

# Robotic Process Automation (RPA) Adoption: A Systematic Literature Review

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## Abstract

**Purpose.** Robotic Process Automation (RPA) is a recent technology that has recently become increasingly adopted by companies as a solution for employees to focus on higher complexity and more valuable tasks while delegating routine, monotonous and rule-based tasks to their digital colleagues. The increased interest, joint with the increased number of articles regarding approaches and test cases, has triggered the necessity for a summary that could extract the more generalizable ideas and concepts about these software robots.

**Methodology.** In this paper, a Systematic Literature Review (SLR) approach was used to find and synthesize information through the obtained articles on this subject.

**Results.** This research identified the most general implementation features of successful RPA adoption cases, observed benefits, challenges commonly faced by organizations, characteristics that make processes more suitable for RPA, and research gaps in the current literature.

**The theoretical contribution.** The findings present in this paper have two purposes. The first is to provide a way for companies and organizations to become more familiar with good practices regarding robotic process automation adoption. The other is to foster further research on the subject by complementing the current knowledge and proposing new paths for research.

## Key words

**RPA, robotic process automation, software robotics, software robot, digital worker, hyperautomation, adoption, implementation**

## Introduction

Robotic process automation (RPA) is a recent technology that promises to generate great returns on investment for companies and organizations (Hallikainen et al., 2018). For most, this concept may resemble physical robots wandering around offices performing human tasks, and as a result contributing to job losses. In reality, it is a software solution that enables the automation of rule-based business processes and tasks by using software bots (Kregel et al., 2021; Lacity et al., 2015; Kokina and Blanchette, 2019). These bots work by imitating an employee's actions within one or several systems. They mimic what humans would do when entering or manipulating data using a computer (Januszewski et al., 2021).

The deployment of this virtual workforce to automate and streamline structured, manual, high-volume, repetitive, and routine tasks, results in human workers delegating their tedious routine tasks to a digital worker, thus allowing them to focus on more difficult tasks (Choi et al., 2021; Hartley and Sawaya, 2019).

RPA is a software that performs routine process tasks based on simple rules. Its umbrella of capabilities includes entering data, making simple calculations, reading and extracting data from Enterprise Resource Planning (ERP) systems, completing forms, responding to emails (Hartley and Sawaya, 2019), opening attachments, logging into applications, moving files or folders, scraping data from a webpage, extracting information from pdf or images, and others. Regarding physical documents, upon scanning them, both optical character recognition (OCR) and natural language processing (NLP) can be utilized to extract information to be further processed. (Hegde et al., 2018)

The usage of robotic process automation (RPA) in organizations has rapidly increased in recent years and is projected to grow in the foreseeable future by 20-30% per year or US\$ 3.97 billion in 2025. RPA growth has also been predicted to happen at a rate of 32.8% from 2021 to 2028. Organizations are

adopting RPA with a motivation to reduce cost, improve efficiency, productivity, and service quality (Choi et al., 2021; Denagama Vitharanage et al., 2020; Harmoko et al., 2021).

As a result of this software implementation, it is expected an increase in productivity by 86%, quality by 90%, and reduce costs in the office by 59%. Due to these numerous benefits, robotics is one of the main priorities of many organizations, also in the banking sector. As a result, it is indicated as a priority by 30% of banks worldwide and by 45% in Poland. (Harmoko et al., 2021; Wojciechowska-Filipek, 2019).

Given the stated potential of RPA, it is paramount to understand how to adopt it in companies and organizations in a more efficient manner. Therefore, it becomes necessary to further study and comprehend where its implementation is advisable, what challenges may arise benefits to expect from its adoption. (Kokina and Blanchette, 2019; Parker and Appel, 2021)

This article is structured as follows: the background in Section 1, where the need for this review is presented and a summary of previous reviews provided, the planning in Section 2, where each review question is specified and data sources and search strategies are defined, and the conducting in Section 3, where data extraction and synthesis is explained and criteria for inclusion or exclusion presented. Section 4 presents the reporting of the key findings with strengths and weaknesses of the evidence in the current literature. In Section 5 it is discussed this review against previous ones taking into account differences in quality and results. Finally, in Section 6 the authors conclude with practical implications of this literature review for the RPA industry and unanswered questions and opportunities for future research.

## 1. Research Background

Companies using IT (information technology) or ICT (information and communication technology) are becoming exponentially more interested in RPAs in recent years (Marciniak and Stanisławski, 2021; Simek and Sperka, 2019). Joint with the increased interest, the number of papers on this subject has also grown substantially (Fig. 1).

However, because it is so recent, there is an inherent lack of awareness or basic knowledge about its implementation resulting from the lack of theoretical foundations that allow for objective reasoning and development of methodologies and frameworks (Marciniak and Stanisławski, 2021; Syed et al., 2020). Moreover, given the current increase in automation necessity driven by the pandemic, scientific research seems to be lagging behind, with a reduced number of articles discussing the role of RPA on organizations (Siderska, 2021).

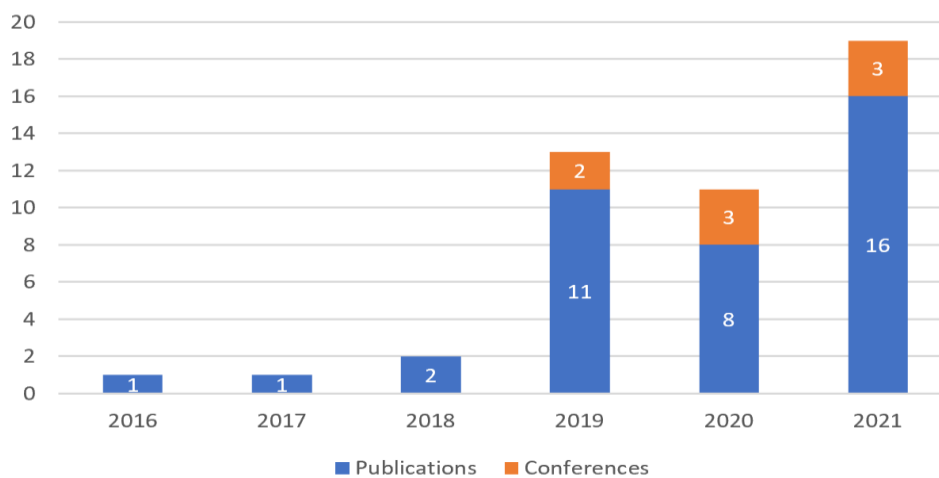


Fig. 1. Publishing year of selected articles for literature review

## *1.1. Previous Reviews*

As a result of search, the 2 literature reviews were found Siderska (2020) and Syed et al. (2020). In this section, a summary of their content will be provided so that they can be compared with this systematic review's findings.

While both reviews refer back to Lacity and Willcocks definition of RPA as a software robot that mimics human actions allowing the automation of rules-based processes that involve routine tasks, structured data, and deterministic outcomes. Syed et al. (2020) goes a step further into distinguishing between RPA and AI, with the former being more rule-based and structured than the latter.

In Syed et al. (2020) we can find reviews of methodologies for RPA adoption within organizations. It states company guidelines for approaching RPAs, approaches to initial task selection, reviews frameworks for RPA roll-out, strategies for bot deployment and management, and RPA long-term success.

We can find a summary of the literature's perception of the potential capabilities of this technology in Syed et al. (2020). The first capabilities are employee level, where changes in the work nature and the employee role inside the company are reviewed. Syed et al. (2020) follows with organization and process-related capabilities, where changes to the organization are discussed. Several other capabilities are audited, such as process transparency, compliance, standardization, organization scalability, flexibility and control, and the ability to use process intelligence for decision making.

Both reviews evaluate the benefits of RPA adoption in the existing literature. While Siderska (2020) places a greater emphasis on the positive impact of the technology by reshaping the work of the companies employees, Syed et al. (2020) focus more on the organizational repercussions of this adoption, for instance, higher efficiency, risk reduction, and compliance, quality of service, ease of implementation and integration with company systems.

The two reviews also provide a bullet list containing all characteristics that cause some processes to be more suitable for automation than others. Both reviews state process complexity, frequency, and access to multiple systems as core factors for process fitness. Meanwhile, Syed et al. (2020) goes a step further and also states other characteristics such as data type and process maturity.

It is possible to find a summary of current leading RPA vendors and the technology positioning within the Open System Interconnection (OSI) model in Syed et al. (2020).

Finally, Siderska (2020) presents a table and further discusses RPA integration with different technologies such as artificial intelligence, natural language processing, process mining, big data, BPM/BPMS, and others.

## **2. Planning**

### *2.1. Research Questions*

The aim of this systematic review goes beyond providing an overview of the current RPA landscape. It intends to search for answers regarding how to efficiently implement this software, what benefits to expect from it, and what challenges may be needed to overcome. It also aspires to answer where RPA is most useful and what gaps in the literature still need to be filled. As a result, this research plans to answer the following questions:

- RQ1: Which are the common features of successful RPA implementations?
- RQ2: What are the benefits of implementing RPAs in organisations?
- RQ3: Which are the current challenges to RPA adoption?
- RQ4: Which process characteristics are more suitable for RPA implementation?
- RQ5: Which are the current RPA knowledge gaps in the literature?

### *2.2. Data Sources and Search Strategy*

A systematic literature review (SLR), or simply a systematic review, is a way to identify, evaluate and interpret all available research relevant to a particular research question, topic area, or phenomenon of interest. A literature review must be thorough and fair to be scientifically valuable. As it follows a predefined search strategy, a systematic review fairly synthesizes existing work (Keele et al., 2007).

This SLR was conducted following Kitchenham (2004) guidelines for systematic literature reviews. As a result, the process was divided into three stages: planning, reporting and conducting the review. During planning, the need for a review was identified and the review protocol clearly determined. In the case of this article, the selection of literature was made on the basis of a search criteria (Tab. 1).

A total of 486 studies were obtain as a result of this search.

Tab. 1. Search criteria

| ELEMENT             | RESEARCH DETAILS   |
|---------------------|--|
| Source              | EBSCO  |
| Final Search String | AB ( "Robotic Process Automation" or "Hyperautomation" or "Software Robotics" or "Software robot" or "Digital Worker" or "Business Process Automation" or "Process Automation" ) AND AB ( "Implementation" or "Adoption" ) |
| Search Strategy     | Articles in academic journals or conference materials, without a date range limit  |
| Results             | 486  |

### 3. Conducting

The second phase of the SLR methodology is conducting, where the selection of studies occurs according to a given inclusion and exclusion criteria. Once the final studies were selected, data extraction, monitoring, and synthesis occurred.

To obtain the final set of papers, a process with several filtering stages were executed over the first set of 486 papers collected (Fig. 2). After removing duplicates (184 papers), a total of 302 unique papers were obtained.

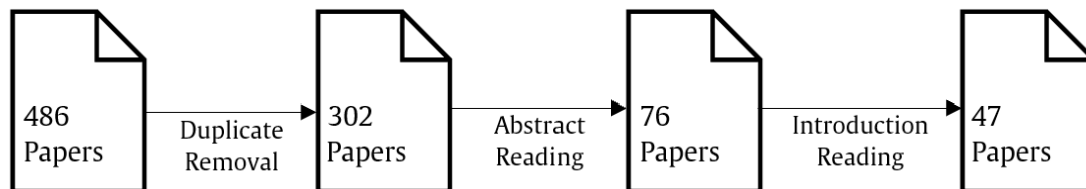


Fig. 2. Papers Filtering Process

#### 3.1. Inclusion and Exclusion Criteria

The titles and abstracts of these papers were read and led to classifying them into three types: "accepted", "rejected", and "maybe". In total, 226 papers were excluded because they did not comply with the inclusion and exclusion criteria. The introductions of the remaining 76 papers, which included "maybe" and "accepted" documents, were fully read and resulted in the further removal of 15 papers due to inaccessibility/being in an unknown language, 5 papers that casually mentioned RPA's in a broad spectrum but didn't fully explore the theme and 5 papers that explored intelligent process automation (IPA).

A final set of 47 papers from different academic journals and conferences (Tab. 2 and 3) was obtained, from which 2 were literature reviews.

Tab. 2. Academic Journals

| <b>PUBLICATION, PUBLISHER</b>  | <b>NUMBER OF PUBLICATIONS</b> |
|--|-------------------------------|
| Journal of Information Technology Teaching Cases, SAGE   | 3                             |
| Accounting Horizons, American Accounting Association   | 2                             |
| International Journal of Accounting Information Systems, Elsevier                                    | 2                             |
| MIS Quarterly Executive, Association for Information Systems   | 2                             |
| Sustainability, MDPI   | 2                             |
| ACRN Journal of Finance and Risk Perspectives, ACRN Oxford   | 1                             |
| Armed Forces Comptroller, American Society of Military Comptrollers                                  | 1                             |
| Banks and Bank Systems, LLC Consulting Publishing Company "Business Perspectives"                    | 1                             |
| Business Horizons, Elsevier  | 1                             |
| Computers in Industry, Elsevier  | 1                             |
| Energies, MDPI   | 1                             |
| Engineering Management in Production and Services  | 1                             |
| Information, MDPI  | 1                             |
| ISSA Journal, Information Systems Security Association   | 1                             |
| Journal of Accounting and Finance, MUFAD   | 1                             |
| Journal of Business Research, Elsevier   | 1                             |
| Journal of Emerging Technologies in Accounting, American Accounting Association                      | 1                             |
| Journal of Government Financial Management, Association of Government Accountants                    | 1                             |
| Journal of Information & Knowledge Management, World Scientific                                      | 1                             |
| Journal of Management, LBUAS   | 1                             |
| Journal of Purchasing and Supply Management, Elsevier  | 1                             |
| Journal of Securities Operations & Custody, Henry Stewart Publications                               | 1                             |
| Journal of Service Theory and Practice, Emerald Publishing Limited                                   | 1                             |
| LogForum, PSL  | 1                             |
| Organizacija, Sciendo  | 1                             |
| problemy zarządzenia - management issues, Faculty of Management UW                                   | 1                             |
| Procedia Computer Science, Elsevier  | 1                             |
| Review of Innovation and Competitiveness, Juraj Dobrila University of Pula                           | 1                             |
| Supply Chain Forum: An International Journal, Taylor&Francis Online                                  | 1                             |
| Tehnički glasnik - Technical Journal, University North Koprivnica/Varazdin                           | 1                             |
| The Data Base of Advances in Information Systems, ACM  | 1                             |
| The Journal of Applied Behavioural Science, SAGE   | 1                             |
| The South African Journal of Industrial Engineering, South African Institute of Industrial Engineers | 1                             |

Tab. 3. Conferences

| <b>CONFERENCE</b>  | <b>NUMBER OF PUBLICATIONS</b> |
|--|-------------------------------|
| European Conference on the Impact of Artificial Intelligence and Robotics (ECIAIR)               | 1                             |
| European Conference on Information Systems (ECIS)  | 1                             |
| Enterprise Distributed Object Computing (IEEE EDOC)  | 1                             |
| International Conference on Information Systems (ICIS)   | 1                             |
| International Conference on Artificial Intelligence and Smart Systems (ICAIS)                    | 1                             |
| IEEE Conference of Russian Young Researchers in Electrical and Electronic Engineering (EIConRus) | 1                             |
| International Conference on Innovative Technology for Sustainable Development (ICITSD)           | 1                             |
| Conferência Ibérica de Sistemas e Tecnologias de Informação (CISTI)                              | 1                             |

## 4. Reporting

In this section of the paper, answers to the research questions will be provided according to what was found when reading and analysing the different articles.

### 4.1 Key Findings

#### 4.1.1 RQ1: RPA Implementation Features

When analyzing the selected set of articles, it was possible to identify that although implementations of RPA's differ from each other based on several factors such as company size, maturity, and area of work, there were still some common denominators (Table 3).

Most companies followed a 4-stage implementation framework consisting of identifying tasks, redefining processes from AS-IS to TO-BE, developing the bot, and finally monitoring its actions (Huang and Vasarhelyi, 2019). Other companies adopted a similar 5-stage framework that would include a testing phase after developing the bot and before its deployment (Gex and Minor, 2019).

Regarding regular features of adoption, most implementations started with a proof of concept (PoC), which intended to demonstrate RPA capabilities and potentials for the company. Low-complexity, high volume/value processes were regularly chosen as PoC, to achieve what some literature calls "quick wins" (Gex and Minor, 2019; Lacity et al., 2015; Flechsig et al., 2021).

Centers of Excellence (CoE) are also commonly implemented when adopting RPA in a company. When compared against outsourcing, CoE's provide critical benefits such as familiarity with the processes, access to confidential information, and the environments where the robots will be implemented facilitating bot testing and deployment. (Vokoun and Zelenka, 2021; Huang and Vasarhelyi, 2019).

Research articles also highlighted the importance of integrating RPA into the company's culture. To achieve this cultural shift, it was common for organizations to host regular RPA Seminars, where RPA potentials and benefits were showcased through test cases, and implement RPA Ambassadors, who would foster a positive outlook on the technology inside the company. Removal of workers' fear of job loss was also critical in this process, and it was usually achieved by showing RPA benefits and reframing their implementation as a way to free employees from tedious tasks and allow them to work on higher complexity ones instead of a means to replace them. (Ågnes, 2021; Marciniak and Stanisławski, 2021).

Tab. 4. RPA Implementation Features

| FEATURE                        | SOURCES   |
|--------------------------------|---|
| Proof of Concept               | Huang and Vasarhelyi (2019); Raza et al. (2019); Gotthardt et al. (2020); Kokina and Blanchette (2019); Kossukhina et al. (2021); Hallikainen et al. (2018); Simek and ˇ Sperka (2019); Hegde et al. (2018); Carden et al. (2019); Lacity ˇ et al. (2015); Flechsig et al. (2021); Schuett (2019) |
| Center Of Excellence           | Huang and Vasarhelyi (2019); Wojciechowska-Filipek (2019); Kokina and Blanchette (2019); Ågnes (2021); Kedziora and Penttinen (2021); Marciniak and Stanisławski (2021); Hegde et al. (2018); Flechsig et al. (2021); Schuett (2019)  |
| Training                       | Wewerka et al. (2020); Wojciechowska-Filipek (2019); Kossukhina et al. (2021); Hallikainen et al. (2018); Viale and Zouari (2020); Fernandez and Aman (2018); Hegde et al. (2018); Willcocks et al. (2017); Flechsig et al. (2021)  |
| RPA Ambassadors                | Wewerka et al. (2020); Kedziora and Penttinen (2021); Hallikainen et al. (2018); Viale and Zouari (2020); Vokoun and Zelenka (2021); Gex and Minor (2019); Schuett (2019)   |
| Removal of Fear of Job Loss    | Wewerka et al. (2020); Ågnes (2021); Hallikainen et al. (2018); Simek and ˇ Sperka (2019); Lacity ˇ et al. (2015); Lemaire-Harvey and Harvey (2020); Sider- ˇ ska (2020)  |
| RPA Seminars                   | Wewerka et al. (2020); Hallikainen et al. (2018); Parker and Appel (2021); Flechsig et al. (2021); Schuett (2019); Lemaire-Harvey and Harvey (2020)   |
| Communication Expert-Developer | Huang and Vasarhelyi (2019); Wojciechowska-Filipek (2019); Ågnes (2021); Hallikainen et al. (2018); Hegde et al. (2018)   |
| Data and Task Standardization  | Kokina et al. (2021); Kokina and Blanchette (2019); Fernandez and Aman (2018); Hegde et al. (2018)  |
| Back-Up Strategies             | Kokina et al. (2021); Kokina and Blanchette (2019); Hallikainen et al. (2018)   |

Other recurrent characteristics of successful implementations include training employees to understand and work with RPAs, focusing on good communication between process experts and RPA developers, standardizing data and tasks, and having backup strategies in place if an RPA deployment fails.

#### 4.1.2 RQ2: RPA Benefits

Several benefits seem to arise from the successful adoption of these digital workers within an organization. In this section, the benefits found in the literature (Tab. 5) will be analyzed.

Tab. 5. RPA Benefits

| BENEFIT                           | SOURCES   |
|-----------------------------------|---|
| More insightful work              | Kokina et al. (2021); Denagama Vitharanage et al. (2020); Kokina and Blanchette (2019); Ågnes (2021); Viale and Zouari (2020); Kaya et al. (2019); Marciniak and Stanisławski (2021); Gex and Minor (2019); Parker and Appel (2021); Fernandez and Aman (2018); Hegde et al. (2018); Willcocks et al. (2017); Arias et al. (2020) |
| Reduced Process Hours             | Wewerka et al. (2020); Wojciechowska-Filipek (2019); Gotthardt et al. (2020); Kokina and Blanchette (2019); Simek and Sperka (2019); Parker and Appel (2021); Shwetha and Kirubanand (2021); Carden et al. (2019); Willcocks et al. (2017); Arias et al. (2020); Harmoko et al. (2021)  |
| Lower Error Rate                  | Denagama Vitharanage et al. (2020); Wojciechowska-Filipek (2019); Gotthardt et al. (2020); Kokina and Blanchette (2019); Ketkar and Gawade (2021); Simek and Sperka (2019); Kaya et al. (2019); Vokoun and Zelenka (2021); Flechsig et al. (2021); Arias et al. (2020)  |
| Cost Saving                       | Wewerka et al. (2020); Wojciechowska-Filipek (2019); Kokina and Blanchette (2019); Kaya et al. (2019); Marciniak and Stanisławski (2021); Gex and Minor (2019); Carden et al. (2019); Willcocks et al. (2017)   |
| Customer Service and Satisfaction | Denagama Vitharanage et al. (2020); Viale and Zouari (2020); Parker and Appel (2021); Willcocks et al. (2017); Arias et al. (2020); Harmoko et al. (2021)   |
| Working 24/7                      | Wewerka et al. (2020); Viale and Zouari (2020); Kaya et al. (2019); Marciniak and Stanisławski (2021); Flechsig et al. (2021)   |
| Improvement in staff skills       | Denagama Vitharanage et al. (2020); Ågnes (2021); Kaya et al. (2019); Parker and Appel (2021)   |
| Standardization                   | Wojciechowska-Filipek (2019); Marciniak and Stanisławski (2021)   |

The most mentioned benefit across the articles was that, given RPA performing more tedious and monotonous work, workers were able to focus and invest their time in more complex, meaningful tasks that provide more value to the company (Kaya et al., 2019). Another observed benefit was that as a result of performing new or more meaningful tasks, employees would also invest more time in developing new skills to become more qualified at their specific job (Ågnes, 2021).

Conferring RPAs the responsibility of handling repetitive and tiring tasks also contributed to a lower error rate due to the elimination of human errors. Unlike humans, the bots do not get tired and therefore aren't susceptible to making the same mistakes that humans would (Ketkar and Gawade, 2021). On the other hand, automated processes are vulnerable to systematic errors due to bad RPA programming (Gotthardt et al., 2020).

articles documented improved customer service and consequent satisfaction. This benefit resulted from several factors such as faster and smoother process execution which led to rapid responses to customers' requests and employees feeling less pressured to rush through interactions with clients (Parker and Appel, 2021).

An observable quantitative benefit of successful implementations was process efficiency, achieved through cost savings, with articles reporting between 25% and 75% (Wewerka et al., 2020; Wojciechowska-Filipek, 2019), and through process time reduction, with companies stating that some processes would take a 10th of the time of what they used to (Wojciechowska-Filipek, 2019). Not only did business processes become more efficient, but the articles also highlighted the ability of bots to work at any time of every day. As a result, not only do processes take less time but the amount of time available to complete them also increased (Viale and Zouari, 2020). Most companies implementing RPAs also

felt the collateral benefits of standardizing and improving their processes. It is necessary for documents to be structured and standardized and for processes to be stable and mature to integrate this technology. As a result, it is fair to classify standardization as an advantage that emerges from the intent to adopt RPA's (Wojciechowska-Filipek, 2019).

Other impacts of these digital workers were: reduction in office space costs by 40% (Wojciechowska-Filipek, 2019), more efficient coping with employees absence, as there was less redistribution of work because RPA could take over basic repetitive tasks, allowing for less office time and more remote work (Kossukhina et al., 2021) and allowing for business continuity during unexpected events, such as COVID-19 (Siderska, 2021).

#### 4.1.3 RQ3: RPA Challenges

Just like benefits, there were several challenges reported throughout the articles (Tab. 6), with some being more predominant than others and most originating from the newness of the technology.

Tab. 6. RPA Challenges

| CHALLENGE                           | SOURCES   |
|-------------------------------------|---|
| Lack of knowledge and experience    | Kokina et al. (2021); Saukkonen et al. (2019); Wewerka et al. (2020); Gotthardt et al. (2020); Kokina and Blanchette (2019); Marciniak and Stanisławski (2021); Hegde et al. (2018); Lacity et al. (2015); Flechsig et al. (2021) |
| Employee and Stakeholder Resistance | Saukkonen et al. (2019); Gotthardt et al. (2020); Viale and Zouari (2020); Marciniak and Stanisławski (2021); Fernandez and Aman (2018); Willcocks et al. (2017); Flechsig et al. (2021)  |
| Access and Security Issues          | Kokina et al. (2021); Raza et al. (2019); Gotthardt et al. (2020); Kokina and Blanchette (2019); Marciniak and Stanisławski (2021); Schuett (2019)  |
| Data Incompatibility                | Wewerka et al. (2020); Januszewski et al. (2021); Gotthardt et al. (2020); Hegde et al. (2018)  |
| Lack of Documentation               | Kokina and Blanchette (2019); Vokoun and Zelenka (2021); Schuett (2019)   |
| Unfit Processes                     | Viale and Zouari (2020); Hegde et al. (2018); Siderska (2020)   |

RPA is such a recent technology that there is a lack of knowledge and experience in its implementation (Wewerka et al., 2020; Gotthardt et al., 2020). Not only do companies have issues with finding the right solutions for their situation, but there is also an internal resistance to adapting to a new culture. An example is the employee's lack of awareness of the impact that this adoption may bring to their work (system, document structure, and other changes) (Marciniak and Stanisławski, 2021).

The cultural resistance to change emerges on account of the lack of knowledge and experience with this software. Firstly, unless forced to, some employees avoided implementing this new technology out of fear of job loss, which led to less adherence (Fernandez and Aman, 2018). Secondly, some stakeholders failed to endorse and prioritize this adoption due to being comfortable with current work cultures (Viale and Zouari, 2020). Together, this lack of urge and desire to innovate poses a critical challenge to RPA implementation.

Although most companies have started to use digital documentation as a more flexible and modern way to store information, others are still lagging. The use of paper, unstructured documents is still a substantial impediment to RPA adoption in organizations (Wewerka et al., 2020). To automate any business process, companies must have structured documents stored digitally.

Understanding which processes are fit for automation is crucial for the success of the adoption of these digital workers. By contrast, attempting to automate unfit processes seemed to be a recurring challenge across organizations. Trying to automate manual, complex, or highly fractional (with multiple parties involved) is a challenge that companies face due to a lack of knowledge and preparation. In these cases, either redesigning the process or choosing a fitter process for automation appeared to be the best solution.

Access and security also pose key issues to RPA implementations. Managing access to resources has always been done with humans. However, with software robots, new measures must take into account robots' access to information (Raza et al., 2019; Schuett, 2019). In the same way, current

security practices do not take into account the existence of digital workers, and successfully implementing a new security framework constitutes a significant challenge to organizations (Kokina et al., 2021). The novelty of the software and the resulting lack of documentation makes it challenging for companies to adopt RPA's as there are currently no standards and methodologies in place (Vokoun and Zelenka, 2021).

#### 4.1.4 RQ4: RPA Suitability Characteristics

In this section the paper aims to provide an answer to what are the characteristics that makes a process suitable for automation according to the articles (Tab. 7).

The first characteristic for suitability is for the process to be rule-based. Processes of this kind follow a concrete set of rules to achieve a given purpose. Decisions do not require judgment and can therefore be automated through if-then decision trees.

Another important feature for the automation of a process is maturity, the process should be subject to minimal changes in the near future. Outcomes and costs are easier to predict, and exceptions are less likely to arise. As a result, automation changes are also less likely, and benefits can be estimated by comparison with the process history.

Structured data, documents being in a standardized format for providing information, is crucial for processes to be suitable for automation. Structuring allows the software bot to find the required data expected for processing. Otherwise, it would be hard for the bot to fetch the data, and it would be prone to errors due to mistaking different information fields. Data should also be digital, through digitalization if necessary, for the RPA to access and then process it. Although it is possible to read scanned documents using optical character recognition (OCR), this technology tends to have a more successful implementation with the digital format of data that eliminates the possibility of document misreading (Januszewski et al., 2021).

Routine processes that occur according to a given periodicity are more apt for automation. A given event that may be an action or a time (for example, every day at noon) can trigger the robot. As a result, without any human interference, the RPA may perform a given task automatically.

High volume processes are the ones performed frequently or by several people. For any organization, tasks of this sort should be a priority for automation as they yield the highest potential benefits and return on investment (ROI).

Processes to be suitable for automation should have a few exceptions. Otherwise, their automation often requires more time than the one necessary to perform them. Besides, the automation is more likely to fail and need to be adjusted. Therefore, tasks with few exceptions are more suitable for automation as their RPAs are easier to develop, monitor, and maintain.

Another important characteristic for suitability is for the process to interact with multiple systems. As a result, the RPA implementation automates part of the process and acts as a top layer providing integration between the different systems.

Tab. 7. RPA Suitability Characteristics

| CHARACTERISTIC   | SOURCES   |
|------------------|---|
| Rule-based       | Kokina et al. (2021); Kokina and Blanchette (2019); Kedziora and Penttinen (2021); Hallikainen et al. (2018); Viale and Zouari (2020); Marciniak and Stanisławski (2021); Hegde et al. (2018) |
| Mature           | Wewerka et al. (2020); Viale and Zouari (2020); Vokoun and Zelenka (2021); Hegde et al. (2018); Siderska (2021)   |
| Structured data  | Kokina and Blanchette (2019); Simek and Sperka (2019); Vokoun and Zelenka (2021); Marciniak and Stanisławski (2021); Siderska (2021)  |
| High Volume      | Wewerka et al. (2020); Kokina and Blanchette (2019); Viale and Zouari (2020); Hegde et al. (2018); Siderska (2021)  |
| Digital data     | Wewerka et al. (2020); Kokina and Blanchette (2019); Vokoun and Zelenka (2021); Siderska (2021)   |
| Routine          | Kokina et al. (2021); Wewerka et al. (2020); Choi et al. (2021); Marciniak and Stanisławski (2021)  |
| Few Exceptions   | Kokina et al. (2021); Viale and Zouari (2020)   |
| Multiple Systems | Kokina and Blanchette (2019); Viale and Zouari (2020)   |

#### 4.1.5 RQ5: RPA Research Gaps

Like most technologies, RPA is in perpetual change, and consequently, new themes and questions arise, leaving research gaps to be investigated and filled. In this section, the paper analyzes potential areas for future research suggested in the literature that may help in further understanding RPA's (Tab. 8).

Regarding the impact of RPA on workers' skills, two common questions were frequently identified: what capabilities are now needed for them to handle RPAs and what skills and knowledge are becoming obsolete due to this implementation (Kokina et al., 2021; Vokoun and Zelenka, 2021). As previously stated, most articles mention a shift in the worker's responsibility in the company to more complex and creative tasks. However, they fail to provide a tangible description of what these new tasks embody.

Another opportunity for research lies in the implementation of RPAs. Being such a recent technology, RPA lacks concrete guidelines for implementation and follow-up procedures. Future researches should seek to provide a framework for successfully implementing RPA in organizations in a way that followup procedures and monitoring are minimized (Wewerka et al., 2020; Siderska, 2021).

Although one of the most researched fields, RPA benefits still have room for research. Due to the growing body of research, companies are becoming more aware of what factors become critical for the success of this technology. As such, future research can try to understand how benefits from early adopters differ when compared to followers that are more aware of the technology's potential and downfalls (Wewerka et al., 2020; Vokoun and Zelenka, 2021).

The final identified research gap across the selected articles regards the future of RPA's. There are significant research opportunities concerning what process, data, and integration-related functionalities are being developed and the future direction of RPA with AI incorporation (Kokina and Blanchette, 2019; Siderska, 2021).

Tab. 8. RPA Research Gaps

| RESEARCH GAP                                | SOURCES   |
|---|---|
| Further benefits research                   | Wewerka et al. (2020); Denagama Vitharanage et al. (2020); Kokina and Blanchette (2019); Januszewski et al. (2021); Vokoun and Zelenka (2021) |
| RPA impact on job characteristics           | Kokina et al. (2021); Kokina and Blanchette (2019); Vokoun and Zelenka (2021); Siderska (2021)  |
| Effective frameworks for RPA implementation | Vokoun and Zelenka (2021); Simek and Sperka (2019); Flechsig et al. (2021); Siderska (2021)   |
| RPA evolution                               | Kokina and Blanchette (2019); Ketkar and Gawade (2021); Siderska (2021)   |

## 5. Discussion

In this section, the paper compares the obtained results of this systematic literature review with the ones gathered in others. Relations between the findings of this review to others will be pinpointed, particularly considering the differences in the obtained results.

With regards to implementation, as previously mentioned, Syed et al. (2020) also provides organizational guidelines for adoption such as methodologies and frameworks, follow-up strategies, and plans for long-term success. However, based on the most recent literature, this paper highlights the role of cultural changes in RPA implementation. As a result, this systematic literature review provides some additional implementation features to foster the RPA adoption in the company's culture, such as removing the fear of job loss and promoting RPAs, whether through seminars or ambassadors.

Both Siderska (2020) and Syed et al. (2020) evaluate the benefits of RPA adoption in the existing literature. As mentioned in the background, the former highlights the reshaping of the work of the companies employees, while the latter places more emphasis on organizational benefits. Although approaching the same benefits, this SLR contributes with more recently discovered benefits resulting from the current COVID-19 pandemic panorama and consequently increased relevance of certain

benefits. These benefits include the ability to work remotely, having more office space, and the capacity of companies to be functional despite employee absences.

None of the selected reviews provides challenges to implementation, as a result, this SLR provides new information regarding challenges for adopting RPA in an organization.

Characteristics that cause processes to be more suitable for automation are provided in both the literature reviews. Although the results found in this review overlap the ones obtained in the previous, this SLR goes a step further into laying out the reasoning for these characteristics to be suitable for automation.

The previous literature reviews date back to 2020 and 2019. From the selected articles for this SLR, 19 are from 2021. As a result, the research gaps found in other literature reviews differ from the revealed in this. With the answers to previous research questions, the rapidly growing exploration of RPA fosters new and more intriguing questions to be answered. Still, given how recent this technology is, the lack of a framework for companies to successfully employ RPAs is a common denominator across the literature reviews for future research.

## **6. Conclusion**

Recent implementations of RPA and consequent case studies provide a means to understand the potential impacts of software robots when successfully implemented and what mistakes lead to their failure. RPA has provided organizations with clear resources benefits. RPA's also impacted these organizations' employees by upgrading their work to one that is more fulfilling.

Although there are many benefits to these digital workers, organizations still face various challenges due to a lack of frameworks and knowledge. This research sought to investigate the factors for successful implementations, benefits, challenges, and suitability of the technology. To conduct this research, a systematic literature review was adopted and a summary of results, together with a table of sources, for each concept was presented.

The main ideas, drawn from analyzing the 47 papers that supported this research, are:

- Overview of the process of adoption of this technology across the several companies mentioned in the test cases and several ideas for maximizing the likeliness of its' success.
- Analysis of impacts and benefits of RPA's in organizations where it was successfully implemented.
- Raising awareness to the biggest challenges to implementation for organizations to be ready to tackle them.
- A comprehensive summary of characteristics of suitable tasks together with the reasoning behind it.
- Description of future avenues of research given the current RPA panorama and what gaps in the literature still exist.

### **6.1 Recommendations**

The factors of successful adoption, challenges, benefits, and suitability characteristics of processes presented in this research can foster new research opportunities but also provide organizations that struggle with innovation with a clearer understanding of the technology.

There seems to be a lack of guidelines for implementation of RPA's in smaller organizations that could constitute crucial future research in this topic, given that these are the ones who could reap the most rewards from task delegation to digital workers. Another opportunity for future work regards the applicability of the discussed frameworks by attempting to replicate them in an organization.

Although process suitability for automation has been thoroughly researched there is still room for future research to provide frameworks for processes redesign with the goal of its' automation.

Given that new frameworks and methodologies for RPA adoption continue being studied and previous ones keep on getting improved, future work could potentially investigate what new benefits may arise from more efficient applications and which new challenges pose new threats to the current RPA landscape.

## 7. Conflict of Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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