenge of positioning the term and assessing RPA's true potential. To objectively discuss the strengths and weaknesses of this technology, we conduct a literature review, a practical implementation of an RPA solution, and an interview with an industry expert. We reveal that the current literature primarily focuses on economic factors. This paper, therefore, adds various social and technical aspects to the discussion. Most importantly, robustness and stability pose technical challenges for successfully implementing RPA. Further research directed at error handling and maintenance of software robots is required to support the successful implementation of RPA.

Keywords: Robotic Process Automation, RPA, Software Robotics, Business Process Management, Automation

1 Introduction

In recent years, Robotic Process Automation (RPA) has emerged as a novel solution for business process automation [1, 2]. The technology has received increasing interest in business research and practice: For instance, the number of publications on this subject is steadily rising [3]. Additionally, the RPA market is predicted to reach a market volume of $ 2.9 billion in 2021 [4]. As a result, many RPA tool vendors have surfaced [5], promising a variety of excessive benefits of this technology. However, the technology lacks credentials that are "backed up with a variety of business cases and decades of experience" [6]. Consequently, it is difficult for researchers and practitioners to determine which possibilities and risks are ultimately incorporated. As a result, companies risk unsuccessful investments, and researchers cannot evaluate if RPA is a promising field of research in which they should engage.

To solve this issue, insights from literature must be combined with practical experiences to get a genuine understanding of its potential. This paper aims to understand the driving forces behind this trend and to objectively discuss the strengths

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and weaknesses associated with RPA. It serves both practitioners as well as researchers by combining an overview of the current state of literature with the practical know-how of an RPA implementation and a realistic assessment of an industry expert.

This paper is structured as follows: In Section 2, we conduct a literature review to obtain a standard definition of RPA and isolate the strengths and weaknesses identified in the literature. We use search strings mainly consisting of terms such as "Robotic Process Automation", "RPA", "strength", "weakness", "challenges", and "risks" in Scopus and Business Source Complete (EBSCO database) to search for topic-related scientific papers. Afterwards, we apply backward search [7] to find additional sources. We seek to solely incorporate peer-reviewed journal articles and scientific conference papers in our analysis. We assess the relevance of each paper for this research and conclude our search with 27 references. Among these are 14 journal articles (published in 2014 (1), 2016 (2), 2017 (3), 2018 (6), 2019 (2)) and 13 conference papers (published in 2017 (2), 2018 (9), 2019 (2)). The findings of the literature review are gathered in structured concept matrices as proposed by Webster and Watson [7]. In Section 3, we carry out an experiment in which we automate the process of business report creation with RPA. With this experiment, we gain insights into RPA practices and outline encountered challenges. Furthermore, in Section 4, we present the results of a qualitative survey with a senior manager for RPA implementation at a leading sportswear manufacturer to further explore the application of RPA in practice. Finally, we conclude the paper with a discussion of our results in Section 5.

2 Literature Review

2.1 Definition and Positioning of RPA

Concerning the definition of RPA, we observe no consensus in the examined literature. Most authors emphasise that RPA mainly focuses on automating the execution of tasks that were previously performed by humans [2, 8–12]. For this purpose, software robots are configured to capture and interpret existing applications [1, 2, 13] mostly on the level of graphical interfaces [5, 9, 14]. Thus, the robot imitates human activity [6, 8, 15, 16] to carry out workflows consisting of multiple steps [17]. In general, definitions of RPA vary depending on the level of abstraction and the technique used to configure a robot. RPA is often referred to as a software instance [16–19] or the configuration of a software [11] which automatically executes selected tasks [18]. However, Fernandez and Aman [13] include methods, systems, and tools, as well as measures to identify suitable processes in their definition. In comparison, van der Aalst et al. [5] define RPA as an umbrella term for tools that operate on user interfaces in the same way as humans. They, thereby, focus on the imitation aspect. When considering the technique used to configure a robot, we observe different methods, including the recording of workflows, the creation of process flowcharts, and the use of scripting [14, 20]. When recording routines on graphical user interfaces, RPA tools retrieve anchors through APIs and HTML code

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[5]. Additionally, we observe diverging opinions on the inclusion of traditional screen scraping [5, 11, 12, 21], which only relies on pixel coordinates on the screen to replicate user actions [11]. In flowcharts, configured process elements are visually arranged to display the process execution. To enable easy reuse and update of modelled sub-processes, components can be grouped in packages and published in process libraries [14]. The third mentioned technique to configure robots is developing scripts which involves programming [14, 20]. Nonetheless, it is stressed that RPA developers do not need any knowledge of programming languages for successful implementation [6, 11, 15, 21]. Furthermore, some authors mention the conjunction of RPA with artificial intelligence (AI), cognitive computing, and robotics [2, 5, 22, 23]. These technologies form a framework for RPA and enable robots to learn and make decisions resulting in intelligent automation [2, 5]. To recapitulate, user interface-based automation of manual tasks constitutes the heart of RPA. However, the exact scope of the term and the inclusion of related technologies are debated.

While we do not want to elaborate on the question of when and where to apply RPA, we consider it an important aspect to understand the technology. The examined literature mostly mentions the following requirements: There should be a high volume [1, 4, 6, 8, 9, 11, 12, 14–16, 21, 24, 25] of repetitive processes [1, 4, 8, 9, 11–13, 24] to justify the costs associated with an automation project [24]. Furthermore, the processes should be rule-based [1, 4, 8, 9, 11, 12, 14, 15, 24, 26] and consist of fixed procedures [9].

2.2 Strengths and Weaknesses of RPA

Having established an understanding of the term of RPA, we now present the strengths and weaknesses of RPA commonly discussed in the reviewed literature. The findings are displayed in Table 1. The illustrated numbers of mentions reveal a predominantly positive rating of the technology.

The most frequently named strengths of RPA revolve around cost savings [2, 4, 6, 8, 9, 11–13, 15, 16, 18, 20, 27]. Kaya et al. [2] disclose that the costs of an RPA solution can be one-fifth of the price of a full-time employee performing the same task. These savings can be attributed to the low-cost implementation [4, 10, 11, 14] and inexpensive integration of RPA into an organisation's infrastructure due to its non-invasive nature [12, 14, 15, 25]. Compared to other automation solutions, RPA is considered "lightweight" IT [11, 14]. As RPA solutions sit on top of existing systems [11, 15], no underlying system's program logic needs to be adjusted [5, 6, 8, 11]. Thus, technical disturbances to the underlying systems are prevented [11]. Furthermore, RPA offers easy configuration [2, 6, 21] since programming skills are not required, as indicated in Section 2.1. Consequently, non-technical employees are enabled to configure software robots [10–13]. When assessing the performance of RPA, the examined literature emphasises increased productivity and improved quality of work [16] concerning accuracy [1, 2, 9, 12, 13, 19] and efficiency [1, 2, 13, 16, 27]. Additionally, reducing human negligence [13] leads to fewer errors [2, 13, 14], which increases the consistency [9, 12] and reliability [12] of activities. Moreover,

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significant time savings are named as another benefit of RPA [19]. This aspect allows employees to refocus on more exciting and high-value tasks [1, 6, 11–13, 18] such as innovation [2] and customer service [2, 12, 16]. As a result, both employee and customer satisfaction can be improved [14, 27]. Besides, RPA can achieve reductions in human labour [4, 11, 13, 15, 16, 21]. Multiple authors ascribe these aspects to the quick implementation [6, 11, 14] and 24-hour availability of robots [2, 4, 12–14]. Furthermore, RPA bears the advantages of both high flexibility [18] and scalability [2, 9, 15, 16, 21]. In summary, the effective but also inexpensive way of automation with RPA can lead to a considerable return on investment (ROI) [4, 14].

Despite fewer mentions in the literature, some weaknesses of RPA are also exposed. First of all, the identification of processes suitable for automation [1, 6, 14, 27, 28] poses a significant challenge. If non-suitable processes are automated, costs can outweigh savings [9]. The lack of human checking [18] and the non-existent consciousness of software robots [21] are cause for a series of further weaknesses. If an implementation solely includes clicks and keystrokes, the configuration of a robot cannot be repurposed or reused [21]. Since the robots lack awareness of business contexts and emerging difficulties [21], mistakes in their configuration remain unrecognised by the robots [21]. Especially when a large number of robots are deployed, extended quality testing [20] is crucial to avoid any negative consequences [16, 20]. Leno et al. [20] state that the process of implementation is, in fact, time-consuming and prone to errors, which contradicts the above-mentioned short implementation time. Additionally, Kopeć et al. [28] address the need for tedious and costly maintenance of robots caused by either process complexity [9] or required adaption to changing environments [14]. Moreover, the review displays multiple social aspects as challenges for RPA. Staff reductions [13] resulting in job losses [28] are potential causes for internal tensions [6]. Software robots can also be regarded as competitors by employees [6, 13] because some jobs might be taken over by robots [13]. Additionally, acceptance problems can arise from employees being frightened to learn about the use of new technologies or simply being reluctant to change their work habits [13]. Hence, Anagnoste [27] states that effective change management is required to ensure the smooth incorporation of RPA [13]. Additional weaknesses include the need for know-how and skills to build RPA solutions [27]. Lastly, Asatiani and Penttinen [6] raise a compelling argument, showcasing that the flexible front-end approach of RPA is “inferior to back-end integration designed for machine-to-machine communication”[6]. They explain that the current state of RPA represents a temporary solution filling the gap between manual and fully automated processes [6].

In summary, the examined literature focuses on the benefits of RPA and mainly discusses economic aspects for companies.

3 Experiment “Automated Business Report Creation”

In the following, an exemplary process is automated with RPA to achieve a better understanding of the technology and to add practical insights to the findings of our

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literature review. At first, we explain the original ("As-Is") and automated ("To-Be") processes. Subsequently, the experiences gained from automation with RPA and the occurred challenges during the development are discussed.

3.1 Problem Definition

Experiment Scenario. The subject of our experiment is the task of creating business reports. Business reports summarise information which is extracted from a large amount of data [29, 30]. Overall, business reports are crucial to a company's Management Team to responsibly base their decision-making on information [29] about the current state and activities of the company. Therefore, a Charting Team provides reports which often include data visualisations such as charts, enabling a more comfortable and faster analysis by the Management Team. In our scenario, the company is a manufacturer of bicycles. Thus, the Management Team needs to make decisions concerning production rates as well as logistics based on stocks of bicycles in different business locations.

As-Is Process. The current non-automated business report creation is modelled in a BPMN diagram, as illustrated in Figure 1. First, the Charting Team searches for the data and extracts it from the company's SAP system. An employee then creates a new PowerPoint presentation containing a chart of the previously filtered data and sends it to the Management Team via email. Subsequently, the Management Team receives the report and analyses it. The results of this analysis then support the Management Team in their decision-making.

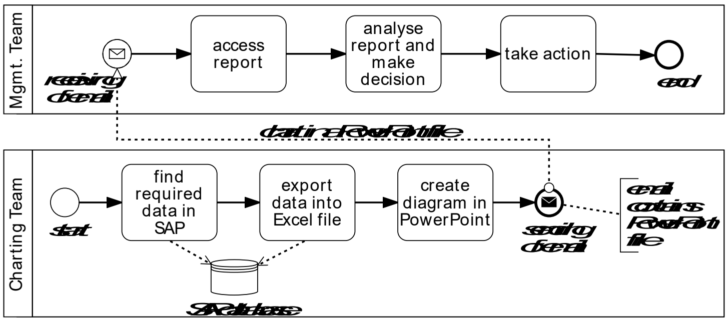

Figure 1. As-Is process of experiment scenario "business report creation"

3.2 Solution Design

To-Be Process. The process steps of the Management Team remain the same because the analysis of reports and the decision-making are sophisticated, non-standardised tasks. Instead, the manual task of business report creation, which was previously executed by the Charting Team, can now be performed by the robot, as displayed in the BPMN diagram in Figure 2.

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Successful Execution. A timer event triggers the robot at a previously set time. All relevant information is extracted from a configuration file during the first step of the process. Similar to the Charting Team in the As-Is process, the robot then performs steps to export the required data from SAP and to create a chart from the exported data in a PowerPoint presentation. Afterwards, the robot sends the presentation to the Management Team via email. Subsequently, the robot terminates and waits for a new execution trigger.

Exception Handling. In case an error occurs during the run time of the robot, both the IT-Support and the Charting Team are informed via email, containing relevant information for each target group. The Charting Team can react to the failure by pursuing the process manually to ensure the Management Team receives the report in time. In the meantime, the IT-Support can identify the cause of the fault and fix the problem to ensure faultless process executions in future runs.

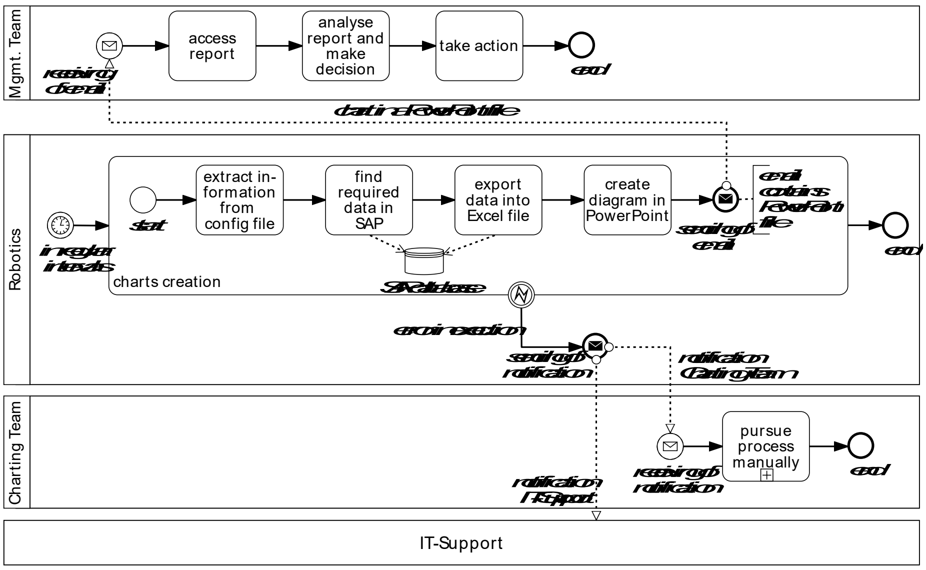

Figure 2. To-Be process of experiment scenario “business report creation”

Implementation. To automate the described To-Be process, we implement the configuration of a software robot with the UiPath Community Edition[2]. This program allows the selected recording and triggering of graphical user interface (GUI) actions in arbitrary applications through extracted identifiers of GUI elements and screen scraping. In addition, predefined packages for uniform sub-processes are available. We divide the process into five workflows to enable separate debugging and testing of independent sub-processes. The execution order, including input and output

[2] https://www.uipath.com/developers/community-edition (Accessed: 13.10.2019)

parameters of each workflow, is illustrated in Figure 3 and is further discussed in the following section. A video on YouTube[3] shows the successful execution of the prototype.

The purpose of the *Main* workflow is to invoke the other four sub-workflows with the required arguments. The *Configuration* workflow extracts the relevant process information from a configuration file (Excel file) and passes it to the *Main* workflow. Next, *Data Extraction* is initiated, which includes the steps of authentication and navigation in SAP as well as the actual data export into an Excel file. Upon completion, *Data Preparation* filters the previously obtained Excel file, so only relevant data (bicycle stock per business location) remains. The *Chart Creation* workflow produces a chart within the pre-processed Excel file which is then inserted into a new PowerPoint file. Finally, the presentation is sent to the recipient's email address.

Within these workflows, we attempt the usage of packages or extracted identifiers of clicked elements whenever possible. However, this approach is not feasible for all activities. Therefore, workarounds with hotkeys and screen scraping are used in these cases, as further outlined in Section 3.3. Overall, it is indeed possible to implement the entire workflow without any knowledge of specific programming languages.

[3] https://youtu.be/VGpkmvvlBRg

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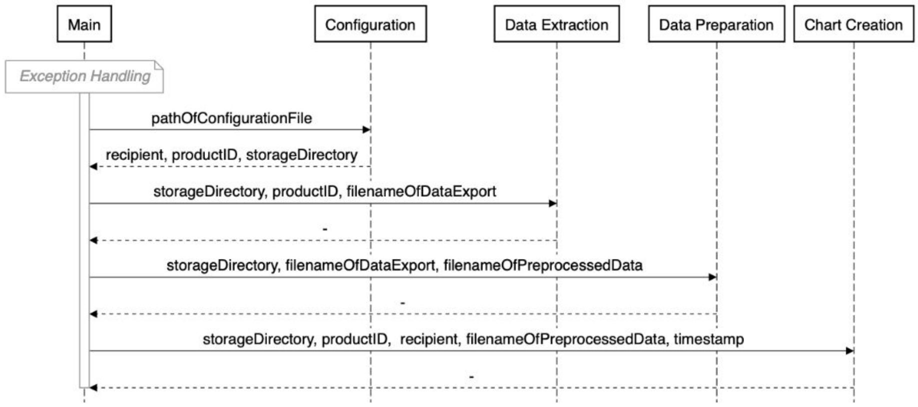

Figure 3. Visualisation of the interdependency of workflows

3.3 Challenges during Development

During the implementation, the incorrect recognition of elements and missing packages pose significant challenges. In Excel, the RPA software does not recognise single cells or columns and only offers the possibility to select a whole worksheet. In SAP, the RPA software sometimes does not identify elements correctly, e.g. the navigation section on the start page. In contrast to Excel, suitable packages to avoid these problems do not exist for SAP. Consequently, we implement navigation in SAP by using workarounds with hotkeys and screen scraping as only the pixel position of elements can be identified. This solution is not desirable because changes to the applications' GUIs may result in the failure of the robot. These unexpected problems with utilised applications slow down the development process.

After the implementation, we observe additional challenges during testing of the prototype. In PowerPoint, a small sidebar occasionally pops up. Although this sidebar is not positioned near any used elements, the robot can no longer identify them and therefore fails to proceed. To fix this problem hotkeys – which do not depend on explicit identifiers – are used again. This issue emphasises the importance of an extensive testing process to reveal events potentially occurring at run time. Automatic adjustments to changing GUIs are not possible with RPA [20, 21]. Thus, handling of possible exceptions needs to be modelled manually and can thereby only contain previously thought of invalid states. Even small modifications to the user interfaces require an adaption of the implementation, increasing maintenance costs of the robot [28]. Interestingly, changing GUIs of the used applications, and the severe negative impact they pose on the robot's performance, are often not adequately conveyed in the literature. Another reason for failure is the usage of a filename different than the one during the extraction of identifiers. In this scenario, the most convenient solution is to avoid changes by using a fixed filename instead. This example shows that unpredictable problems also arise during the testing of interdependent workflows.

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When the robot is executed several times during testing, we observe non-deterministic behaviour of the prototype. The robot might fail in one run and succeed in the next run, even if the environment and the process are not changed. Not knowing whether non-deterministic behaviour or an implementation error causes the failure, imposes an obstacle to troubleshooting. As a consequence, RPA – in contrast to observations in the reviewed literature – does not seem stable in our application.

4 Expert Interview

In the following, we present the key findings of an interview with a senior manager for RPA implementation at a leading sportswear manufacturer. We compare the results of our literature review and experiment with his practical knowledge and conclude with a prediction about the future development of RPA.

As deducted from the literature, social problems are a significant challenge for RPA solutions. Indeed, our expert confirms that employees oppose automation because they fear the elimination of their job. However, he states that this type of displacement has never occurred in his organisation. Employees also reject automation as they believe that the targeted procedure is too complicated to successfully be automated.

Furthermore, he reveals interface changes as the most severe technical challenge. Even if the best practices of development and best "spying methods" are used, substantial user interface modifications will cause the robot to fail. As a result, robots must be actively monitored and maintained. Additionally, employees need to be informed ahead of new releases of applications to put necessary adjustments into place. While we experience some technical issues during the implementation of our experiment, our expert ensures that his organisation has never encountered unsolvable technical problems with RPA. However, he also states that resolving emerging difficulties during development requires advanced technical knowledge, contrary to the findings of our literature review. According to his assessment, RPA tools are currently not mature enough to work without coding. Nevertheless, the coding effort is relatively low compared to other automation solutions.

Apart from the strengths of time savings, fewer errors, and higher accuracy, RPA has also changed the perspective of people towards automation. The main reason for this development is the name "RPA" itself. The full term contains the word "robot", which people can understand, imagine, and relate to as an aide. As a result, employees are more excited about the idea of automation and start to think about potential use cases. Moreover, RPA triggers "thinking about […] intelligent automation" and "more advanced technologies". According to our expert, despite the first impression of the technology being smart, employees quickly realise its lack of intelligence to perform sophisticated tasks. Consequently, developers combine RPA with OCR (optical character recognition), a weak form of AI, to extract texts from images. Typically, machine learning and other forms of AI are also introduced to assist decision-making and to extract patterns. When asked about future use and potential of RPA, our expert estimates that a more straightforward usage of RPA will make it

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“something like the Excel of the future”. Accordingly, in the near-term future, he expects an establishment of a broader range of predefined components, for example, libraries similar to the UiPath Excel extension used in our experiment. In the long run (i.e. more than fifteen years from now), our expert predicts that a concept based on front-end automation will not survive. Most automation focuses on manipulating data. In this case, back-end automation is more suitable as it can enable direct access and does not rely on unstable GUIs. Furthermore, he estimates that the use of APIs and connectors will allow people to automate tasks directly within systems.

5 Conclusion

With a growing interest in process automation, RPA is becoming increasingly the subject of scientific research. All definitions of the term incorporate the aspect of automation of manual tasks but vary concerning the affiliation of other technologies and procedures. To get a better understanding of RPA, our research aims to evaluate its strengths and weaknesses by conducting a literature review, an experiment, and a qualitative interview with an industry expert. All identified aspects are summarised in Table 1 with their corresponding sources and number of mentions if applicable.

By examining the literature, we reveal that the strengths of RPA outweigh the weaknesses in terms of numbers of mentions. Both strengths and weaknesses can be of economic, social, or technical nature. When considering economic aspects, the technology is depicted positively with savings in cost and time. Concerning social aspects, the technology is portrayed rather negatively, naming fear of job losses and acceptance problems. The experiment and the expert interview add to the identified strengths and weaknesses of the literature review. Our industry expert confirms the severe challenges of employee resistance, but also adds social benefits to the findings. According to him, RPA has motivated people to think about automation itself and how to improve its intelligence. In our experiment, we are challenged with the incorrect recognition of elements and changing user interfaces, among other technical difficulties. Our expert confirms that his organisation also considers interface changes their most significant technical challenge with RPA. He believes that unsolvable technical problems do not arise in an organisational set-up, but also emphasises the need for technical knowledge to write additional scripts. This statement contrasts with the examined literature, which stresses that no programming skills are required. After conducting the experiment, we conclude that it is possible to implement RPA without the use of programming languages. However, having to rely on naïve workarounds drastically affects the robustness of the robot, which is crucial in an organisational context. Nevertheless, RPA tools such as UiPath already offer integrated packages extending the traditional front-end approach. Our experiment shows that these extensions are improving the robustness of robots. Therefore, we – as well as our expert – predict that the future use of RPA includes a growing number of predefined components. Additionally, as indicated in the literature and by our specialist, the combination of RPA with other technologies such as artificial intelligence and increasing back-end automation is further improving its applicability. For further

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stability enhancements and automatic adaption to uncertainties, we suggest the establishment of new solutions for error handling and maintenance.

Table 1. Strengths and weaknesses of RPA referenced in literature (L), experiment (E), and expert interview (I), classified in economic (e), social (s), or technical (t) aspects

Strengths	**Source**	**Weaknesses**	**Source**
Cost savings, low-cost implementation, ROI (e)	L(16), I	Selection of suitable processes (e)	L(5)
Quality of work (e)	L(13)	Overestimation of ROI, varying cost savings (e)	L(3)
Non-invasive, lightweight IT (t)	L(13)	Job losses, competition (s)	L(3), I
Productivity, efficiency (e)	L(12), I	Time-consuming quality testing (e)	L(3), E
Time savings, quick implement. (e)	L(12)	Change management (s)	L(2)
Customer/employee satisfaction (s)	L(12)	Costly, tedious maintenance (e)	L(2), E, I
Flexibility, scalability (e)	L(12)	Stability of environment (t)	L(2), E
No programming skills required (t)	L(10), E, ↯I	No reuse or repurposing (e)	L(2)
Reduced human labour (e)	L(8)	Know-how and skills required (e)	L(1), E, I
Availability (e)	L(5)	Inferior, temporary solution (e)	L(1), I
Creation of new jobs in RPA development (s)	L(4)	Acceptance problems (s)	L(1), I
Compliance, data security (e)	L(4)	Low data quality, multiple formats (t)	L(1)
New products, new services (e)	L(1)	Not profitable for infrequent tasks (e)	L(1)
Initiates thinking about intelligent automation (s)	I	Low stability due to changing user interfaces (t)	I, E
Integrated packages enable improved robustness (t)	I, E	Incorrect recognition of elements (t)	E
AI and back-end automation enable improved applicability (t)	I	Additional scripts require technical knowledge (t)	I, E

In summary, the observed technical difficulties in combination with overdrawn promises of RPA vendors indicate that the technology is currently overrated suggesting a hype. Nevertheless, the combination with other technologies reveals a development towards a superior process automation solution which raises hope for RPA.

The following limitations to the study exist: Due to limited scientific research on the subject [3], we include case studies in the reviewed literature. Furthermore, we evaluate the challenges of our experiment based on a single RPA tool. Ultimately, we conclude that our research reveals unambiguous economic strengths as well as less consistent and more debatable social and technical aspects. Future research could focus on the latter. We emphasise the importance of conducting empirical studies and further experiments that objectively assess the potential of RPA.

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References

1. Bourgouin, A., Leshob, A., Renard, L.: Towards a Process Analysis Approach to Adopt Robotic Process Automation. In: 15th International Conference on e-Business Engineering (ICEBE). pp. 46–53. IEEE, Xi'an (2018)
2. Kaya, C.T., Turkyilmaz, M., Birol, B.: Impact of RPA Technologies on Accounting Systems. Journal of Accounting and Finance. 82, 235–249 (2019)
3. Ivančić, L., Suša Vugec, D., Bosilj Vukšić, V.: Robotic Process Automation: Systematic Literature Review. In: Business Process Management: Blockchain and Central and Eastern Europe Forum. pp. 280–295. Springer International Publishing, Cham (2019)
4. Anagnoste, S.: Robotic Automation Process - The next major revolution in terms of back office operations improvement. In: Proceedings of the International Conference on Business Excellence. pp. 676–686. De Gruyter, Bucharest (2017)
5. van der Aalst, W.M.P., Bichler, M., Heinzl, A.: Robotic Process Automation. Business & Information Systems Engineering. 60, 269–272 (2018)
6. Asatiani, A., Penttinen, E.: Turning robotic process automation into commercial success – Case OpusCapita. Journal of Information Technology Teaching Cases. 6, 67–74 (2016)
7. Webster, J., Watson, R.T.: Analyzing the Past to Prepare for the Future: Writing a Literature Review. MIS Quarterly. 26, xiii–xxiii (2002)
8. Aguirre, S., Rodriguez, A.: Automation of a Business Process Using Robotic Process Automation (RPA): A Case Study. In: Figueroa-García, J.C., López-Santana, E.R., Villa-Ramírez, J.L., and Ferro-Escobar, R. (eds.) Applied Computer Sciences in Engineering. pp. 65–71. Springer, Cham (2017)
9. Geyer-Klingeberg, J., Nakladal, J., Baldauf, F., Veit, F.: Process Mining and Robotic Process Automation: A Perfect Match. In: 16th International Conference on Business Process Management. pp. 1–8. Springer, Sydney (2018)
10. Hallikainen, P., Bekkhus, R., Shan L. Pan: How OpusCapita Used Internal RPA Capabilities to Offer Services to Clients. MIS Quarterly Executive. 17, 41–52 (2018)
11. Lacity, M.C., Willcocks, L.P.: Robotic Process Automation at Telefónica O2. MIS Quarterly Executive. 15, 21–35 (2016)
12. Madakam, S., M. Holmukhe, R., Kumar Jaiswal, D.: The Future Digital Work Force: Robotic Process Automation (RPA). Journal of Information Systems and Technology Management. 16, 1–16 (2019)
13. Fernandez, D., Aman, A.: Impacts of Robotic Process Automation on Global Accounting Services. Asian Journal of Accounting and Governance. 9, 123–132 (2018)
14. Penttinen, E., Kasslin, H., Asatiani, A.: How to Choose between Robotic Process Automation and Back-End System Automation? Presented at the European Conference on Information Systems , Portsmouth (2018)
15. Osmundsen, K., Iden, J., Bygstad, B.: Organizing Robotic Process Automation: Balancing Loose and Tight Coupling. In: 52nd Hawaii International Conference on System Sciences. pp. 6918–6926. HICSS, Hawaii (2019)

https://doi.org/10.30844/wi_2020_r6-hindel

16. Ratia, M., Myllärniemi, J., Helander, N.: Robotic Process Automation - Creating Value by Digitalizing Work in the Private Healthcare? In: Proceedings of the 22nd International Academic Mindtrek Conference. pp. 222–227. ACM Press, Tampere (2018)
17. Isaac, R., Riya Muni, Kenali Desai: Delineated Analysis Of Robotic Process Automation Tools. Presented at the International Conference on Information Technology, Communications and Computing , Bhopal, M.P. (2017)
18. Leopold, H., van der Aa, H., Reijers, H.A.: Identifying Candidate Tasks for Robotic Process Automation in Textual Process Descriptions. In: Enterprise, Business-Process and Information Systems Modeling. Springer, Tallin (2018)
19. Gejke, C.: A new season in the risk landscape: Connecting the advancement in technology with changes in customer behaviour to enhance the way risk is measured and managed. Journal of Risk Management in Financial Institutions. 11, 148–155 (2018)
20. Leno, V., Dumas, M., Maggi, F.M., La Rosa, M.: Multi-perspective process model discovery for robotic process automation. In: CEUR Workshop Proceedings. pp. 37–45. CEUR Workshop Proceedings, Tallin (2018)
21. Willcocks, L.P., Lacity, M.C., Craig, A.: Robotic Process Automation: Strategic Transformation Lever for Global Business Services? Journal of Information Technology Teaching Cases. 7, 17–28 (2017)
22. Tsaih, R.-H., Hsu, C.C.: Artificial Intelligence in Smart Tourism: A Conceptual Framework. In: Proceedings of the 18th International Conference on Electronic Business. pp. 124–133. ICEB, Guilin (2018)
23. Anagnoste, S.: Setting Up a Robotic Process Automation Center of Excellence. MDKE. 6, 307–322 (2018)
24. Fung, H.P.: Criteria, Use Cases and Effects of Information Technology Process Automation (ITPA). Adv Robot Autom. 3, 1–10 (2014)
25. Lacity, M.C., Willcocks, L.P.: A new approach to automating services. MIT Sloan Management Review. 58, 40–49 (2017)
26. Moffitt, K.C., Rozario, A.M., Vasarhelyi, M.A.: Robotic Process Automation for Auditing. Journal of Emerging Technologies in Accounting. 15, 1–10 (2018)
27. Anagnoste, S.: Robotic Automation Process – The operating system for the digital enterprise. In: Proceedings of the International Conference on Business Excellence. pp. 54–69. De Gruyter, Bucharest (2018)
28. Kopeć, W., Skibiński, M., Biele, C., Skorupska, K., Tkaczyk, D., Jaskulska, A., Abramczuk, K., Gago, P., Marasek, K.: Hybrid Approach to Automation, RPA and Machine Learning: a Method for the Human-centered Design of Software Robots. In: Proceedings of the 21st ACM Conference on Computer-Supported Cooperative Work and Social Computing. CSCW, Jersey City (2018)
29. Kuiper, S., Clippinger, D.: Contemporary Business Reports. Cengage Learning, Florence, United States (2012)
30. Stair, R.M., Reynolds, G.W.: An Introduction to Information Systems. In: Principles of Information Systems. pp. 4–5. Cengage Learning, Mason (2017)

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