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Business robot farm management in the Robotic Process Automation (RPA)

1. Introduction

The 21st century brought enormous growth potential to the global digital services market. Never before has digital technology developed so rapidly as in the past two decades. We are witnessing both a digital evolution and a digital revolution. Along with the digitization of many sectors of the economy, the customer has been placed as a superior value. It resulted from the use of IT tools and solutions to support the process of co-creating products and services (Vargo et al., 2014). The emergence of the 'software-as-a-service', 'infrastructure-as-a-service' or 'platform-as-a-service' models together with the use of IT algorithms for analyzing and processing huge amounts of data changed the face of the world around us, and it enabled machines to "learn" to use their maximum potential to support people in almost every manufacturing or business sector (Mendling et al., 2018).

This article will aim to analyze the one of management models of business robots farm, which are widely used in the automation of business processes in organizations operating in almost every industry. The presented research in this study aims to propose an

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efficient way of operating and best practices employed in the organization of work within the entity referred to as an RPA robot farm. The efficient management of RPA robot farms in accordance with best practices holds the potential to markedly elevate an organization's automation capabilities and financial performance. By elucidating the nexus between effective RPA management and organizational outcomes, this study underscores the pivotal role of strategic RPA governance in driving operational excellence and competitive advantage. In addition to the review of the scope of the literature - a Scopus review (SR) conducted by the author, and a case study describing the issues related to the subject of this article will be presented. The considerations are intended to fill the existing research gap, caused by insufficient attention of the scientific world devoted to the issues related to the robotic process automation industry. There are practicly no articles explaining the management model of the entity called RPA business robot farm. Sobczak (2019) outlined the need for further research on developing a management model for the digital automation industry. This subject can be a very interesting source of knowledge for both practitioners and theorists, and its multi-level nature creates a very wide field for further scientific considerations.

2. Theoretical Background

Robotic automation of business processes (RPA) is a modern technology based on the use of artificial intelligence to work on information systems. Such solutions have been used in the IT market for a short time (UiPath, 2016). RPA is characterized by dynamic development and very high interest of companies, resulting from the possibility of increasing the production efficiency of enterprises with an incomparably lower financial contribution compared to employing a larger number of employees who are to perform the same tasks (Capgemini, 2017). They consist of a non-invasive way of imitating human behavior in the field of repetitive, often monotonous activities aimed at the implementation of specific business processes (Fernandez, Aman, 2018, p. 125). The robot can imitate an employee, enter data into the application, read and analyze content and, in accordance with the process logic, lead to the full implementation of specific tasks (Martinek-Jaguszewska, 2018, p. 233). Technology, the main goal of which is to automatically perform tasks traditionally carried out by "human employees" (Rutschi and Dibbern, 2020), is mainly based on interaction with the existing UI, i.e. the graphic layer of systems and applications (Greyer-Klingeberg et al. 2018). Its main

advantage is that it can be compared to an infinitely scalable solution that imitates a virtual employee, which can be trained in a very short time to perform operations based on established rules (in other words, a business procedure) at the speed of the machine (Lacity and Willcocks, 2016). Thanks to this approach, it is possible to create a virtual workforce corresponding to virtually any number of real employees without the need to train each of them, because once designed business logic that makes up the construction of the solution can be used many times within the operation of a given business process.

A virtual employee not only does not need a mass of implementation training consisting of those based on work safety or administrative (such as settling their working time, reporting hourly schedules, or how to use organizational system applications) but also does not need to eat, sleep or rest (Huang and Vasarhelyi, 2019). Technology that allows the user to shorten the time needed to perform tasks, reduce errors related to the interference of the human factor or constantly process huge amounts of data in practice, allowing to redirect employees' attention to tasks requiring creativity, where people will probably not be replaced for a long time (Gejke, 2018). In addition to obtaining financial benefits resulting from the implementation of the solution, there will be aspects such as reducing employee demotivation or generally freeing them from routine, often monotonous and frustrating tasks, which, in their opinion, do not allow for real professional development (Willcocks and Lacity, 2017). Thanks to these advantages, the technology was quickly noticed and appreciated in the business world, which is constantly looking for solutions that allow organizations to gain a competitive advantage. One of the first sectors to see an opportunity to apply such solutions was finance and accounting (Opus Capita - Asatiani and Penttinen, 2016), telecommunications (Telefonica O2 - Lacity and Willcocks, 2016), and human resource management (Deloitte - Buckingham and Goodall, 2015). The unflagging popularity of robotic process automation also caught the eye of banking specialists, based on the case study of the Scandinavian bank Nordea (Kedziora and Penttinen, 2020). Thanks to such a great interest in intelligent automation services, the technology was able to develop further, offering more and more new solutions and tools, which, although they were not something completely new, but rather a combination of the usability of many cooperating available solutions. Their constant evolution and far-reaching improvements have allowed them to raise the quality of solutions to a completely different level.

Automating processes not only boost efficiency by expediting tasks and heightening productivity levels compared to manual methods but also offer multifaceted benefits to the organization. Additionally, process automation streamlines information integration, reducing reliance on human intervention across various dimensions of operation (Nalgozhina et al., 2023).

To better illustrate the use of robotic process automation technology, an exemplary business process can be proposed that would be a real solution problem in the organization. The proposal of such a task would be the need to create an advanced report based on a large amount of data collected from various IT systems - e.g. data on a very large number of employees. After collecting all the necessary information, there would be a need to check its correctness (validation), process, segregate and then create a report that would be sent to a certain number of people in an appropriate form. The proposal would meet almost all the features of an ideal business process for automation: a large volume of data distributed in many IT systems, a monotonous, repetitive procedure according to which the task is performed, and overall time-consuming (Gejke, 2018). The method of automating work of this nature using the described technology would consist of the interaction of technology with existing applications and systems (and more specifically their interfaces) by mapping the steps taken by human employees to achieve the intended goal (Greyer et al., 2018). The solution is based on the use of non-invasive mechanisms that analyze the structure of applications, websites, systems, and IT tools, thanks to which a map of attributes of the elements available in them, such as buttons, triggers, text boxes, or images is built. Attributes describe almost every aspect of an element, from position to color, font, and function. Once mapped, an element will be recognized by technology each time, which will enable simple and quick interaction, e.g. clicking a button, selecting an appropriate option from a drop-down list, reading text or even the entire table, or entering specific text or values into cells or fields (Leno et al., 2018). It is possible to perform other activities such as opening and closing applications, and processes, recognizing objects or windows, sending server queries, or using practically most IT functions available in popular programming languages such as .net or C # (Rajesh and Ramesh, 2018). Thanks to this level of non-invasiveness, Robotic Process Automation solutions have been defined by the Institute of Robotic Process Automation and Artificial Intelligence (IRPA-AI) as not part of the existing IT infrastructure of the organization, but rather as an additional solution at its peak. This was also mentioned by Enriquez in one of his works (Enriquez, 2020). Kommer (2019) very rightly pointed out that

RPA aims to replace people with automation done in an outside-in manner. This differs from the classical inside-out approach to improving information systems.

In 2014, when solutions of this class were not yet very popular, a report by a large consulting agency was published, presenting the advantages of the technology and describing its mode of operation (Forrester Consulting, 2014). The strategic partner and source of technical knowledge at that time was one of the first major players in the business process automation market - Blueprism. The successes achieved in the field of digital robotization have focused the interest of technology companies on this aspect. There are a lot of competitive solutions on the market that started to fight each other for customers, the use of innovative automation tools, and the highest quality in increasing the efficiency of the organization. Currently, we can distinguish 4 suppliers of robotic process automation technology, which are undoubtedly recognized as market leaders. These are the above-mentioned British Blueprism, UiPath created in Romania, the American Automation Anywhere, and the Microsoft product - Power Automate (Gartner, 2021). Regardless of the implementation model or the technology used, the demand for this type of service has increased significantly in the RPA market. This was demonstrated in projected revenues for market leaders - UiPath, Blueprism, and Automation Anywhere (Wadhawani and Prasenjit, 2020). The constant dynamic growth of this IT sector has created a huge demand for specialists in robotic automation technology. According to Schlegel and Kraus research carried out in 2021, about 65% of the surveyed companies expressed a need for experts in this field, and 40% of them are looking for employees who use more than one tool. The time related to the Covid-19 pandemic additionally fueled the market and increased the demand for some implementations in non-commercial conditions. In the literature, we can find a description of "coronarobots" used in the healthcare sector in response to the difficulties that arise in the market and the increased occupancy of hospital patients (Kedziora and Smolander, 2022).

From a financial point of view, robots are most often sold in the form of a license. One license allows one automation to run at a time, which can run continuously 24/7 (Uipath, 2022). In the case of Blueprism or UiPath technology, one robot can simultaneously perform one "foreground" process - that is, activities on the graphical interface of applications and systems, or several "background" processes, which means operating on the programming layer, without mapping the actual system navigation.

In the literature, we can find examples of savings and benefits obtained by companies operating in various business sectors. The Blueprism technology provider boasted about the effects of implementing their technology in Coca Cola company. This made it possible to perform up to 8 times more work without the need to hire new employees, add about 16 working hours (in the context of the effects of automation) each day, support data audits, and improve customer experience (Blueprism, 2018). Another market technology vendor, UiPath, told the Federal Bank's story of automating business processes. The result of the implementation was a case study of work on 10,000 customer records. While a human worker was processing 200 to 300 records in a full working day, it took about an hour for the robot to do so (UiPath, 2019). The software provider Automation Anywhere boasted a successful project for Australia Post, which resulted in the implementation of 120 robots to automate 25 business processes. This resulted in savings of 18,000 working hours per year and a 15% reduction in the cost of accounting services (Automation Anywhere, 2019). The Deutsche Bank case study describing the use of both robotic process automation and machine learning technologies documented a 70% decrease in the time of performing automated tasks, and an increase in work accuracy while reducing the number of errors (Villar and Khan, 2021).

The use of a single robot can significantly facilitate the organization of work and relieve some employees by performing daily tasks for them, but also in this case the real strength is manifested in the application of a large-scale solution. In order to influence global results, multiple robots are required to automate many business processes. This allows taking an advantage of the maximum opportunities offered by technology, ranging from improving the company's financial results to non-business aspects such as influencing the level of employee creativity or increasing the overall customer satisfaction of a given organization (Marciniak and Stanislawski, 2021). Investing in software robots entails the need to employ qualified specialists who deal with the full implementation from the analysis of business processes susceptible to automation, to development, to the point of their implementation in the production environments in which they are maintained (Anagnoste, 2018).

For the purposes of this article, the concept of an RPA robot farm will be introduced, probably used only by practitioners in business realities and operational departments. The issues related to the robotic process automation industry are still a relatively little explored niche, which deserves attention due to both the results obtained by its application, the very high pace of development of the entire sector, and the huge development potential in the

future. In the context of Robotic Process Automation (RPA), a business robot farm represents a sophisticated ecosystem where numerous software robots, or bots, work collaboratively to streamline and automate diverse business operations. These bots operate autonomously, meaning they execute tasks without continuous human intervention, thus enhancing efficiency and reducing manual errors. Furthermore, the orchestration of these bots is automated, facilitated by advanced scheduling algorithms and centralized management systems, ensuring seamless coordination and optimal utilization of resources. There are examples in the literature regarding the development of centers of excellence with automation, along with research on its management model (Sobczak, 2019), but the very approach to RPA robot farm management in the form of a corporate structure still creates a large research gap. This article will primarily address the management challenges associated with operating an RPA business robot farm, particularly in relation to the multidimensional nature of digital workforce organization. These challenges encompass various aspects such as financial considerations, information management, and security concerns. The major limitation of this article is the limitation to a single case study that allowed us to examine a single organization. Conducting similar research on other organizations could significantly contribute to deepening knowledge about the studied issues and could allow for comparison of different entities, which would contribute more to the creation of best practices in managing and managing an RPA robot farm.

3. Research methodology

3.1. Characteristics of research methods

This article assumes the use of two research methods: scoping review (SR) and case study (CS). The review of the scope of literature is a method that enjoys an increasing interest in the scientific world. This is confirmed by the fact that studies have been prepared and knowledge is synthesized on this subject (Pham et al., 2014). There are many definitions of scoping review, but the most common (and the most popular) in the form of information synthesis, answering exploratory research questions (Colquhoun et al., 2014). The method assumes searching for relevant sources of information, qualitative data selection, and mapping the research conducted on the discussed issues (Peters et al., 2015).

Several essential steps have been taken to obtain relevant results through a literature review. They are defining research questions, searching for sources of knowledge appropriate for this purpose, making a quantitative and qualitative selection (in the form of selecting materials most suited to the discussed issue), conducting research presenting the results, and finally discussing them. This approach is consistent with that presented in the literature (Ćwiklicki, 2020). The main tool used for this purpose was the EBSCO search engine, selected due to the possibility of indexing sources from the analyzed thematic scope.

Table 1 presents the results of the search of databases containing papers and scientific articles, along with the criteria selected in terms of the selection of literature, in accordance with the protocol of the scoping review (SR) method. The searches concerned documents presented in English, with the limitation of the year of publication from 2014 to 2022. Some of the references used were not included in this literature review as it was found based on the reference of scientific articles to other studies available in the literature. It allowed to more effectively reach the most interesting issues in the context of the discussed issue.

Table 1. Research details for the document subject

SR Protocol element	RPA research details
Sources	EBSCO search with links to Research Gate and IEEE Explore
Keywords	Robotic process automation, case study, organization, business management
Search strategy	Analysis of the title of the work and the date of publication, abstract analysis, analysis of the text in the case of compliance of the subject matter presented in the abstract with the subject of this article
Inclusion criteria	Articles published within the range of 2014 - 2023, Priority for articles published in scientific journals and science publications, Articles containing full text PDF files, Case studies from companies using RPA solutions
Exclusion Criteria	Articles without full access, Articles without references to other papers, Articles without full PDF files, Articles with abstract access only

Source: own study

Table 2 shows the number of articles found using the EBSCO search engine. Its content shows the selection of keywords and the number of articles in three categories: total results, full text results, and results published in scientific journals.

Table 2. Keywords used in EBSCO search

Search Criteria	Number of results	Full text	Scientific journals
robotic process automation	2,001	1,785	127
robotic process automation AND case study	44	26	19
robotic process automation AND organization	401	371	32
robotic process automation AND business management	90	77	12

Source: own study

The second method used was a case study representing a qualitative scientific approach. It is characterized by an attitude toward a better understanding of the studied topic, the main purpose of which is to obtain new information about the studied issue. The method assumes a more thorough examination of a smaller number of cases in a detailed manner, as opposed to the analogous quantitative method, based on examining a large group of recipients in order to obtain statistical data (Yin, 2003). The presented case study concerns a company that is one of the technological leaders in implementing new digital technologies. The organization is recognized as a world leader in the digital transformation market, as evidenced by, among others, cloud technology implementation services, artificial intelligence, modern applications, and robotic process automation. The reason for choosing this specific example is the large experience of organizations related to the subject of the digital robotization of enterprises discussed in this article.

3.2. Defining research questions

The review of the scope of the literature showed, on the one hand, a great interest in the discussed subject, but on the other hand, it proved the thesis about evident gaps in the deeper analysis of the issues related to robotic process automation. The discussed issue concerns the still relatively young branch of science and computer science itself. This creates a huge research gap in the context of considering the RPA robot farm management model. There is a lack of analysis and research regarding both the best practices and the approach to effective management and supervision of digital employees, which would certainly find interest in the broadly understood IT business, using this young and innovative technology. The revealed problem has a multi-level background, which consists of financial, information or security issues. In connection with the above, 4 research questions were created, the answer to which will be presented for further consideration:

RQ1: How to realize financial cost optimization in RPA business robot farm management?

RQ2: How to ensure a high level of knowledge and information resources on the RPA business robot farm?

RQ3: How to calculate and evaluate the benefits resulting from the implementation of RPA technology?

RQ4: How to ensure a high level of security for the environment and sensitive data?

4. Results

4.1. Case selection

The case study concerns an international corporation originating from the European market, which provides its services all over the world, focusing mainly on IT-related aspects. The main markets in which it operates are banking, finance, and the public sector, for which it implements projects related to the broadly understood digitization, including the development of cloud technologies, artificial intelligence, integrated enterprise management systems, IT infrastructure, security and digital automation of business processes. In addition to the above-mentioned aspects, solutions including data management, system integration with the implementation of advanced system solutions, or Big Data should also be emphasized. The company employs over 100,000

employees worldwide, including nearly 8,000 employees in Poland, where it has several branches located in strategic cities. The Polish daughter company has an efficiently operating RPA robot farm, which is designed to automate structured and repetitive tasks for several departments of the organization, mainly in the area of human resource management. The robot farm consists of an orchestration platform and several dedicated virtual machines using UiPath technology, and partly PowerPlatform. The main tasks performed from start to finish by robots include, for example, issuing medical applications, booking working time, recruitment processes and operations on the SAP system. Automation units operate using over several software robots that automate the work of over 20 business processes, with the benefit of bringing savings for the organization. Robots operate fully autonomously, often at the same time, working on various business processes simultaneously, which results from the use of multiple virtual desktops. Technological robotic process automation solutions are gaining more and more interest in the company due to the fact that employees are skilfully relieved of monotonous and time-consuming duties that were performed by employees for some time.

4.2. Answers to the research questions

When answering the first research question (**How to implement the optimization of financial costs in the management of an RPA business robot farm**), first of all, several components that affect the financial costs of an RPA business robot farm should be mentioned. For the purposes of the article, the following have been listed:

- license costs (software),
- costs of IT infrastructure (hardware,
- costs related to employees responsible for maintaining a robot farm,
- costs related to changes in business processes,
- costs related to delays in starting the work of robots due to failures,
- automation prioritization.

The first thing to mention is the licensing costs. Providers of the most important technologies in the RPA industry (UiPath, Blueprism, AutomationAnywhere) operate on the basis of a licensing model. Licenses are divided (depending on the technology, but also within a given technology) into the prices of robots (a single license corresponds to the possibility of one robot operating at a time, 24 hours a day), licenses allowing the use of the development studio itself, and those responsible for the possibility of

commercial use of an automation platform that gives users the ability to fully remotely and automatically run individual robots, along with functions that collect logs and present data in a visual form (e.g. the amount of work performed, operation statistics). First of all, the need for a specific number of licenses should be assessed on which the entire farm will operate, and the second, they should be selected in terms of quality - they often differ in the way they operate, so they can be used in various business cases. The unwise selection of a license that is too large, too small, or intended for other purposes will be an additional and unnecessary cost. A perfect example illustrating this problem is the unreasonable planning of automation launches. If we imagine the license price as a 24-hour time slot, on which we can impose the time of launching individual robots, assuming that each of them works for about 3 hours and we divide the time of these launches with hourly breaks, we can see that the price of one license will allow us to run a maximum of 6 automation on one key, in one day. Reasonably planning the start-up time, compared to the presented example, we will gain an additional 6 hours (constituting as much as 25% of the license cost) to be used. The second important aspect is the cost of IT resources (laptops, physical servers, virtual machines), which works similarly. Too many machines will result in unnecessary costs related not only to the cost of infrastructure, but as well as additional licenses of applications or systems, and too little will limit the automation potential, potentially resulting in the creation of a work backlog for robots, and thus lowering the efficiency of the entire investment. The third cost is directly related to the personnel working with the technology. It must be responsibly selected both in terms of the number of specialists and their competencies. Insufficient number of staff will have to take into account delays in both the maintenance of robotic resources (ongoing repairs and improvements) and delays in developing new solutions for automated business processes. The key is to consciously select specialists with appropriate competencies, e.g. a team, selecting experts (senior developers) to handle only a few robots, or more simple-to-use automation) may be an excess of form over content, and the other way around - the selection of inexperienced employees may affect for a significant extension of the time they perform tasks, and in extreme cases even the inability to cope with serious problems. Another important aspect in terms of finance is the conscious planning of changes or updates to applications and systems used by robots. Unfortunately, robotic process automation technologies are not very good at dealing with this problem. In the case of visual changes or changes in the source codes of applications and

systems, there is often a problem related to the inability to interact with the elements used in RPA solutions. The technology is based on the so-called selectors that allow it to recognize a given element and perform actions related to it. Of course, updates are very often inevitable and it is impossible to avoid this problem, but you can minimize its impact by planning the entire project, starting from informing the RPA team about the nature of the changes, selecting the appropriate implementation dates, and smooth repair (or maintenance) of solutions in which there will be even minimal risk of failure due to changes. The smoothness of the tasks performed can be crucial in the case of critical automation. Therefore, it is worth taking care of the smooth flow of information in the form of a system or solution that accepts user reports regarding malfunctions or the lack of performance of tasks performed by robots. In the case of a large-scale solution (a large RPA robot farm), an inseparable element of the puzzle is the use of the ticket system. This allows for the continuity of work along with the continuous flow of information obtained by users or persons responsible for specific business divisions. Systems of this type allow users to simultaneously track the pace and level of advancement of activities related to maintaining solutions in good condition and keep the maintenance department informed about the potential consequences of maintaining a failure state. This translates directly into the reduction of potential losses caused by robot downtime, which leads to a reduction in the efficiency of business divisions using automation. Concerning failures, it is necessary to create a well-thought-out prioritization of operating solutions, due to the differences in the importance of specific business processes. The most common model is to use a priority on a scale from 1 to 5, or from 1 to 4, where 1 is a business process critical for the organization's operation, and 5 or 4 is a relatively light process. In the event of failure of the most important solutions, it is necessary to take immediate actions to eliminate the defect and restore the solution to the condition prior to its occurrence. Appropriate nomenclature of robots and documentation regarding priorities allow to maintain a high level of vigilance and increase the speed of reaction to any errors.

The answer to the second research question (**How to ensure a high level of knowledge and information resources on the RPA business robot farm**) is inextricably linked with having an appropriate knowledge base on robots, procedures, and business processes. The knowledge base should have information on each of the automation in the form of appropriate documentation: process design document (PDD) - describing the course of the

business process step by step, solution design document (SDD) - presenting the technical aspects of the solution, very often including a full description of the implemented IT logic, information on the values in and out of automation as well as low and high-level business process maps. A good knowledge base on processes should also document the contact points appropriate for the solutions, such as the owners of a given process, people approving automation, and decision-makers with the possibility of continuous updating of these data in the event of team rotation within the organization. It is a popular practice to record meetings aimed at presenting the business process and all steps related to its course, at meetings with specialists responsible for their implementation so far, and with the greatest knowledge of each aspect of the procedure. In the real world, even with your best notes, knowledge can be fleeting. Creating a well-thought-out recording saves the time of both those responsible for the process in the future and developers working on the solution because this method allows us to quickly return to the meeting and get answers to a large part of the questions. The same method can also be used for ready-made and working solutions in order to potentially transfer knowledge between specialists during their design or organizational rotation. The phenomenon of attrition is, of course, a very natural process, the effects of which affect the level of technical knowledge should be avoided with the greatest care. Another important, but often overlooked document, is the solution maintenance manual, which contains information on the most common errors along with advice on how to solve them. This is often skipped, but is very useful in high attrition companies, where the maintenance engineers are replaced by other employees, lacking the deep knowledge of the solutions. Each process change should be recorded, as well as each version of the robot implemented in the production environment. In the first case, attention should be paid to a detailed technical description of all changes made in specific parts of the logic, in such a way that allows efficient navigation to the corrected elements and easy understanding of the reason for which the given part was edited. Secondly, when deploying new robot versions to the productional environment, the description should be included that shows the differences from the previous version in a structured way that gives as much information as possible without going into the most technical aspects of the changes. The issue of technical descriptions of the edition of solutions can be solved using specially created documents, and the control of production versions can be facilitated by the use of special IT repositories, very often used in the programming industry, such as

GitHub, Microsoft Team Foundation Server (TFS) or Bazaar. RPA software providers also have their own solutions, which unfortunately are not as advanced as dedicated market software, but very often you can come across additional RPA technology mechanisms that allow for their full integration. The perfect example are UiPath Orchestrator platform, or Blueprism's Control Room.

In response to the third research question (**How to calculate and evaluate the benefits of automation**), mention should be made of the documentation or the use of an IT application cataloging the savings resulting from the applied automation. The correct calculation should be based on the comparison of the average time of performing certain tasks by human employees in relation to the time of performing the same job or tasks by a digital employee. For example, if an employee performing certain activities needs about 10 minutes to process one request (taking into account breaks, fatigue, or corrections caused by human errors) for 100 requests a day, we can define the time needed to complete the entire task as 1000 minutes, or approximately 17 hours. If the robot completes the same task for 3 minutes, for 100 requests, the full processing time will be 300 minutes or 5 hours. One-time automation will allow the beneficiary of the sample automation to recover 12 hours a day for the presented scenario. If we assume that 100 is the total number of daily reports, we can define the savings as 12 hours a day, which in relation to the working time of a single employee, i.e. 8 hours, will give us 1.5 FTE (Full time equivalent). However, if there are many more applications, and the automation can operate 24/7, including weekends and non-working time, the savings will be much higher. The most common form of representation of savings is the one expressed on a monthly basis, related to the average value of 160 working hours, referred to as 1 FTE. The use of IT tools for cataloging the savings obtained each time also allows the user to document how the saved time was used by the organization. Employees can be redirected to more creative tasks, or the total number of employees needed to work in a specific unit can be reduced by using automation. We can define this type of savings as those correlated with financial results, but it is worth noting that the benefit, which is definitely a more difficult to measure factor, may be the increase in the so-called customer experience. Although it is difficult to assess how customer satisfaction with using the services of a given organization translates into its specific financial results, it is certainly known that they certainly contribute to their growth and the increase in the popularity of the organization itself among customers.

The last research question (**How to ensure a high level of security of the environment and sensitive data**) concerns the protection of the environment and the prevention of disclosure or leakage of particularly sensitive data, such as personal, financial, confidential, or top secret data. First of all, steps should be taken to increase the security level of the infrastructure itself. A popular practice is the use of the virtual private network (VPN), which allows access to websites or virtual environments only to users logged in to the internal network of the organization. This practically prevents unauthorized access to resources by unauthorized persons, but it is not sufficient protection. The next step is to limit the number of users of the environment and limit access depending on the role of the employee performing the tasks. This allows access to specific functionalities only for appropriate employees, depending on their specialization and the specificity of the work they can perform depending on the division into projects, areas of interest, or clients for whom they work. It is necessary to consider an appropriate access policy to access passwords. Tools of the credential manager type come to the rescue, which can come both from the technology provider and from external sources (e.g. windows credential manager, KeePass, and various types of password vaults). Avoid the so-called hardcoding of passwords in the logic of the solution, because they create a huge threat from unauthorized or irresponsible employees. It is also possible to create master accounts, access to which should be granted only to appropriate users with high technical, supervisory, or managerial functions. Two-step authorization is gaining more and more popularity, which, apart from the required passwords, requires an additional source of security (such as codes sent to a mobile phone or PKI cards). Another important aspect is the care for the high quality of logs generated by RPA solutions. Industry best practice is to use a clear flow of information and to avoid (or completely exclude) the use of sensitive information in your logs. If any data of this type must be used in transactions, due to the specifics of the business process, all data should be encoded (encrypted). Such a procedure effectively reduces the chance of a security breach or data leak. The last step is a well-thought-out infrastructure that limits or eliminates the possibility of serious failures of the entire environment. The applications of the HAA (High Availability) solution allow us to maintain the continuity of services, even in the event of damage to a specific resource. It involves the use of several synchronized servers and dynamic redirection of their load without losing the smoothness of tasks performed on them, at the same time solving the problem of temporary unavailability of a specific environment, and significantly facilitating maintenance work on IT infrastructure.

5. Discussion

In reference to the **first research question**, a reference will be made to individual studies based on the analysis of a technological solution of major international companies in the business market. The case study of Nordea conducted by Kedzior and Pettinen (2020) indicates the need for an appropriate selection of technology staff, with an indication and particular emphasis on specialists involved in the maintenance of the RPA robot farm. Geyer-Klingeberg et al. (2018), using the example of a Vodafone case study, noted that having an efficient solution maintenance team is the key to success, and continuous monitoring of the quality of solutions helps to avoid serious problems related to the use of technology. This confirms the earlier thesis about the importance of using the ticket system in order to shorten the time of information flow and the speed of responding to failures or application updates, especially those regarding the automation with the highest priority. Unforeseen or poorly planned processes of changing or updating systems and applications may cause delays or, in extreme cases, lead to the complete failure of robotic process automation projects resulting from the lack of return on investment (Marciniak and Stanisławski, 2021). Other authors came to similar conclusions during the research conducted for the Nordea bank (Kedziora and Pettinen, 2020). Minimizing the financial costs associated with the services provided (as well as offered) should be a natural sequence of things, and according to the results obtained in the example of the Opus Capita case study, this is one of the requirements that customers will be striving for (Hallikainen et al., 2018). Cost minimization should be a key element in creating an RPA robot farm, but it should be done in a reasonable way (e.g. based on a conscious selection of licenses, the number, and quality of specialists, appropriate infrastructure, the use of appropriate tools), and not at any cost.

Taking into account the results obtained in response to the **second research question**, it is worth starting with the need to structure documentation that appears in the literature. The lack of an appropriate knowledge base regarding the entire technological solution and maintained solutions may have its potential effect on reducing the level of knowledge regarding the entire automation project. Fernandez and Aman (2018) identified a decrease in the level of competencies or a low level of knowledge about technologies and solutions as one of the factors that could harm the success of the entire project based on RPA technology. The same conclusion was obtained in the course of the research conducted at Opus Capita. The authors emphasized

the constant need to develop in terms of technical competencies, knowledge of potential problems, and raising the level of knowledge about existing solutions by specialists (agents) working with technology (Hallikainen et al., 2018). Sobczak (2019) described in his work many aspects related to the use of robotic technology for automating business processes and indicated both the benefits resulting from it, as well as the potential costs and risks. One of the few listed elements was the need to train the personnel responsible for the technology, which indicates the need to build an appropriate knowledge base and high-quality documentation to be used also for this purpose. An additional aspect indicating the importance of an efficient flow of knowledge is building employees' awareness of what the technology is and how it works. It is aimed at avoiding potential mistakes and errors related both to the reckless actions of users while operating on the business processes themselves and to interactions with technical solutions. Among the most important documents, Sobczak mentioned those describing the business logic on the basis of which the robot logic is built (process maps built in the BPML standard, based on which the process design document - PDD is created) and the documentation of the robot code, i.e. differently speaking the solution design document - SDD.

The results of answering the **third research question** can be compared with the results of other case studies. Unfortunately, they do not talk about the method of calculating the results, but they present a preliminary comparison of the price of a virtual employee to the cost of employing a human employee. According to one of the studies, the ratio of such cost varies between 1/3 and 1/5 of the price of an ordinary employee (Capgemini, 2017), also in the results of another study, there was information that one robot is able to replace an average of 3 to 5 employees (Willcocks and Lacity, 2016). Another example described in the literature presented a calculation showing an even more significant advantage of a robotic solution over ordinary workers. Assuming that the robot works continuously for 24 hours a day, the savings obtained on this account would be up to 15 times more efficient compared to the work of human hands. Although the calculation seems very optimistic, in practice some cases could confirm this theory (Distler et al., 2018). The example of Axmann and Haroko (2020) showed an interesting case when the work of 3 people was replaced by one robot. The employees operated 8 hours a day, in 3 shifts each. Their work could be replaced by using one digital worker who worked continuously around the clock. The result of this study was a saving in the form of 2 FTE, which in practice means that one solution could successfully replace 3 specialists (3 FTE).

The **fourth research question** brought answers regarding the provision of high-quality infrastructure security and the policy of securing data particularly sensitive from the point of view of the organization. An example of a case study will be cited, in which the necessity to use an appropriate IT infrastructure was taken into account, as well as its modernization in order to meet security requirements (Kedziora and Pettinen, 2020). The key is the use of appropriate virtual machines or workstations with the granting of appropriate access to the environment only to unauthorized persons (Marciniak and Stanisławki, 2021). Another author of the same opinion (Sobczak, 2019) emphasized the importance of the interaction of the RPA automation department with other teams, in particular with the IT team. Particular attention should be paid to complying with all guidelines for ensuring the appropriate safety of the entire environment, as well as prior construction (or modernization) of an effective and well-thought-out IT infrastructure. Another aspect of the solution's application is the realization that a single robot (or rather, an access account to the systems and applications on which it operates) reflects the accumulated IT access and operational capabilities of the robot account itself, which may pose a threat to the organization if it is used in an improper way, or used by unauthorized employees.

6. Conclusions

Answers to the research questions asked could probably be supplemented by additional solutions, due to the very dynamic development of the entire sector. The case study is a very good method for qualitative description of a problem, but it has its significant limitations resulting from the subjectivity of the approach to solving specific research problems. A single case study provides information on only one economic entity and could be successfully extended to include further practical examples of the application of a specific management methodology or project methodology. Nevertheless, the application of best practices, which are suggested by both technology providers, users, and other organizations operating in the industry, are still very universal and can be used in virtually every case, without dividing the size of the organization or the level of its technological advancement. The second serious limitation is the insufficient amount of research available in the literature on the subject, the results of which could be juxtaposed. Considering modern technologies and innovative business solutions carries a risk in the form of subjectivizing the obtained results. The consequence of

this limitation is the inability to refer to a satisfactory number of scientific articles and to support the obtained results with a significant number of results obtained by other authors dealing with a specific topic. Research available in the literature, conducted on organizations operating in many business sectors, shows many analogies regarding almost every aspect considered in this work. The optimization of financial costs in the management of an RPA business robot farm is crucial for achieving operational efficiency and sustainability. This study identified key cost components, including licensing, IT infrastructure, personnel, business process changes, and failure-related delays. Effective cost management requires careful planning and judicious selection of licenses and IT resources, as well as an appropriately sized and skilled workforce. Additionally, strategic planning for system updates and the implementation of a robust ticketing system are essential to minimize downtime and enhance operational continuity. On the other hand financial benefits have to be properly calculated. Evaluating the benefits of automation involves precise calculation and documentation of time and cost savings, typically expressed in Full-Time Equivalents (FTEs). Automation not only reduces operational costs but also enhances customer experience and overall operational efficiency. Although the benefits of improved customer experience are more challenging to quantify, they undoubtedly contribute to the organization's growth and popularity. Next operational aspect of the RPA farm is knowledge management. Maintaining a high level of knowledge and information resources is imperative for sustaining the efficiency of an RPA business robot farm. This necessitates the development of a comprehensive knowledge base that includes detailed documentation of processes, technical designs, and maintenance manuals. Recording meetings and meticulously documenting changes and versions in IT repositories can significantly mitigate the impact of staff turnover, ensuring continuity of expertise and smooth operation of automation processes. Finally, ensuring a high level of security in the RPA environment is crucial and involves implementing multiple layers of protection. Utilizing VPNs, role-based access control, credential management tools, and two-step authorization are essential measures to safeguard access and protect sensitive data. High-quality logging practices should be adopted to monitor activities while avoiding the inclusion of sensitive information. Additionally, implementing High Availability Architectures (HAA) ensures service continuity and minimizes the risk of serious infrastructure failures. Regular security audits and assessments can further identify vulnerabilities and reinforce security measures. Continuous training and awareness

programs for staff are also vital to maintaining a strong security posture and preventing potential breaches.

The conclusions drawn from this research provide practical guidance for organizations seeking to enhance their RPA capabilities. By following the recommendations for optimizing finances, managing knowledge effectively, evaluating benefits, and bolstering security measures, companies can operate their RPA systems more efficiently and securely. These insights not only contribute to improving RPA management practices but also offer clear steps for organizations to navigate the challenges of adopting and maintaining RPA, ultimately supporting their long-term growth and competitiveness in today's digital business environment.

Authors of future research on the issues presented in this article may successfully focus on the aspects of documentation hygiene, the approach to the calculation of savings in combination with the financial aspects of running an RPA farm (such as potential costs and potential profits). There is a high probability that the area of IT infrastructure integration, robotic process automation technology as well as security and cybersecurity issues is also an interesting direction for future considerations. Subsequent articles on the RPA robot farm management model would allow the results of this case study to be compared, which could in the future supplement the omitted aspects or potentially verify the results obtained in this document.

Abstract

The growing demand for innovative IT solutions allowed the existing industries to develop and enabled the emergence of new ones, which filled the existing technological gaps. Among them, we could observe a dynamic growth of the robotic process automation sector. Business robots are designed to automate the organization's business processes by imitating real users performing their daily duties, which are based on structured, repetitive procedures, increasing the operational efficiency of the organization while reducing the impact of the human factor. With the advent of this solution, there were also issues regarding the management model of the RPA robot farm. The results presented in this article are based on the results obtained from a case study on an organization operating in the IT consulting sector. This article addresses critical challenges in managing a robotic process automation infrastructure, focusing on financial optimization,

knowledge management, benefits evaluation, and security enhancement. Through the case study it investigates strategies for realizing cost efficiencies, ensuring robust knowledge resources, evaluating implementation benefits, and fortifying security measures within RPA environments, offering valuable insights for organizations navigating the complexities of RPA deployment and management.

Keywords: *Robotic process automation, RPA Farm, Software Robots, Automation management***.**

JEL Codes: M15.

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