Human Technology

ISSN: 1795-6889

https://ht.csr-pub.eu

Volume 18(2), October 2022, 143–190

ANALYSIS OF THE CONDITIONS INFLUENCING THE ASSIMILATION OF THE ROBOTIC PROCESS AUTOMATION BY ENTERPRISES

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Abstract: *More and more companies are implementing the RPA (Robotic Process Automation) tools that belong to the newly emerging category of IT solutions used to automate business processes and enable the development of the so-called software robots. The term robot has a metaphorical meaning here – it is a special kind of software, not a device. Due to the fact that this is a new product category and many companies do not have extensive experience in this area yet, the use of the RPA tools is associated with many risks. At the same time, due to the increasingly competitive environment, it seems that there is no turning back from the implementation thereof. For this reason, two goals have been set in the article. The first is to build and verify a research model based on the TOE model (Technology-Organization-Environment), allowing for the identification of the determinants (drivers) influencing the assimilation of the robotic process automation by enterprises. The second goal is to develop recommendations for the managers responsible for implementing the RPA tools that will allow for increasing the assimilation of the robotic process automation. The following methods were used to accomplish these goals: literature research, a survey (conducted on 267 Polish enterprises) and statistical analysis (with the use of the structural equation models).*

Keywords: *Robotic Process Automation, TOE model, Assimilation of innovative IT*

DOI: https://doi.org/10.14254/1795-6889.2022.18-2.4

INTRODUCTION

S. Zuboff described in detail the impact of digital technology on employees and their work using an ethnographic approach in his study *In The Age Of The Smart Machine: The Future Of Work And Power* published at the end of the 1980s (Zuboff, 1988). Despite the extremely rapid technological changes that have occurred in recent decades, Zuboff's main observations on the impact that "intelligent machines" have on the way professional work is carried out are still valid today. According to the author, automation means using information technology to perform work faster and more efficiently. In the long run this will result in a profound transformation of the labor market. A few years later, in 1995, J. Rifkin presented the hypothesis according to which "we are entering a new phase of world history in which fewer and fewer workers are needed to produce goods and services for all mankind" (Rifkin, 1995). In his opinion, the declining demand for employees is a consequence of the progressing process automation made possible thanks to the use of more and more sophisticated IT solutions. At the same time, some researchers indicate that, especially in recent years, there has been a tendency in the media to exaggerate the impact of automation on the labor market. This is demonstrated, among others, by the results of the research (Eikebrokk & Olsen, 2020) analyzing the impact of the robotic process automation on the changes in the white collar workers' employment levels. According to the authors, robotic automation at the current stage of its implementation does not result in labor redundancies – most often it leads to the shifting of workers to perform other tasks within the same company.

However, one should be aware of the fact that the robotic process automation solutions (especially in combination with artificial intelligence) will be offering more and more capabilities year by year. The growing interest of enterprises in the use of the RPA (Robotic Process Automation) tools that belong to the newly emerging category of IT solutions in the field of business process automation is already visible. Enterprises interested in the use of software robots most often decide to implement the Robotic Process Automation (RPA) tools. These tools enable a relatively simple and quick development of software robots that perform activities carried out thus far by people and automate all or a part of selected business processes.

A number of benefits can be achieved thanks to the use of the RPA tools – both measurable as well as non-measurable ones. The most important among them include: cutting down the costs of running business processes, increasing the capability to carry out these processes without raising the headcount, improving Employee Experience by relieving employees from performing routine, tedious and mundane activities, improving the quality of products/services provided – thanks to reducing the number of errors made by employees involved in the performance of business processes, or, finally, increasing the number of innovations implemented in the organization by enabling rapid prototyping of new products/services that require an integration of various systems – in addition, without the need to involve internal IT departments.

At the same time, the author's previous research indicates that a significant number of enterprises in Poland have relatively little experience with the implementation of the RPA tools or are examining how to scale up the previously completed deployments (i.e. move from several to several dozen or more software robots developed with the use of the RPA tools). Therefore, it seems crucial for this purpose to identify determinants (drivers) that have an impact upon the assimilation[1] of these technologies by enterprises.

Therefore, the goals of this article include: (G1) building and verifying a research model allowing for the identification of the determinants (drivers) influencing the assimilation of the robotic process automation by enterprises; (G2) developing recommendations for managers responsible for implementing the RPA tools that will allow for increasing the assimilation of the robotic process automation.

In pursuing the above-mentioned goals of the study a diverse set of research tools was used. These include, accordingly: literature research, survey, statistical analysis (with the use of the structural equation models) and creative thinking techniques.

Due to the above presented goals of the article, the following paper structure was adopted. Section two presents the differentiating features of the Robotic Process Automation against the backdrop of the traditional tools used for automating business processes and indicates why these tools should be perceived as IT innovations, and also discusses the issue of the assimilation of innovative IT tools (RPA tools are an example of tools from this category). Section three provides a description of the structural equations model developed for the analysis of the assimilation of the robotic process automation. This section also discusses the hypotheses that were the basis for the development of the model. The next section presents the method used to acquire the research data, the characteristics of the research sample and the results obtained. Section five discusses the research results obtained and outlines the limitations of the research procedure applied. Section six presents research and application implications (including the recommendations for managers which, if applied, would allow for increasing the assimilation of the robotic process automation). In the last section the up to now considerations (conclusions) are summarized and the potential directions of further research are discussed.

THEORETICAL BACKGROUND

Robotic Process Automation Against the Backdrop of Traditional Automation Methods

The starting point for the analysis of the robotic process automation as compared to the traditional automation methods is to define the software robot concept. According to Willcocks and Lacity ((Willcocks & Lacity, 2016) p. 65), it is a piece of software that automates specific human activities (most often reproducing them faithfully) as part of the performance of the whole or a part of a selected business process. Thus, looking from this perspective, the robot is not regarded as a technical device and does not have the locomotive abilities of a human being. Software robots usually operate based on the set algorithm, although more and more often they are enriched with certain elements of artificial intelligence, thanks to which they are able to make more and more complex decisions (including learning from the data provided thereto - both structured and unstructured) (Lacity & Willcocks, 2018), p. 26).

RPA tools are used to build software robots. It is one of the fastest growing categories of the process automation software. Nevertheless, a consistent and universally binding definition of these tools has not yet been developed, especially as these solutions are evolving. The author, based on the literature studies (Lacity & Willcocks, 2018), (Willcocks, Hindle, & Lacity, Becoming Strategic with Robotic Process Automation, 2020), (Agostinelli, Marrella, & Mecella, 2019), (Aguirre & Rodriguez, 2017), (Anagnoste, 2018), (Kedziora & Penttinen, Governance models for robotic process automation: The case of Nordea Bank, 2020) made an attempt to identify the main differentiating features of this class of IT solutions. It can be stated that:

- RPA software allows for developing software robots that usually operate directly on the IT systems' user interface, most often faithfully reproducing (mimicking) the activities performed thus far by an operator (although more and more often they can use APIs and have direct access to databases);
- software robots automate repetitive and mass (high volume) activities - i.e. ones that are carried out many times within the given unit of time – e.g. within a month or a year;
- use of the RPA tools does not require coding in the traditional sense – instead of writing the robot's code the software is created from predefined code components (providing specific functionalities), presented as graphic objects, which are then configured by providing specific parameters or recording actions (e.g. clicks) performed by a human operator (although some RPA tools already available also allow for traditional coding);
- implementation of software robots built with the use of the RPA tools does not require introducing of any changes to the business processes being automated this way (although this is recommended and allows for achieving much better business results);
- RPA tools do not require the development of dedicated programming interfaces to be used for data exchange between the systems being automated (although more and more tools enable the use of ready-made connectors or adding new ones);
- RPA tools use the business logic of the systems being automated – this eliminates the problem of reproducing this logic (as a consequence it is not necessary to have knowledge about the internal structure (design) of the systems, which is important in the case of legacy systems) and results in no need to change the source code or the database of the systems being automated (which is a common problem in the traditional model of IT systems integration).

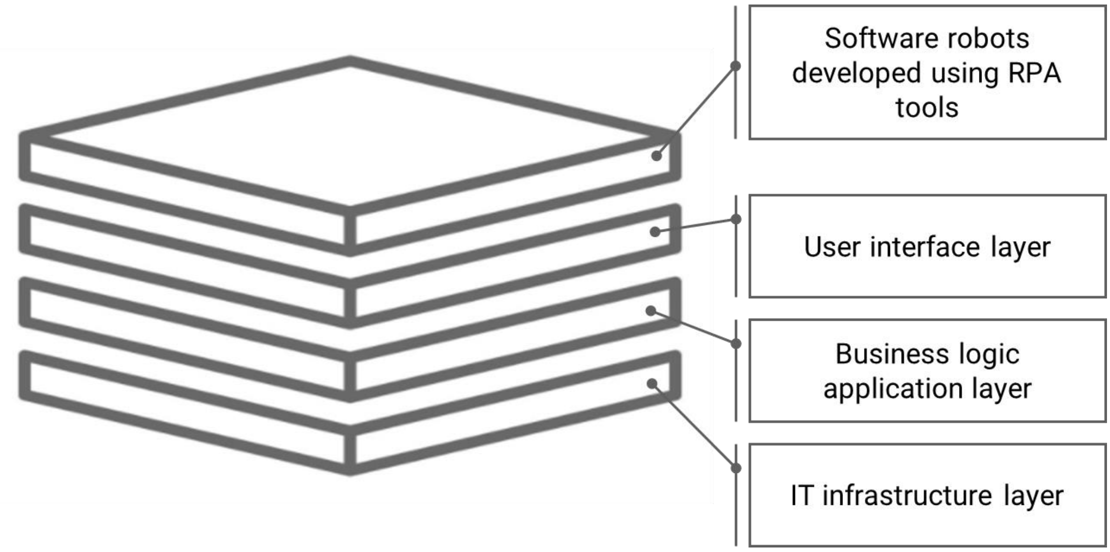

Figure 1. Layered model of process automation using software robots built in the RPA tool.
Source: own study

When comparing the RPA tools with the traditional solutions used to automate business processes – such as workflow systems or the BPMS (Business Process Management System) tools ((Shaw, Ch., Kawalek, Snowdon, & Warboys, 2007), p. 92-94), a single common feature and a number of differences can be identified. As far as the similarity is concerned, the RPA tools and the traditional automation solutions have the same goals – increasing the efficiency of business processes, cutting down the costs of the implementation thereof and ensuring the highest quality of the products of such processes. However, these goals are pursued in different ways.

The deployment of the workflow or BPMS solutions is most often associated with the implementation of complex IT projects, as part of which new components are deployed and the existing ones are altered. That is why such projects are usually carried out by the dedicated IT teams. In addition, this approach to automation assumes a profound alteration (revamping. overhaul) of the existing processes, and the introduction of the changes to these processes after the implementation has been completed results in the need to introduce modifications in the solutions used to automate them (the implementation of which requires time and adequate IT competences).

The RPA tools represent the opposite of the above approach. Their suppliers are striving to make them intuitive to use so that the representatives of business units, not the IT specialists, are able to use them (i.e. so that they are able to develop software robots themselves without or with a minimal support from the IT departments). At a number of companies it is done in the dedicated teams that constitute Centers of Excellence (Anagnoste, Setting Up a Robotic Process Automation Center of Excellence, 2018). Such centers are very frequently placed within the organizational structure of the company on the business side (not IT). The other model used to develop software robots is the distributed model – where people located in typical business units create such solutions (usually in collaboration with the security and IT departments). This approach has a number of advantages – among other things it ensures high speed and scalability of the robot development process and additionally allows for implementing automation based on deep domain knowledge (contained in the minds of the people who create these robots). At the same time, it should be noted that this approach could be dangerous if it were to allow for the occurrence of the phenomenon referred to as the "shadow IT" (i.e. if the robots being developed do not take into account the corporate standards and requirements with respect to security, compliance and IT architecture). Yet another way to acquire software robots is to rent (outsource) them from an external company. In this model the robot acts as a service (Robot as a Service), playing the role of a "digital worker" (Asatiani & Penttinen, 2016). The business department "hires" such a robot to perform a certain task, specifying the requirements for it in advance, and the external company (service provider) delivers and maintains it (in particular introduces changes).

At the same time, when implementing the RPA tools, there is a probability of an occurrence of certain risk factors – some of which are universal (i.e. they also occur in the case of applying the traditional automation methods), but some are specific to the robotic process automation. The most important risk factors – according to the author – that can be indicated include, inter alia, the wrong perception of the robotic process automation by employees (only taking into account the reduction of the costs related to human resources, and not, for example, focusing on improving the employee experience), the risk related to the wrong choice of the approach to the robotic process automation in the given organization (e.g. overly centralized activities related to robotization which will result in a slowdown of these activities), the risk related to the wrong choice of a robotic process automation tool (e.g. a tool that is not adapted to the company's existing IT architecture), the risk related to an inadequate approach to change management in the processes being automated (e.g. robotic automation of the so-called "mess"), the risk related to the resistance of the employees involved in the processes intended to be automated (due to the fear of losing their jobs), the risk of a competence gap (a loss of knowledge of the processes being automated – if robots are developed without adequate documentation) ((Lacity i Willcocks, Robotic Process Automation and Risk Mitigation: The Definitive Guide, 2017), p. 37-42), the lack of up to date and codified knowledge on the actual course of the business processes, in particular with regard to the way of dealing with exceptional situations occurring during their implementation (which may result in underestimating the time and expenditures required to develop the robots) and the lack of the coordination of the changes introduced in the systems as part of which the robot is operating (which usually results in the emergency stopping and downtime of the robotically automated processes).

To sum up, the deployment of the RPA tools can be perceived as one of the ways of implementing digital transformation (understood as a profound alteration (revamping. overhaul) – thanks to the use of technology – of the way an organization operates, leading to the development of a new model of its functioning) and as a digital innovation. Innovations of this type are understood as a) a new type of an IT solution, b) the outcome (result) of using this IT solution, c) the way the processes are implemented using this IT solution, changing the nature, structure or method of delivering products/services or the method of creating value for these customers, which in turn may lead to a transformation of the rules of operation for entire industries (Nambisan, Lyytinen, Majchrzak, & Song, 2017). Based on the presented determinants (drivers) of digital innovation, it can be stated that: (1) RPA tools are classified as innovative IT solutions, (2) software robots (developed with the use of the RPA tools) enable introducing a change in the way a business process is implemented and/or creating of completely new products, (3) use of the RPA tools changes the way entire industries operate – it can be seen most clearly in the banking and investment sector, as well as among the companies providing advanced business services (BPO and SSC) (Fernandez i Aman, 2018) (in the case of this industry it is even referred to as "cannibalization" of the traditional way of doing business ((Hallikainen, Bekkhus i Pan, 2018), p. 50). For this reason, it is so important to develop mechanisms allowing for the effective assimilation of the RPA tools by enterprises and their employees.

As seen from the literature analysis presented above, software robots are a particular type of software that can be used as one of the tools to carry out digital transformation in enterprises. Several existing scientific publications are concerned with identifying the distinguishing features of software robots—on the one hand, against the background of classic, domain-specific IT systems (Lacity & Willcocks, 2018), and, at the same time, against the backdrop of other process automation solutions—in particular, BPMS platforms ((Shaw, Ch., Kawalek, Snowdon, & Warboys, 2007), p. 92-94). The specific features of software robots (e.g. operations mimicking human-operator behavior) allow several benefits to be achieved—both financial (the implementation of Robotic Process Automation—RPA—is a source of significant savings, in particular) and non-financial - concerning, for example, a change in the way and scope of work previously carried out by employees (Willcocks, Hindle, & Lacity, Becoming Strategic with Robotic Process Automation, 2020). On the other hand, implementing RPA solutions may give rise to several risk factors (Lacity i Willcocks, Robotic Process Automation and Risk Mitigation: The Definitive Guide, 2017). These can be divided into elements that are universal to IT projects (i.e., constantly occurring, regardless of the approach or technology used in the project) and those specific to RPA projects. To minimise the likelihood of these risk factors materialising, choosing an appropriate model for implementing RPA and RPA governance solutions is essential (Kedziora & Penttinen, Governance models for robotic process automation: The case of Nordea Bank, 2020). This usually involves the decision to set up a dedicated competence centre, operating in a completely different way from the classic IT department (Anagnoste, Setting Up a Robotic Process Automation Center of Excellence, 2018).

At the same time, the implementation of software robots can be considered a special kind of digital innovation (innovative IT solutions) that requires appropriate approaches and is conditioned by many factors—organisational, technological, human, or related to the external environment (Tornatzky & Fleischer, 1990). Taking this as a starting point for further consideration, the literature analysis carried out by the author indicated that there is a research gap in this area—in particular concerning the identification of approaches to the assimilation of robotic process automation by enterprises (which determines the achievement of the assumed benefits from the robotisation of business processes and allows for its wide dissemination, the so-called scaling up the enterprise).

Models for the Assimilation of Innovative IT Solutions

For at least 30 years now we have been witnessing the development of modern IT solutions that change, on a mass scale, the way organizations operate – starting from the revolution related to the personal computers becoming ubiquitous, through the Internet revolution, the mobile revolution, and up to now, when there are revolutions related to mass robotization and artificial intelligence on the horizon, as well as the introduction of metaverse.

In parallel to the wide spreading of innovative IT solutions, a number of research models have been developed that are used to analyze the factors influencing the assimilation of innovative technologies. Based on these models the creators of digital innovations are able to better adapt the developed solutions to the current market requirements, needs, preferences and trends – which makes them more competitive. It is extremely important – both due to the multitude of technological innovations available today, as well as the ever richer experience of the organizations applying such solutions.

It should be emphasized that the literature on the assimilation models is extremely rich and presents both primary research, meta-analyses as well as the purely model-focused works. For the purpose of the article the author focused on a narrow selection of the topics discussed therein.

Models for the assimilation of digital innovation can be divided into two categories. The first one is related to the technology assimilation models from the perspective of the direct users. In particular, the following models can be identified in this category: TAM (Chuttur, 2009), TAM 2 (Venkatesh & Davis, 2000), UTAUT and UTAUT 2 (Venkatesh, Thong, & Xu, Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology, 2012), (Escobar-Rodríguez & Carvajal-Trujillo, 2014), D&M IS Success (DeLone & McLean, 2002), (DeLone & McLean, The DeLone and McLean Model of Information Systems Success: A Ten-Year Update, 2003). When analyzing these approaches it can be observed that they have been modified a number of times by the researchers. In addition, they have used several methods and/or theories simultaneously, extending one model by adding elements drawn from another. The recommendations developed based on the application of these approaches allow for indicating to the creators of digital innovations the directions of their products' development with respect to providing users with a more ergonomic, reliable and safe way to use their solutions.

The other group of models examines the topic of the assimilation of digital innovations from the organizational perspective. The number of such models is smaller as compared to the first category. The following models can, among others, be included in this group: Strategic Alignment model (Henderson & Venkatraman, 1993) and IT-Enabled Business Transformation frameworks (Venkatraman, 1994), (Agarwal & Brem, 2015). However, the most common model in this area is the TOE (Technology Organization and Environment) model. It was developed by Tornatzky and Fleischer (Tornatzky & Fleischer, 1990). The name of the model comes from three aspects which, according to the authors, affect the process of the organizational adoption and implementation of technological innovations, i.e. the technological, organizational and environmental aspects.

The factors related to the first aspect refer to the technological conditions – both internal (already functioning within the given organization – in particular the technical and organizational compatibility) as well as external (existing outside the organization, but not yet taken into account thereby). It should be noted that in this context the technology can be considered in tangible terms (e.g. hardware), but also in intangible terms (e.g. data and methods applied as well as the positioning of IT within an organization). This aspect is highlighted in the TOE model in order to draw attention to how the attributes related to the technological solutions and the implementation thereof can affect the assimilation of innovative solutions.

The organizational aspect is related to the entities' resources and assets, such as top management support, organizational culture, the complexity of the management structure measured by the degree of centralization and formalization, the quality of human capital, additional resources, process related conditions of the organization's operations. This aspect is highlighted in the TOE model in order to draw attention to how the attributes related to organizational conditions can affect the assimilation of innovative solutions.

Finally, the environmental aspect is related to the environment in which an organization is operating, including competitors and their pressure, technology suppliers, relationships with government entities, social and cultural issues, as well as access to ICT consultants. This aspect is highlighted in the TOE model in order to draw attention to how the attributes related to the nearer and farther environment in which the organization is operating can affect the assimilation of innovative solutions.

Researchers use the TOE model with respect to large organizations, but also more and more parts of it are used to analyze issues related to the assimilation of IT innovations by small and medium-sized enterprises.

The TOE model is widely used for research on the assimilation of innovative IT solutions – it has been applied in such areas as, for example, Cloud Computing (Hiran & Henten, 2020), CRM and eCRM (Cruz-Jesus, Pinheiro, & Oliveira, 2019), Supply Chain (Amelina, Hidayanto, Budi, Sandhyaduhita, & Shihab, 2016), Software-as-a-service (Hwang, Huang, & Wu, 2016), (Valdebenito & Quelopana, 2019), Radio frequency identification (RFID), (Pool, Asadi, & Ansari, 2015) Green IT (Chong & Olesen, 2017), Business Intelligence (Puklavec, Oliveira, & Popovič, 2017), e-commerce (This & Eam, 2011), but also AI (Na, Heo, Han, Shin, & Roh, 2022). The author has also decided to use this model in the research presented further on in the article.

Finally, it should be noted that some researchers believe that the analysis of issues related to the assimilation of digital innovation by enterprises using the TOE model is incomplete without taking into account such constructs as the enthusiasm of the owner and his/her growth (expansion) ambition (Fillis, Johansson, & Wagner, 2004), top management support and productivity of the management (Grandon & Pearson, 2004), differences in the beliefs of managers (Riemenschneider & McKinney, 2002) as well as the competences and characteristics of the CEO.

METHODOLOGY

Rationale for the Selection of the Use of the Structural Equation Modeling by Applying the Partial Least Squares Method (PLS-SEM)

PLS-SEM modeling falls within the scope of multivariate statistical methods known as the so-called second generation methods. The first generation methods (Fornell, 1987) include such analytical approaches as, for example, multiple and logistic regression or Analysis of Variance (ANOVA). In the case of the research problem under consideration, the applied approach (PLS-SEM) allows to overcome the weaknesses of the first generation methods, among others by including immeasurable constructs in the analysis, i.e. unobservable variables and the diagnosis of the relations between them, as well as taking into account measurement errors with respect to the observable variables (Chin, 1998).

An additional advantage of the PLS-SEM approach is the empirical measurement of a latent (hidden) variable, which is performed not only based on several (2-3) indicators, but also taking into account several indicators. As a consequence, the PLS-SEM data modeling process provides a much broader information horizon compared, for example, to the regression analysis, which is based on single observable variables. It is in this context that the structural equation modeling using the partial least squares method (PLS-SEM) proposed in this paper becomes of great importance – due to the range of indicators and the number of latent (hidden) variables as well as the relationships between them. The use of several indicators to measure the given type of a latent (hidden) variable gives this variable a more accurate picture as part of the phenomenon described.

Other advantages of the PLS-SEM approach with respect to data measurement and modeling include a high efficiency of complex model estimations, i.e. the possibility of configuring a research model with a large number of determined paths (relationships, dependencies), while at the same time taking into account a large number of indicators and latent (hidden) variables on the basis of relatively small sizes of the research samples; as in the case of this paper where N = 267 (the detailed information on the research sample is presented further on in the article). From the perspective of mathematical statistics, larger research samples obviously lead to greater precision and significance of the estimated results, however PLS-SEM does not exclude small samples due to an efficient estimation procedure (Hair, Hult, Ringle, & Sarstedt, 2017); (Henseler, Ringle, & Sinkovics, 2009). In this case, the algorithm used, which does not perform calculations on the basis of all dependencies (relationships) in the model simultaneously (as in the case of CB-SEM), but uses an approach based on OLS (least squares regression method), which allows to estimate model relationships in stages, in a partial manner, is important. Thanks to this approach, the PLS-SEM models do not require large samples, as evidenced by the results of empirical studies by a number of authors, such as Chin and Newsted (Chin & Newsted, Structural equation modeling analysis with small samples using partial least squares, 1999), Hui and Wold (Hui & Wold, 1982) as well as Reinartz et al. (Reinartz, Haenlein, & Henseler, 2009). At the same time, the PLS-SEM data modeling process does not require the fulfillment of rigorous assumptions regarding the normality of the distributions of individual observable variables (indicators) from which latent (hidden) variables – theoretical constructs – are created (Cassel, Hackl, & Westlund, 1999); (Wold, 1982); Reinartz et al. (2009); (Ringle & Wilson, 2009).

Theoretical Assumptions for the Design of the PLS-SEM Structural Model

The basis for the specification of the structural model presented in the article and the PLS-SEM analyses carried out in the Smart PLS-SEM statistical program are theoretical assumptions generated on the basis of the previously conducted literature review (presented in the first part of the article). Thus, the design of this model, or more precisely the diagnosis of its measuring elements, does not force the construction of latent (hidden) variables and their indicators from scratch. The author, using the theoretical advancements to date, took into account these constructs (latent variables) based on the analysis of the theory related to both the assimilation of technological innovations as well as the robotic process automation (robotization of business processes), which provided him with the basis for the verification of the theoretical dependencies (relationships) postulated in the Polish research conditions. It is worth emphasizing that one of the key conditions preceding any design of the measurement and structural model (PLS-SEM), taking into account the latent (hidden) variables and indicators associated therewith, is an accurate diagnosis of the current state of affairs based on a review and a critical evaluation of the literature items in the light of the theory under review, as well as the precise definition of latent (hidden) variables and the indicators thereof that the researcher uses to develop models (Węziak-Białowolska, 2011). In an operational sense, this task comes down to checking whether, in theory, there are already clearly defined latent (hidden) variables and whether any relationships between them have already been investigated in the literature on the subject. The researcher may propose an additional, i.e. a new order (configuration) of the relationships analyzed in the structural model, using the same theoretical variables, or he may take into account the same variables, at the same time including new variables in the model, the task of which is to enrich the previous scientific research results. Thus, the decision on what will ultimately be the subject of the PLS-SEM analyses is made by the researcher himself, who reviews the given configurations of sets of latent (hidden) variables in the PLS-SEM structural models in accordance with his own research needs, while using the existing theory to support his efforts.

At the same time, it should be assumed that if the proposed PLS-SEM structural model, and in particular the latent (hidden) variables (theoretical constructs) it contains, reflect a completely new (exploratory) dimension, then these variables must be subjected to a thorough statistical diagnosis from the point of view of the content provided thereby. Since in this study the construction of the model diagnosed with the use of PLS-SEM uses the literature available to date (i.e. the latent (hidden) variables have already been operationalized in the theory using the indicators), hence the overall effort related to the identification thereof has been simplified. Therefore, there is no need to generate a new type of indicators to describe latent (hidden) variables (theoretical constructs), but only to review them and perform a general evaluation with respect to the consistency thereof in accordance with the principles of adaptation of latent (hidden) variables to the given conditions of the social and cultural environment and the specifics of the given issue (in this case, robotic process automation).

Hypotheses Development

For the purpose of conducting research on the determinants of the assimilation of the robotic process automation by enterprises, the assumption was made to transfer and apply the hypotheses related to the implementation of innovative IT solutions previously stated and confirmed in the literature on the subject. The author could not directly use the hypotheses related to the implementation of the robotic process automation, because according to the author's knowledge, at the time of preparing the article, no publications on this topic were available. Therefore, the hypotheses proposed by the author are based on the literature research, but they have been adapted to the specifics of the robotic process automation.

The TOE model presented in the first part of the article is the starting point for the formulation of the research hypotheses. It includes three aspects: technological, organizational and environmental. Having carried out the literature research, the author did not identify articles on the assimilation of the robotic process automation as viewed from the TOE model perspective, and therefore decided to use the research works based on this model conducted in other IT areas.

Six hypotheses (H1-H6) are defined for the technological aspect. The assumptions behind their formulation are presented below.

A rapid increase in the importance of digital technologies has been noticeable over the last few years – both on the micro scale (at the level of the individual enterprises) as well as on the macro scale (at the level of the entire economy). Their wide spread application often leads to a profound transformation of the functioning of not only the individual entities, but even the entire industries. Business decision makers have realized that IT has transitioned from performing a support function to becoming a source of value generation, and they are beginning to appreciate the role of information technology. The literature on the subject repeatedly emphasizes the importance of the provision of benefits by IT technology as a factor having a significant impact on the assimilation of innovative solutions ((Kang & Kim, 2015) (Lai, Sun, & Ren, 2018).

Based on the above considerations the author has defined the H1 hypothesis:

H1: Providing the enterprise with benefits from the use of IT technology has a positive impact on the assimilation of the robotic process automation.

It is a truism to say that "data is the oil of the 21st century." Organizations realize that it is crucial to have data of adequate quality and to make sure that this data is integrated and available without any restrictions. Only then we can talk about the implementation of the "data driven company" concept. The literature on the subject emphasizes that having high quality data and managing integration mechanisms between systems have a positive impact on the assimilation of innovative IT solutions (Park, Kim, & Paik, 2015).

Based on the above considerations the author has defined the H2 hypothesis:

H2: High quality of data and ensuring the integration thereof has a positive impact on the assimilation of the robotic process automation.

Organizations have an ever increasing number of IT solutions that are implemented using diverse technologies and are based on various architectures (at large entities it is usually a combination of a mainframe computer architecture, three-tier architecture, microservice architecture). Organizations that are able to adequately manage the IT architecture and introduce changes thereto in a controlled manner find it much easier to ensure the coherence of the solutions developed (where coherence is understood as a degree to which IT solutions are perceived as compliant with the existing principles, experience and needs of the potential buyers – (Rogers, 1995)). The literature on the subject emphasizes that ensuring IT coherence (and thus effective management of IT architecture) has a positive effect on the assimilation of innovative IT solutions (Verma & Bhattacharyya, 2017). At the same time, in order to ensure the functioning of the tools that are used to robotically automate business processes, it is necessary to provide an ICT infrastructure (which is a part of the company's IT architecture), which must be adequately accessible and scalable. The literature on the subject repeatedly emphasizes the role of the IT infrastructure management as a factor that has a positive impact on the assimilation of innovative IT solutions (Soares-Aguiar & Palma-Dos-Reis, 2008), (Pan & Jang, 2008).

Based on the above considerations the author has defined the H3 hypothesis:

H3: Management of the enterprise's IT architecture and infrastructure has a positive impact on the assimilation of the robotic process automation.

There is a number of different methods of obtaining innovative IT solutions. There are costs associated with each method – such as licensing fees and expenditures related to the implementation. The literature on the subject emphasizes that the cost of innovative IT solutions has an impact on the assimilation thereof – it cannot be too high, as for many organizations it represents a significant barrier to the implementation (Rouhani, Ravasan, & Ashrafi, 2018).

Based on the above considerations the author has defined the H4 hypothesis:

H4: Low cost of the RPA tools has a positive impact on the assimilation of the robotic process automation.

Some of the key factors influencing the assimilation of innovative IT solutions are the features of the implemented solutions – taken into account both from the functional as well as the non-functional side. As described in the literature, in particular, the non-functional issue related to such aspects as stability of operation, ease of use, security, compatibility of the implemented tools with the organization's other, already existing IT solutions, have a positive impact on the assimilation of innovative IT solutions (Janz, Pitts, & Otondo, 2005); (Zailani, Iranmanesh, Nikbin, & Beng, 2015).

Based on the above considerations the author has defined the H5 hypothesis:

H5: Features of the RPA tools have a positive impact on the assimilation of the robotic process automation.

There are specific risks associated with any technological innovation – whether it is related to the choice of the tool or the performance of the implementation itself or, subsequently, the use of the tools acquired. As described in the literature, a high risk (in particular related to security, privacy, ensuring business continuity) is a significant barrier to the implementation of such innovations (Alshamaila, Papagiannidis, & Li, 2013); (Maroufkhani, Tseng, Iranmanesh, & Khairuzzaman, 2020). Therefore, it is necessary to take a number of measures aimed at ensuring continuous management of the risk related to the implementation of innovative IT solutions.

Based on the above considerations the author has defined the H6 hypothesis:

H6: Management of the risk associated with the RPA implementation has a positive impact on the assimilation of the robotic process automation.

Five hypotheses (H7-H11) are defined for the organizational aspect. The assumptions behind their formulation are presented below.

The implementation of innovative IT solutions is not only a technological undertaking. It is, in many cases, a change of the way an enterprise is conducting its business operations. In practice this means that committed management personnel is necessary to carry out and maintain an innovative IT implementation in an organization. As described in the literature, a high level of the decision-makers' awareness of the role of information technology (Boritz, Efendi, & Lim, 2018) and their pro-innovative attitude have a positive impact on the assimilation of innovative IT solutions (Asiaei & Rahim, 2019); (Maroufkhani, Tseng, Iranmanesh, & Khairuzzaman, 2020).

Based on the above considerations the author has defined the H7 hypothesis:

H7: Pro-innovative attitude and awareness of the management personnel have a positive impact on the assimilation of the robotic process automation.

The literature on the subject repeatedly emphasizes that it is the organizational culture in place at an enterprise that determines the speed and effectiveness of implementing innovations – including also the digital innovations. In particular, the role of the employees' trust in the company is highlighted in this respect as well as an organizational culture focused on openness and sharing of knowledge. Such an environment has a positive impact on the assimilation of innovative IT solutions (Veiga, Floyd, & Dechant, 2001).

Based on the above considerations the author has defined the H8 hypothesis:

H8: Company's pro-innovative organizational culture has a positive impact on the assimilation of the robotic process automation.

The implementation of innovative IT solutions entails the need for an organization to have human resources with adequate competences available. Paradoxically – with the growing role of IT at companies – more and more often the division of competences between the representatives of IT and business departments is blurred. This means that the IT specialists should have business competences, and the business people – both process competences as well as digital transformation related competences. As described in the literature, having employees with adequate competences available and being willing to develop them has a positive impact on the assimilation of innovative IT solutions (Cooper & Molla, 2014).

Based on the above considerations the author has defined the H9 hypothesis:

H9: Employees' competences and knowledge have a positive impact on the assimilation of the robotic process automation.

One of the key success factors for the digital transformation is the implementation of a process based approach. Organizations are moving away from a point-based view of the performance of the individual activities and turning towards a holistic view of the processes implemented. Only such an approach allows for improving the Customer Experience or ensuring the actual implementation of the multi-channel customer service concept. As described in the literature, the use of the process-based management by enterprises on a large scale and the ability to manage such processes (in particular, standardization and minimization of the complexity of the processes) have a positive impact on the assimilation of digital innovations (Van Looy, 2017)

Based on the above considerations the author has defined the H10 hypothesis:

H10: Implementation of the process-based approach in an organization has a positive impact on the assimilation of the robotic process automation.

The experience of recent years demonstrates that the organizational structure in place at companies has a significant impact on the success of implementing innovative IT solutions. According to the literature the role of a flat organizational structure in which decisions can be made quickly is indicated as a factor of particular importance for the assimilation of digital innovations (Ali, Shrestha, Osmanaj, & Muhammed, 2020); (Nkhoma & Dang, 2013). A similarly important role is attributed to the departure from the centralized decision-making process and moving towards the distributed decision-making process, which improves the flexibility of this process (Oliveira, Thomas, & Espadanal, 2014); (Yu & Tao, 2009).

Based on the above considerations the author has defined the H11 hypothesis:

H11: Flat organizational structure and the flexible decision making process have a positive impact on the assimilation of the robotic process automation.

Four hypotheses (H12-H15) are defined for the environmental aspect. The assumptions behind their formulation are presented below.

Organizations are increasingly operating not only in a turbulent environment, but also in an environment that is characterized by a growing degree of competitiveness. This competition – as an environmental context – may induce companies to implement innovative solutions in order to maintain or build a competitive advantage (Rouhani, Ravasan, & Ashrafi, 2018). As it is emphasized in the paper (Zhu, Kraemer, & Xu, 2006) companies operating in the competitive environments are more likely to use IT to achieve a competitive advantage.

Based on the above considerations the author has defined the H12 hypothesis:

H12: Competitive pressure has a positive impact on the assimilation of the robotic process automation.

Organizations are operating in an increasingly volatile environment. These changes may be caused by a number of factors, such as - a global pandemic (e.g. Covid-19), military situations (e.g. the war in Ukraine) or changes in the regulations at the level of the entire European Union (e.g. the Data Act). This translates into the behaviors displayed by both other, competing companies, as well as the consumers themselves. In order to survive in such a volatile environment organizations are undertaking a number of projects – involving both organizational as well as technological changes. As described in the literature, the volatility of the environment is regarded as a catalyst for specific projects inside the organization and has a positive impact on the assimilation of innovative IT solutions (Hsing Wu, Kao, & Lin, 2013).

Based on the above considerations the author has defined the H13 hypothesis:

H13: Volatility of the environment has a positive impact on the assimilation of the robotic process automation.

Successive generations of customers expect an ever higher quality of service from the product suppliers and service providers. At the same time, more and more organizations emphasize the role of customer-centricity in their business strategies, believing that this way they will build a competitive advantage. As described in the literature, the pressure exerted by customers regarding the implementation of new technologies by companies has a positive impact on the assimilation of innovative IT solutions (Chatzoglou & Chatzoudes, 2016) (Nugroho, Susilo, Fajar, & Rahmawati, 2017).

Based on the above considerations the author has defined the H14 hypothesis:

H14: Customer pressure has a positive impact on the assimilation of the robotic process automation.

As it has already been mentioned several times in the article, the role of IT at enterprises is growing. At the same time, IT companies – suppliers of these IT technologies – are becoming important partners in the activities carried out by their customers. In order to provide an effective service for their customers, IT companies are building complex, multi-level ecosystems of partners and are investing in consultants who provide the required knowledge and carry out complex implementations of the products supplied. In addition, the IT suppliers support the development of the community of the end users of their solutions. As described in the literature, such activities have a positive impact on the assimilation of innovative IT solutions (Premkumar & Roberts, 1999)

Based on the above considerations the author has defined the H15 hypothesis:

H15: Suppliers of the robotic process automation technology, and the ecosystem of partners and communities they have built, have a positive impact on the assimilation of the robotic process automation.

The author has also formulated four hypotheses (H16-H19) regarding the effects of the assimilation of the robotic process automation by enterprises (Stjepić, Ivančić, & Vugec, 2020).

The implementation of innovative IT solutions is the basis for the way enterprises are operating. In particular, it enables changing the way business processes are carried out at these companies. According to the literature, the determinant (driver) of a successful digital transformation is, inter alia, the redesigning of the existing or even creating new business processes dedicated to the digital channels (Stjepić, Ivančić, & Vugec, 2020).

Based on the above considerations the author has defined the H16 hypothesis:

H16: Assimilation of the robotic process automation enables introducing an innovative change in the way business processes are implemented in the company.

At present organizations have less and less opportunity to build a competitive advantage by applying an approach based on optimizing the use of the existing resources and processes. It is believed that innovations will be the source of the competitive advantage – including, in particular, product innovations. As described in the literature, innovative IT solutions are increasingly becoming the basis for the introduction of such product innovations (Kedziora, Leivonen, Piotrowicz, & Öörni, 2021).

Based on the above considerations the author has defined the H17 hypothesis:

H17: Assimilation of the robotic process automation enables introducing a change to the existing products or launching of new products.

The use of innovative IT solutions directly or indirectly contributes in many cases to an improvement of the Customer Experience. In the case of a direct improvement of the Customer Experience, it is related to the fact that IT solutions enable the introduction of omnichannel services, personalization of products or services, or the introduction of mechanisms supporting the so-called "Voice of Customer" (Foroudi, Gupta, Sivarajah, & Broderick, 2018). In the case of an indirect improvement of the Customer Experience, it stems from the fact that, thanks to innovative IT solutions, not only employee efficiency is often improved, but also the level of satisfaction with the work they are performing goes up (as a consequence of getting rid of monotonous activities). A more satisfied employee will definitely be implementing customer service processes better (Kedziora & Kiviranta, Digital Business Value Creation with Robotic Process Automation (RPA) in Northern and Central Europe, 2018).

Based on the above considerations the author has defined the H18 hypothesis:

H18: Assimilation of the robotic process automation enables improving of the Customer Experience.

The introduction of innovative IT solutions allows, in many cases, to alter (revamp, overhaul) the existing business model of an enterprise (Pateli & Giaglis, 2005). The business model is understood as: a description of the values that the enterprise is offering for its customers, as well as the structure of the company and the network of partners for creating, transferring and delivering of these values in order to generate a profit and sustainable revenue streams (Osterwalder, Pigneur, & Tucci, 2005). The growth of the role of IT can be seen very well on the example of the Business Model Canvas ((Osterwalder & Pigneur, Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, 2010) an approach that has become a de-facto standard when it comes to documenting business models. In this approach IT solutions become a key asset of an enterprise. These solutions very often allow for delivering a new type of a business value or reaching a new customer (Bican & Brem, 2020).

Based on the above considerations the author has defined the H19 hypothesis:

H19: Assimilation of the robotic process automation enables introducing a change to the enterprise's business models.

Specification of Theoretical Constructs (Latent Variables) and the PLS-SEM Model

As part of the design of the PLS-SEM structural model, sets of indicators available in the literature were used to define individual types of latent (hidden) (theoretical) variables that constituted individual measurement elements. The configuration of latent (hidden) variables, i.e. the sequence of dependencies (relationships), stemmed from the theoretical foundations (based on the TOE model and the previously formulated hypotheses), logical premises and practical experiences observed by the researcher (in particular, the specifics of the implementation of the projects related to the robotic process automation were taken into account). In a practical sense, this sequence involves placing the independent (so-called exogenous) latent (hidden) variables on the left hand side of the structural model, and the dependent latent (hidden) (endogenous) variables on the right hand side. Thus, the exogenous variables must precede the endogenous variables. Taking these guidelines into account, the following constructs were the independent (exogenous) latent (hidden) variables: "Technology" (T), "Organization" (O), "Environment" (E). On the other hand, the construct defined as "Assimilation of the Robotic Process Automation" (AR) was classified as the dependent (endogenous) latent (hidden) variable placed on the right hand side of the structural model. The relationships between the constructs taken into consideration are shown in Figure 2. Overall, as part of the structural equation model and its measurement models, a total of four types of latent (hidden) variables (theoretical constructs) were used, which were made up of 19 sub-areas:

- a construct defined as "Technology" (T), composed of 6 sub-areas;
- a theoretical construct "Organization" (O), defined based on 5 sub-areas;
- a diagnostic construct "Environment" (E), composed of 4 sub-areas;
- a construct defined as "Assimilation of the Robotic Process Automation by an Enterprise" (AR), including 4 elements.

The components of each construct are the derivatives of the previously defined detailed hypotheses.

"Technology" (T) construct includes 6 sub-areas:

T1 – *The benefits of using IT*, described by the indicator:

- T1a: Providing the company with benefits resulting from the use of RPA tools

T2 – *Data quality and their integration* described by the indicators:

- T2a. High intensity of information exchange between the departments of the enterprise
- T2b. High quality of the data processed by the enterprise's IT systems
- T2c. High level degree of integration between the enterprise's IT systems
- T2d. Openness of the enterprise's IT systems from the perspective of the ease of data exchange between them

T3 – *Technical architecture of the enterprise and IT Infrastructure* described by the indicators:

- T3a. Minimizing the complexity of the company's IT infrastructure
- T3b. Preparedness (readiness) of the IT infrastructure for the implementation of the robotic process automation

T4 – *Costs of acquiring the robotic process automation tools* described by the indicator:

- T4a. Low cost of purchasing a license and implementing the RPA tools

T5 – *Features of the robotic process automation tools* described by the indicators:

- T5a. Stability of the RPA tools' operation
- T5b. Ease of use of the RPA tools
- T5c. Security mechanisms provided by the RPA tools
- T5d. Compatibility of the RPA tools with the company's other IT solutions

T6 – *Risk related to the robotic process automation* described by the indicator:

- T6a. Risk management related to the implementation of the robotic process automation

Theoretical construct "Organization" (O) is defined based on 5 sub-areas:

O1 – *Attitudes and awareness of the management personnel* described by the indicators:

- O1a. Support from the management personnel in implementing the robotic process automation
- O1b. Pro-innovative attitude of the management board
- O1c. High level of awareness of the company's management board of the role of information technology

O2 – *Organizational culture of the company* is described by the indicators:

- O2a. Employees' trust in the company
- O2b. Company's organizational culture is focused on openness and sharing of the knowledge

O3 – *Employees' competences and knowledge* described by the indicators:

- O3a. Business competences of the IT personnel
- O3b. Process related competences of the business departments' staff
- O3c. Digital competences of the business departments' staff

O4 – *Process based approach in the organization* described by the indicators:

- O4a. Minimizing the complexity of implemented processes / tasks
- O4b. Application of the process approach in the company

O5 – *Organizational structure and decision making process* described by the indicators:

- O5a. Flat organizational structure of the company
- O5b. Decentralized way of making decisions in the company
- O5c. Distributed way of making decisions in the company

Diagnostic construct "Environment" (E) is composed of 4 sub-areas:
E1 – *Pressure from the competition* described by the indicator:

- E1a. Pressure from the competition

E2 – *Volatility of the environment* described by the indicator:

- E2a. Speed of changes (technological, economic, legal) taking place in the company's environment

E3 – *Customer pressure* described by the indicators:

- E3a. Customers in the industry in which the company is operating are constantly looking for new, innovative products/services
- E3b. Customers in the industry in which the company is operating expect a very high quality of products/services

E4 – *Suppliers of the robotic process automation technologies and their ecosystem* described by the indicators:

- E4a. RPA tool supplier’s reputation
- E4b. Access to the community of the RPA tool users
- E4c. Ecosystem of partners, training and certifications built by the RPA tool provider
- E4d. Ensuring support from the RPA tool provider or its partners
- E5e. Ensuring support from external consultants in implementing the RPA tools

The construct defined as "Assimilation of the Robotic Process Automation by an Enterprise" (AR) includes the following elements:
AR1 – Change in the way processes are implemented thanks to the robotic process automation described by the indicator:

- AR1a. Robotic process automation enables innovative changes to the way business processes are implemented in a company

AR2 – Changed / new products / services thanks to the robotic process automation described by the indicator:

- AR2a. Robotic process automation enables a significant improvement of the already provided products / services or an introduction (launching) of new products / services

AR3 – Improving Customer Experience thanks to the robotic process automation described by the indicator:

- AR3a. Robotic process automation enables an improvement of the quality of customer service (Customer Experience)

AR4 – Change of the enterprise's business model thanks to the robotic process automation described by the indicator:

- AR4a. Robotic process automation enables changing of at least one component of the company's business model (e.g. implementation of the key activities, cost / revenue structure, customer contact methods, etc.)

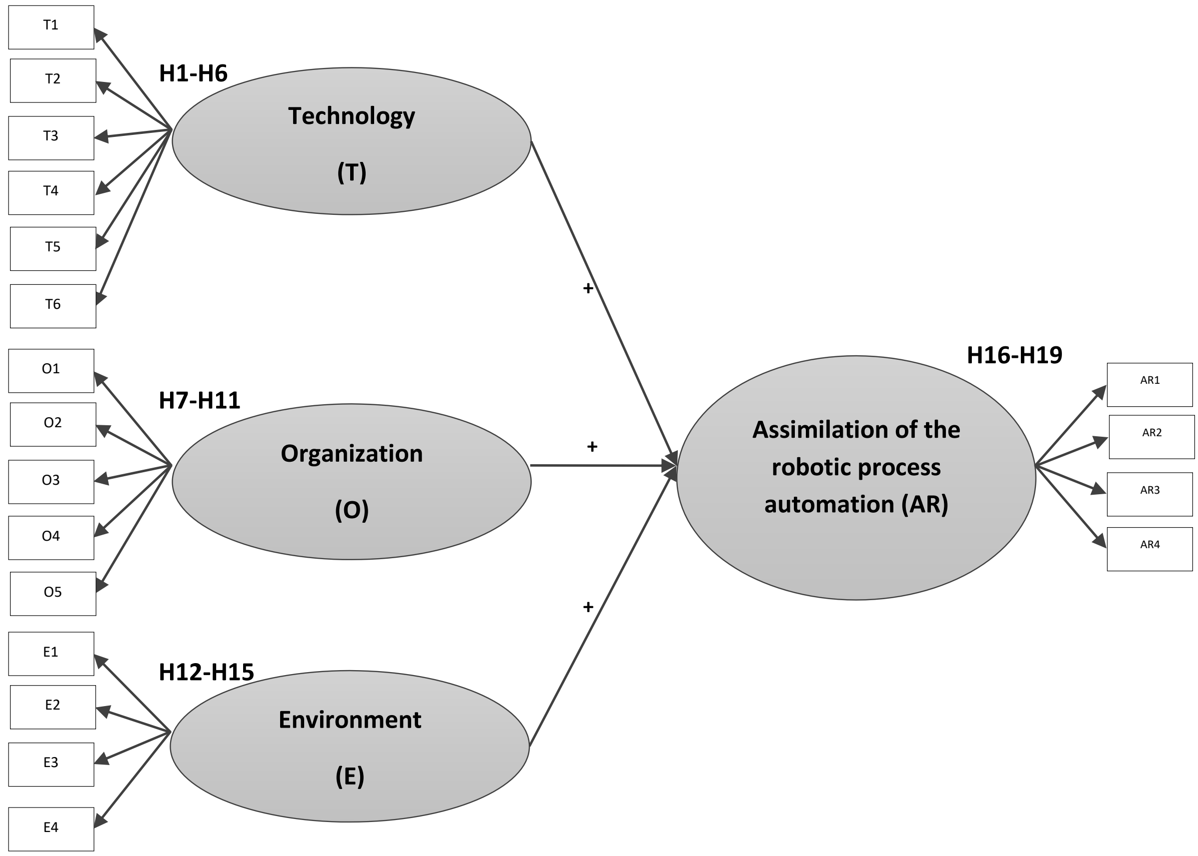

Figure 2. PLS-SEM structural model to diagnose the theoretical relationships with respect to the independent and dependent latent (hidden) variables.
Source: own study

Key: Arrows connecting the latent (hidden) variables (measurement elements of the PLS-SEM model) define the postulated (positive) directions of the PLS-SEM model relationships. Arrows placed between the latent (hidden) variables and the indicators (marked with squares) represent the factor loadings. The oval shape represents the latent (hidden) variable, and the square represents the indicator as part of the latent (hidden) variable.

THE METHOD OF CONDUCTING THE SURVEY AND THE CHARACTERISTICS OF THE SURVEY SAMPLE STRUCTURE

In order to verify the developed research PLS-SEM model, the author prepared and conducted a survey in the time frame from October 2020 to January 2021, which was composed of two stages – a pilot survey and the full scale research. A survey questionnaire related to the determinants (drivers) of the assimilation of the robotic process automation was created and verified during the pilot project. The prepared research questionnaire was verified in the form of a pilot survey conducted among 10 enterprises representing industries that were planned to be included in the full scale research. As part of the verification process the respondents' understanding of the questions included in the questionnaire was assessed, as well as the completeness thereof. As a result of the pilot surveys completed, modifications were introduced in the survey questionnaire itself – three questions were significantly reformulated, and in four questions the wording was made more precise. Due to the changes in the questionnaire the research material collected during the pilot survey was not used in the full scale research procedure. As part the next stage of the research procedure, the key – from the perspective of the verification of the developed research PLS-SEM model – survey was conducted. The selection of enterprises included in the survey was deliberate – each company had to declare the production implementation (deployment) of at least one software robot (developed with the use of the RPA, RDA or C-RPA class tools).

The CAWI (Computer Assisted Web-Interviews) technique was used to carry out the survey, where a respondent completed the electronic version of the questionnaire available online. It is currently one of the most frequently used survey techniques. As Smith and Kim point out, CAWI is a part of the Computer Assisted Survey Information Collection (CASIC) group, which is a part of a wider group of Computer Assisted Data Collection (CADAC) techniques (Smith & Kim, 2015). The author's choice of this survey technique was dictated by several factors. First of all, the main reasons for the use of the questionnaire in an electronic form included: obtaining the largest possible number of surveys collected (the survey was addressed to a specific group of respondents for whom online tools are a natural working environment), shortening the time of conducting the survey, enabling respondents to respond at a convenient time for them and reducing the costs of performing the research work while maintaining a high level of completeness and quality of the responses (possible to achieve thanks to the introduction of the validation rules for the individual fields of the questionnaire and the validation between the individual fields). Significant arguments in favor of choosing the CAWI technique also included the ease and convenience of filling in the questionnaires by the respondents, as well as reducing the influence of the interviewer on the answers given by the respondents (such an influence might occur during a survey using the direct interview technique). The final argument for the choice of the research technique was the coincidence of the timing of conducting the survey with the pandemic situation and the resulting limitations of the direct communication with respondents.

The responses obtained were subjected to an additional verification, going beyond checking the filling of all of the mandatory fields in the questionnaire. In the case of ambiguity or inconsistency in the answers provided, the respondent was contacted by e-mail (the prerequisite for including the given questionnaire in the research pool was the provision of the business e-mail address of the person completing the questionnaire), and asked for explanations to be provided by e-mail, or if there were more ambiguities – a telephone conversation was arranged or teleconferencing tools – Zoom and MS Teams – were used.

The author consciously decided not to engage a survey company to conduct the research. It is true that such a method of conducting a survey has many benefits (including the possibility of the direct clarification of ambiguities that the respondents experienced when filling in the questionnaire, increased motivation of the respondent to fill in the questionnaire, which translates into a higher rate of survey returns), but it also has a number of limitations. First of all, it significantly extends the time and costs of conducting a survey, and also generates the risk of a diversified training of interviewers, which translates into the possibility of inconsistencies in the explanations provided to the respondents. The direct interview research is useful in the case of questionnaires containing a large number of open-ended questions (which was not the case with the questionnaire used by the author, as practically all of the questions were closed-ended) and in the event it is necessary to take actions aimed at forcing answers to all questions (this was not the case with the questionnaire used by the author as the system applied to develop the questionnaire enabled imposing the necessity to provide an answer by the respondent).

Finally, a total of 267 questionnaires were qualified for the analysis, each of which met the following set of conditions:

- a questionnaire was completed by a representative of the enterprise from the industry included in the survey;
- all of the mandatory fields were filled (all questionnaires met this condition); this way the author wanted to avoid the averaging of the respondents' answers, which was a typical procedure in the event this type of situation occurred;
- all validation rules were met;
- all doubts regarding the completion of the questionnaire were clarified by the author by e-mail or during an interview.

The questionnaire used in the survey included basic questions and a respondent's particulars part (demographics, personal information). A number of questions were included in the questionnaire as control variables. They were related to such issues as:

- size of the enterprise measured by the number of employees,
- industry of the enterprise.

In addition, a filtering question was introduced – its purpose was to separate enterprises with at least one software robot implemented in the production environment from enterprises that could not demonstrate such an implementation (in such a case their answers were not included in the research pool).

A 5-point Likert scale was used to measure the individual indicators in the study. Despite the fact that this scale assumes the ordinal nature of the response, in special cases it approaches the properties of a stronger quasi-interval scale (see (Mooi & Sarstedt, 2011)), as long as the adequate design rules are maintained. Special attention should, however, be paid, as part of the process of preparing questions and statements for the scale, to the coding of the responses and the fulfillment of the so-called condition of equal distance between the response categories on the scale. The use of a 5-point scale in the research presented, with categories such as: (1) strongly disagree, (2) disagree, (3) neither agree nor disagree, (4) agree and (5) strongly agree, allowed for expressing equal "distances" between categories 1 and 2 as well as between categories 3 and 4.

The companies from the following industries were included in the survey: banking and insurance, other finance (excluding banking and insurance), professional business services (split into: Business Process Outsourcing (BPO) and Shared Services Centers (SSC)), e-commerce, retail, logistics, media, advertising and entertainment, health care (including pharma), manufacturing, telecommunications, utilities (including power, gas, district heating). The respondents mainly included the representatives of banking and insurance, manufacturing industry and Shared Services Centers – see Figure 3. Companies from these industries are the leaders of the robotic process automation in Poland.

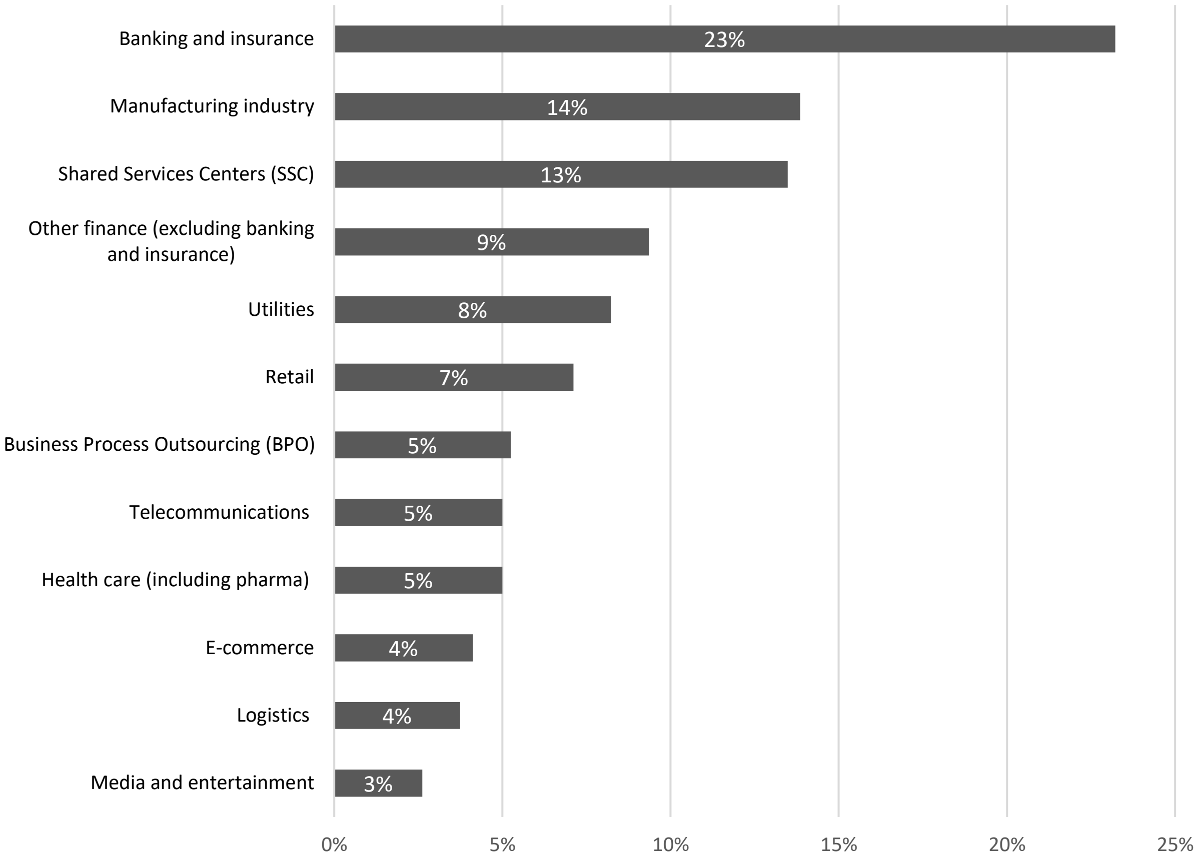

Figure 3. Industries included in the research [N = 267].
Source: own research

Companies from the IT industry (including the RPA tool suppliers) and consulting companies were not included in the study on purpose, as the range of topics covered by the survey concerned mainly intra-organizational issues related to the assimilation of the robotic process automation. The research also did not cover public administration units, as these entities have not yet started to use the robotic process automation on a larger scale. The author is monitoring the progress of the robotic process automation project implementations in the Polish public sector entities (Sobczak, 2021). At the time of conducting the survey only three municipal offices in Poland disclosed information on the implementation of the robotic process automation solutions, and a few more were just getting ready; also in the literature on the subject, there are few references to the implementations at such units – see for example (Nauwerck & Cajander, 2019).

As mentioned earlier, 267 enterprises from all over Poland participated in the survey. When analyzing the structure of the respondents (see Figure 4), it can be observed that large enterprises (i.e. with more than 250 employees) dominated the sample – there were over 70% of them in the group surveyed. Small and medium-sized enterprises, i.e. those employing up to 250 people, were a definite minority.

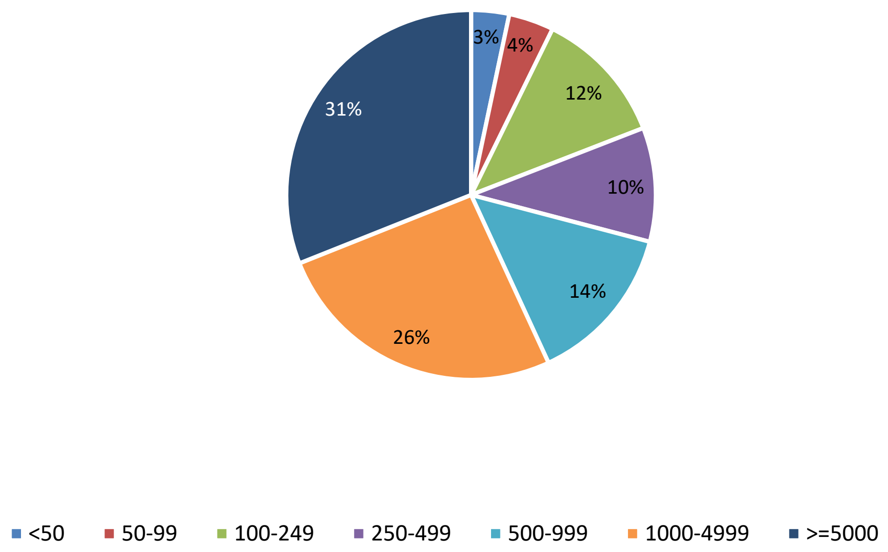

Figure 4. The size of the enterprises participating in the survey [N =267].
Source: own research

As the results of the survey indicate (Figure 5), at most of the enterprises the robotic process automation is a new or a relatively new topic. – 58% of the respondents have been implementing such solutions for no longer than two years. Companies implementing the robotic process automation for more than 3 years (23%) are a minority. According to the author, these results indicate a relatively early stage of the implementation of the robotic process automation at the entities surveyed.

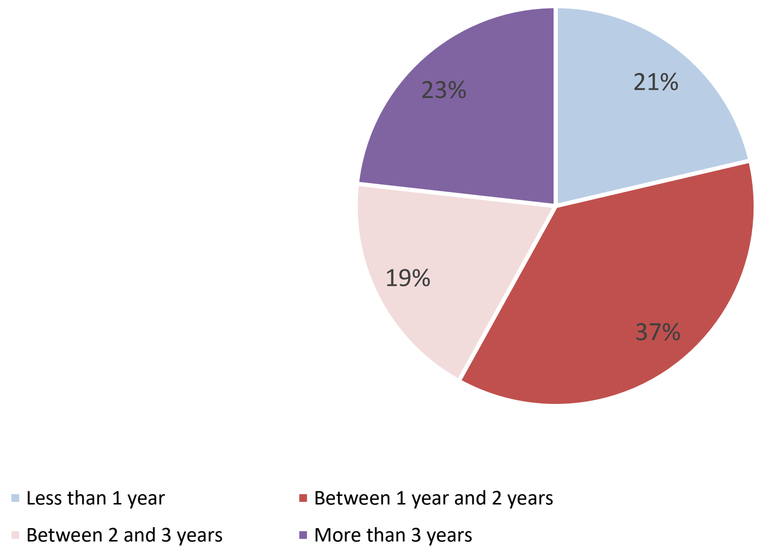

Figure 5. The period of implementing the robotic process automation at the enterprises [N = 267]
Source: own research

The initial stage of implementing the robotic process automation is also confirmed by the number of robots deployed at the companies surveyed. Based on Figure 6 it can be observed that at the overwhelming majority of the companies surveyed (43%) the number of robots deployed ranges between 1 and 4. At the same time, nearly 15% of the enterprises already have more than 100 robots in place.

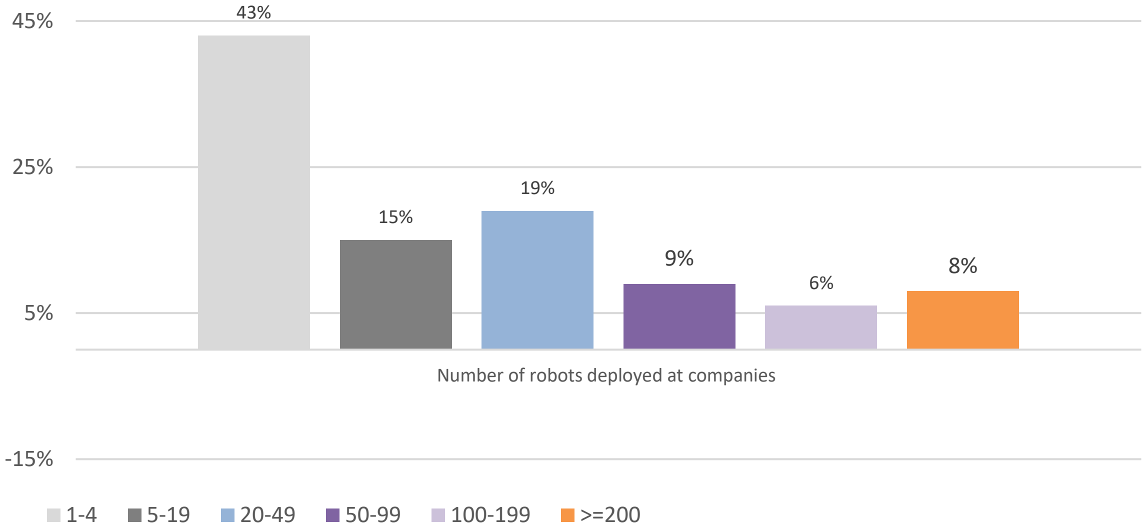

Figure 6. Number of robots deployed at companies [N = 267].
Source: own research

Finally, it is worth noting that the respondents were mainly managers of the units / leaders of the teams responsible for the robotic process automation – 39%. Among the remaining respondents, a large group were project managers who were responsible for the implementation of the robotic process automation – 29% (see Figure 7).

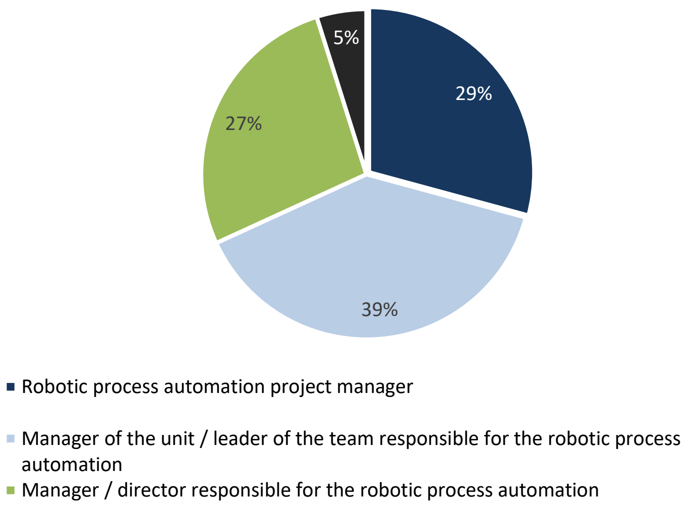

Figure 7. Respondent positions [N = 267].
Source: own research

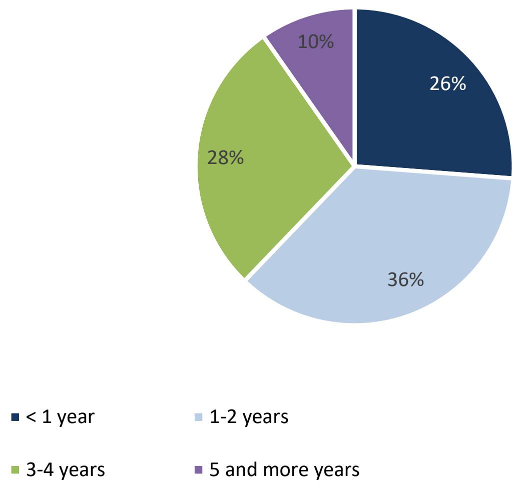

Figure 8. Professional experience of the respondents in the robotic process automation [N = 238].
Source: own research

The respondents were dominated by people with a relatively short experience in the RPA area activities (between 1 and 2 years – there were 36% of them) or with an average experience (between 3 and 4 years – there were 28% of them) (see Figure 8).
Such a structure of people participating in the survey confirms that Polish enterprises already have some experience related to the implementation of the robotic process automation, but it is relatively limited (this is also due to the fact that the robotic process automation in Poland on a larger scale began to be implemented only starting from around 2019).

DISCUSSION OF THE RESULTS OBTAINED

Diagnosis of the Latent (hidden) Variables as the Main Components of the PLS-SEM Structural Model

The key element having an impact on the correctness of the PLS-SEM structural model is the quality of the individual latent (hidden) variables. They must meet the formal and statistical adequacy criteria. The assessment of this adequacy is made on the one hand on the basis of the assessment of the adequacy of the indicators (among others, the size of factor loadings). The higher the factor loading (see Table 1), the stronger the constructive substantive relationship between the given indicator and the corresponding latent (hidden) variable. On the other hand, the second part of the analysis comes down to the assessment of the level of consistency (reliability) of the theoretical construct itself (latent (hidden) variable). However, the reliability of the latent (hidden) variables depends on the properties of the individual indicators, which means that the quality of a single indicator determines the level of the precision of the measurement of the selected latent (hidden) variable.

Therefore, taking into account the above guidelines, the first step in the evaluation of the results was to verify the indicators for the individual latent (hidden) variables used in the PLS-SEM structural equation model. In this case, the indicators were assessed on the basis of the size of their factor loadings. In the light of the theoretical assumptions (see (Thurstone, 1931); (Sztemberg-Lewandowska, 2008); (Spector, 1992)), these values should generally stand at 0.70, which in turn allows the given latent (hidden) variable to explain a significant part (more than 50%) of the variance. Based on table 1 it can be observed that all factor loadings of the indicators under consideration within the range of the latent (hidden) variables selected for the measurement were even higher.

As part of the second stage of the diagnosis, the level of internal consistency of the latent (hidden) variables was assessed. For this purpose, Jöreskog's composite reliability coefficient (1971) was used, where higher values indicate a higher level of reliability of the latent (hidden) variable. The values of this coefficient within the (0.60 - 0.70) range are considered acceptable for the construct (Chin, The partial least squares approach to structural equation modeling, 1998); (Höck & Ringle, 2010), and the values within the (0.70 - 0.90) range indicate a good or even a very good level of reliability.

Taking into account the latent (hidden) variables considered in the study, the values of Jöreskog's coefficients were respectively: 0.91 (for the "Technology - T" construct); 0.89 (for the "Organization - O" construct); 0.88 ("Environment - E") and 0.83 ("Assimilation of the Robotic Process Automation - AR"). Therefore, the figures provided meet the internal consistency requirement.

In addition to the above reliability index, its alternative variant (Cronbach's alpha) was used as well. It is also worth emphasizing that the minimum level of acceptability of the Alpha reliability coefficient is 0.60. This value is a kind of a threshold for the latent (hidden) variables under consideration.

Table 1. Factor loadings of the indicators and the quality of the latent (hidden) variables.

Indicators	Latent (hidden) Variables and their Indicators Used in the PLS-SEM Structural Model			
	T	O	E	AR
T1	0.85			
T2	0.73			
T3	0.82			
T4	0.89			
T5	0.83			
T6	0.81			
O1		0.86		
O2		0.85		
O3		0.82		
O4		0.81		
O5		0.79		
E1			0.78	
E2			0.85	
E3			0.79	
E4			0.81	
AR1				0.88
AR2				0.82
AR3				0.74
AR4				0.79
	Reliability and Validity Indicators			
Jöreskog's indicator	0.91	0.89	0.88	0.83
Alpha indicator	0.82	0.86	0.79	0.74
AVE indicator	0.68	0.71	0.65	0.66

Key: T = Technology; O = Organization; E = Environment; AR = Assimilation of the Robotic Process Automation. N = 267
Source: own research

Thus, taking into account the above guidelines, the values of Cronbach's alpha coefficients for the latent (hidden) variables under consideration stood at, respectively: 0.82 (for the "Technology - T" construct); 0.86 ("Organization - O"); 0.79 ("Environment - E") and 0.74 ("Assimilation of the Robotic Process Automation - AR"). Therefore, the values provided (calculated on the basis of the indicators contributing thereto) meet the internal consistency requirement.

At the same time, it is also worth emphasizing that the calculated alpha coefficients came in at lower values, on average, in comparison with Jöreskog's reliability coefficients. This is because Cronbach's alpha is a reliability measure whose items are not weighted. On the other hand, Jöreskog's complex reliability coefficient is determined based on the weighted indicators, i.e. factor loadings.

Finally, the AVE index was used in the study to assess the convergent validity of each of the highlighted latent (hidden) variables. This measure reflects the average level of the total variance explained by the given theoretical construct (latent (hidden) variable) on the basis of its co-creating indicators, and to be more precise, the factor loadings thereof. The lowest acceptable level of AVE in the analyses stands at 0.50 (Chin, 1998) (Höck & Ringle, 2010) and it assumes that the given latent (hidden) variable should explain min. 50% of the variance for all analyzed indicators (items). On the other hand, the value of AVE below the level of 0.50 means that the error variance outweighs the true variance. With these facts in mind, in the case of the data under consideration, we can conclude that all AVE values of the analyzed latent (hidden) variables exceeded the level of 0.50 (see Table 1), thus an acceptable level of convergent validity was obtained.

Assessment of the Quality of the Structural Equation Model in the PLS-SEM Analysis

Having validated the theoretical constructs as the main components (latent (hidden) variables) of the PLS-SEM structural equation model, the PLS-SEM model was assessed as a part of the next phase (see Figure 9). This aspect of the analyses was related, firstly, to the general diagnostics of the predictive capabilities of the models and the diagnosis of the relationships between the theoretical constructs (latent (hidden) variables) in terms of the statistical significance of the results. The evaluation process was carried out in five stages (see Figure 2). Thus, as part of the first stage, the model was verified with respect to the problems of collinearity between the latent (hidden) variables of the structural model. The lack of this type of verification could result in an erroneous estimation of the parameters of the PLS-SEM model's structural paths. Collinearity, similar to the regression models, determines the level of dependence (relationship) between the endogenous variables and their predictors – the exogenous variables. The problems of collinearity in the PLS-SEM models are diagnosed using the so-called collinearity index (VIF – variance inflation factor). In practice, the value of the VIF parameter above 5.0 indicates a significant problem related to the collinearity between the predictors and the estimated parameters of the model (Mason & Perreault, 1991). On the other hand, VIF values in the range between 3.0 and 5.0 are considered acceptable (Hair et al. 2017) (Hair, Hult, Ringle, & Sarstedt, 2017). However, the most desirable VIF values are values below 3.0. According to these premises, based on the observation of the results obtained (see Table 2), we can conclude that in the case of the latent (hidden) variables under consideration, VIF values did not exceed 3, which proved the lack of collinearity between the predictors (exogenous latent (hidden) variables) in the PLS-SEM model.

As part of the second stage, the value of the R^2 determination coefficient of the endogenous latent (hidden) variable (AR) was checked. This coefficient measures the predictive accuracy of the PLS-SEM model and is computed as the square of the correlation between the actual and the predicted values of the given endogenous variable (i.e. the dependent latent (hidden) variable). The value of the R^2 coefficient ranges from 0 to 1, with the higher value reflecting the higher level of predictive accuracy of the exogenous variables. In the literature on the subject the following values of the R^2 coefficient in the PLS-SEM analyses are assumed: 0.75, 0.50 or 0.25, which are assigned the level of explained variance at the following levels: significant, moderate and weak ((Hair, Ringle, & Sarstedt, PLS-SEM: Indeed a silver bullet, 2011); (Henseler, Ringle, & Sinkovics, 2009). Taking these guidelines into account, it can be concluded that the model based on the endogenous variable (AR) in relation to the three exogenous latent (hidden) variables ("Technology" - T, "Organization" - O, "Environment" - E) produced the value equal to 0.63.

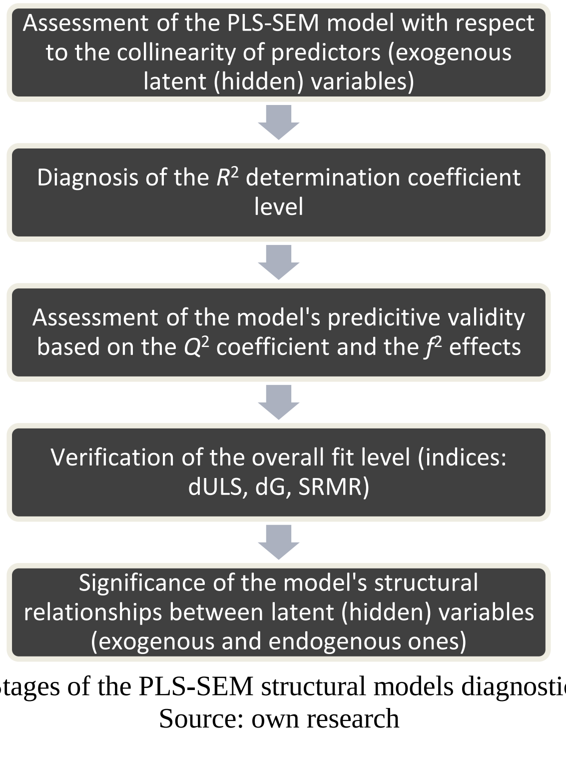

Figure 9. Stages of the PLS-SEM structural models diagnostics process.
Source: own research

Table 2. Diagnostic assessment of the PLS-SEM model based on the selected indicators

Exogenous Latent (hidden) Variables	Endogenous Latent (hidden) Variable (AR)	
	VIF Values	f^2 Values
Technology (T)	2.55	0.22
Organization (O)	1.75	0.42
Environment (E)	2.10	0.36
	Indicators	
R^2	0.63	
Q^2	0.55	
SRMR	0.05	
dULS	0.15*	
dG	0.12*	

Reference values: (*) $p > 0,05$. N = 267
Source: own research.

In addition to the evaluation of the R^2 determination coefficients, in order to verify the predictive relevance of the models, the Stone-Geisser Q_2 predictive quality (relevance) indicator (see (Geisser, 1974); (Stone, 1974)) was also used in the study. This indicator allows to determine the predictive relevance of the given endogenous latent (hidden) variable (taking into account its indicators – AR) along with the simultaneous impact of the exogenous latent (hidden) variables thereupon. The higher this indicator, the more accurate (relevant) the level of prediction is, which also translates into a higher level of the estimated paths in the PLS-SEM model in terms of the relationship between the endogenous latent (hidden) variable and the given exogenous variable under consideration. The interpretation of the Q_2 indicator's value should be as follows; values slightly higher than 0 (after the decimal point) indicate a poor level of prediction, while the values 0.25 and 0.50 reflect the average and high level of prediction of the given path in the PLS-SEM model. In the case of the model under consideration, the value of the predictive quality (relevance) indicator stood at 0.55.

Next, the level of impact of the exogenous latent (hidden) variables on the endogenous latent (hidden) variable was considered. In other words, the effects of the magnitude (f^2) of the relationships under consideration with the endogenous latent (hidden) variable from the perspective of the impact of the individual exogenous latent (hidden) variables were verified, assuming that the given exogenous variable is deliberately omitted from the model in order to estimate its true impact on the endogenous variable. This way the so-called potential effect that is the effect of an exclusion (loss) of an exogenous latent (hidden) variable from the structural model is subjected to verification. Guidelines for the interpretation of the magnitude of this f^2 effect can be found in the following papers (see (Cohen, 1988); (Wong, 2019)). Thus, the f^2 level of 0.02, 0.15 and 0.35 reflects a small, medium, and large effect of removing an exogenous latent (hidden) variable from the dependency (relationship) model. Taking these guidelines into account and the calculated f^2 effects (Tab. 2), we find that among the exogenous variables of the model in question the following constructs had the greatest impact: "Organization" at $f^2 = 0.42$, and then "Environment" at $f^2 = 0.36$. A moderate level of impact is visible in the case of the "Technology" variable with $f^2 = 0.22$.

Finally, the Standardized Root Mean Squared Residual (SRMR) index was used to perform an overall diagnosis of the proposed model (see Figure 2). The value of this index, if it does not exceed the level of 0.08, indicates an adequate level of the model's fit (see

Henseler et al. 2014), while a level equal to or lower than 0.5 means a very good fit level. As part of the alternative measures, two indices: dULS and dG, were also used (Dijkstra & Henseler, 2015), which allowed to diagnose the level of discrepancy between the empirical covariance matrix and the implied covariance matrix by the model. The difference between the matrices should be as small as possible so that it could be possible to obtain the best fit of the PLS-SEM model. In other words, the difference is defined in terms of the statistical insignificance of the result obtained ($p > 0.05$). This means that the discrepancy determined by the dULS and dG indices with respect to the compared matrices should be small enough to be ascribed to a negligible percentage of the impact of random errors. On the other hand, if this discrepancy is considered as significant ($p < 0.05$), then the model's fit in terms of the relationship (dependency) configurations (between exogenous and endogenous variables) postulated by the researcher may raise doubts. In the light of these rules it can be concluded that the value of the calculated SRMR index came in at 0.05. Thus, it did not exceed the model's upper rejection level (0.08); the model is within the range of the theoretical recommendations (Henseler et al., 2014). A similar situation occurs in the case of the dULS index which clocked in at 0.15 with $p > 0.05$. The dG index reflects the adequacy of the model and stands at 0.12 for the case under consideration, with $p > 0.05$.

Diagnosis (assessment) of the Relationships (dependencies) Occurring in the PLS-SEM Structural Model

The acceptance of the quality of the proposed PLS-SEM model allows, as part of the next step, for a closer look at the values of the structural parameters (path coefficients) describing the relationships between the exogenous latent (hidden) variables and the endogenous variable under consideration (see Figure 2).

The first approach applied in the study to estimate the relationships (dependencies) in the model was based on a point diagnosis of the estimated value of the path (relationship, dependency), while an analytical procedure based on "BCa Bootstrapping" was used as part of the second stage. The latter procedure made it possible to obtain a 95% confidence interval with respect to the estimated value – the result for the given path. The size of the samples taken, based on which the confidence interval is finally determined, may be between 1 000 and 10 000 samples. For the purpose of estimating the confidence intervals of the diagnosed structural parameters in the model under consideration, the sampling size was assumed to be 5 000.

The results obtained are presented in Table 3. Their analysis demonstrates unequivocally not only the significance of the three estimated paths at $p < 0.05$; 0.01, but is also in line with the theoretical premises of the model: T → AR ($\beta = 0.39$; $SB = 0.04$, with a 95% confidence interval of BCa from 0.31 to 0.47); O → AR ($\beta = 0.62$; $SB = 0.05$, with 95% of BCa ranging from 0.52 to 0.72); E → AR ($\beta = 0.53$; $SB = 0.06$ with BCa from 0.45 to 0.64).

Table 3. Results of the structural model with respect to the relationships (dependencies) diagnosed.

Structural Parameter	Estimated Statistics			95% Confidence Interval of the Path (BCa)	
	β	SB	*t*	Lower limit	Upper limit
T → AR	0.39	0.04	9.75	0.31	0.47
O → AR	0.62	0.05	12.40	0.52	0.72
E → AR	0.53	0.06	8.83	0.45	0.64

Explanations: T = Technology, O = Organization, E = Environment, AR = Assimilation of the Robotic Process Automation, SB = Standard Error, β = Estimated Path Value. BCa = Estimate based on the deviation correction procedure. All structural parameters are significant at p <0.05; 0.01. N = 267
Source: own research.

Discussion

As can be seen from the analysis presented in the 'Theoretical background' section of this article, at present, the vast majority of research papers focus on the attempt to identify the distinctive features of robotic process automation, the identification of the benefits and risks associated with the implementation of this approach, and the narrowly perceived technological aspects. A distinct minority of studies are dedicated to the strategic positioning of RPA, RPA governance, and the scaling of RPA implementations. Also, there is scarcely any research on the role of the organisational factor in the implementation of RPA (if such studies are conducted, they mainly focus on the issue of the fear of robotisation that can occur among employees). Finally, a significant part of the existing research uses qualitative methods (usually case studies) rather than quantitative research.

The research conducted by the author, with its results presented in this article, attempts to address the issue of assimilation robotic process automation by enterprises as comprehensively as possible. The main goal of the research was to identify factors influencing the assimilation of the RPA by companies. In the author's view, correctly identifying these factors and subsequent action relating to them will ensure the appropriate scaling of RPA and its strategic positioning.

For this purpose, the TOE model was selected as the basis of the research process – following the completion of the literature research presented in the first part of this article. Based on this model, a structural equation model was developed, which was made up of four types of theoretical constructs:

- a construct defined as "Technology" (T) composed of 6 sub-areas;
- a theoretical construct "Organization" (O) defined based on 5 sub-areas;
- a diagnostics construct "Environment" (E) composed of 4 sub-areas;
- a construct defined as "Assimilation of the Robotic Process Automation by an enterprise" (AR), including 4 elements.

and 19 detailed hypotheses were formulated.

In order to validate the model developed, the author used the results of his own quantitative research.

The research procedure completed allowed to come to a conclusion that all of the hypotheses had been confirmed (although with a varying "strength" – see figure 10-12).

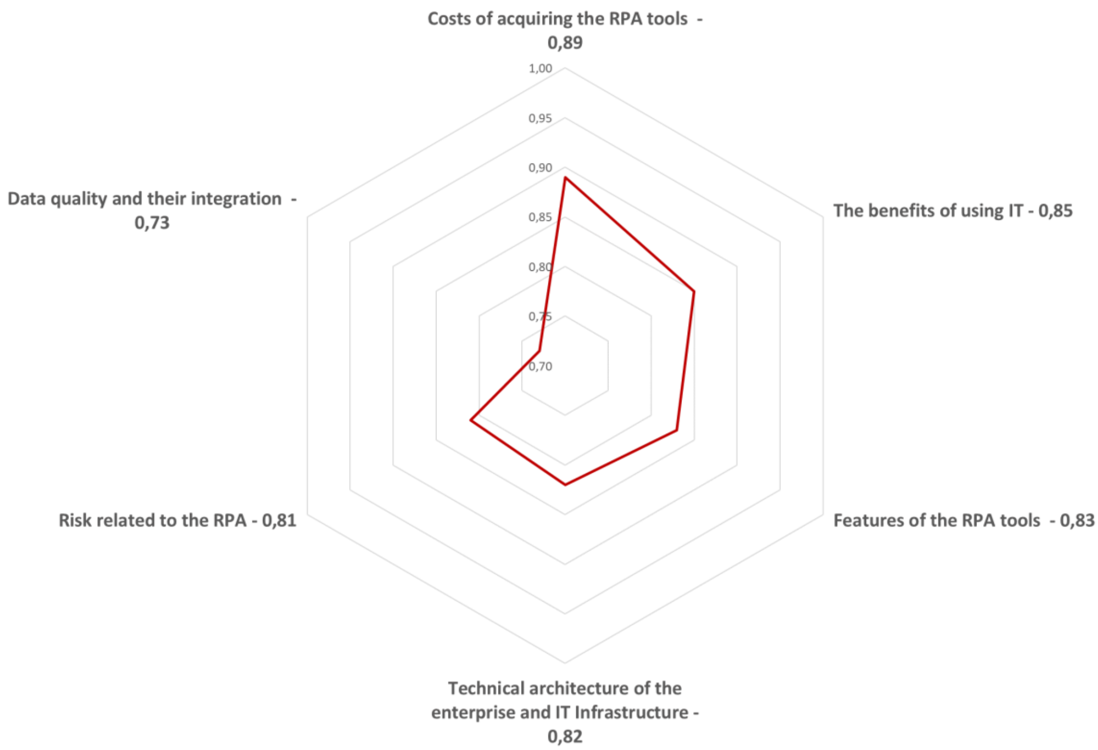

Figure 10. Decomposition a construct defined as "Technology".
Source: own research

With respect to the construct related to the Technology (figure 10), the T4 sub-area, covering the cost of acquiring the RPA tools, obtained the highest value of factor loadings. The issues related to licensing methods and costs of RPA tools have been repeatedly raised in source literature (Willcocks, Hindle, & Lacity, Becoming Strategic with Robotic Process Automation, 2020). As the author's practical experience demonstrates, currently the license fee for the RPA tool from a top supplier can reach several thousand EURO per annum. This may constitute a significant barrier to the spread of the robotic process automation at an enterprise. That is why it is so important to precede the choice of a tool with an in-depth analysis of the RPA solutions available on the market. It may turn out that a tool from a less renowned supplier, albeit definitely a cheaper one, will meet all the expectations of the organization. It is worth noting here that a possible solution to the problem of high costs of acquiring software robots is their implementation in the robot-as-a-service model. According to it, you pay for example for the actual working time of the robot or for the number of transactions made, and not for the license (Lacity i Willcocks, Robotic Process Automation and Risk Mitigation: The Definitive Guide, 2017).

The second Technology related construct's sub-area that obtained a high factor loadings value was the T1 sub-area, covering the provision of benefits thanks to the robotic process automation tools. This is also an important topic from the practical point of view. The issue of assessing the benefits of implementing the robotization of processes – their abilities to identify and estimate the delivered value, also are the subject of many literature studies (Kedziora & Kiviranta, Digital Business Value Creation with Robotic Process Automation (RPA) in Northern and Central Europe, 2018). The authors focus primarily on selecting the appropriate processes for robotization – in particular in the context of any possible savings. Some non-financial aspects are also increasingly emphasized – such as e.g. improving the quality of services provided and creating innovative products (Kedziora, Leivonen, Piotrowicz, & Öörni, 2021), (Willcocks, Hindle, & Lacity, Becoming Strategic with Robotic Process Automation, 2020).

Finally, the third sub-area that obtained a high factor loadings value was the T5 sub-area, covering the features of the RPA tools – especially with respect to the non-functional characteristics (such as safety, operational stability, ease of use). In the source literature, you can find in-depth analyses of key functionalities of tools for the robotization of processes – they take the perspective of both the construction of the robots themselves, as well as of their subsequent exploitation (Willcocks & Lacity, Automation: Robots and the Future of Work, 2016). This aspect of the analysis is also reflected in practice.

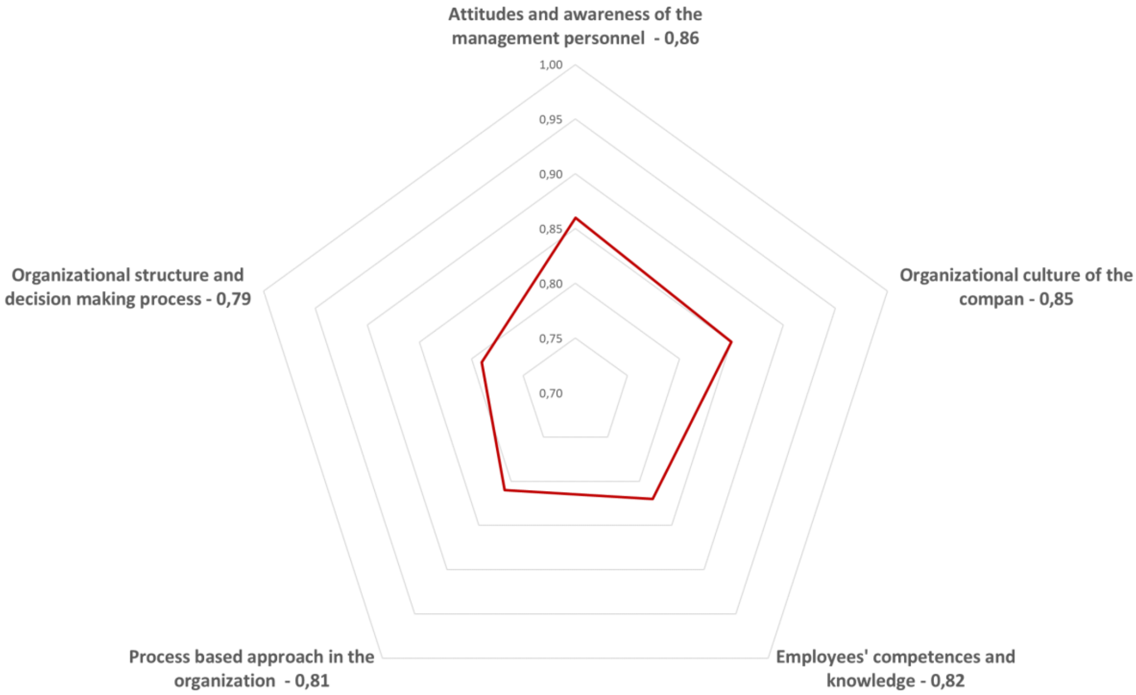

Figure 11. Decomposition a construct defined as "Organization".
Source: own research

With respect to the construct related to the Organization (figure 11), the O1 sub-area, covering the attitudes and awareness of the management personnel, obtained the highest value of factor loadings. At the moment, the source literature related to the cultural and managerial aspects of the implementation of the RPA is still underdeveloped (Willcocks, Hindle, & Lacity, Becoming Strategic with Robotic Process Automation, 2020). This may be due to the fact that RPA is perceived mainly through the prism of technology, and not of business change. In the author's view, this approach to RPA is too limited (Sobczak, 2021).

Robotic process automation is one of the digital transformation tools. At the same time, this transformation cannot be successful without the actual involvement of the decision makers (it is much more important than the involvement of other employees). Thus, this result is reflected in practice. The Organization related construct’s second sub-area that obtained a high value of factor loadings was the O2 sub-area, covering the issues dealing with the organizational culture of enterprises. Without an organizational culture that is focused on openness and sharing of knowledge it will be extremely difficult to increase the level of the RPA tools’ assimilation. It is worth noting that the O1 and O2 sub-areas are closely interrelated – in many cases it is up to the management personnel to decide what kind of organizational culture will be formed at the enterprise. Finally, the third sub-area that obtained a high value of factor loadings was the O3 sub-area, covering the competences and knowledge of employees. The issue of developing competences among employees in relation to the digitization of business processes (including their automatization) is relatively widely discussed in the source literature (Stjepić, Ivančić, & Vugec, 2020). In particular, this applies to issues referred to as upskilling and re-skilling. It is worth noting, however, that the development of digital and process competences among the employees of the business departments of enterprises, and at the same time the development of business competences among the employees of the IT departments undoubtedly contribute to increasing the assimilation of the robotic process automation.

With respect to the construct related to the Environment (figure 12), the E2 sub-area, covering the volatility of the environment, obtained the highest value of factor loadings.

Undoubtedly, the phenomenon of an increasing speed and frequency of changes, related to the technological, economic or legal aspects, taking place in the company's environment, which has been observed over the last few years, is a catalyst enhancing the assimilation of the robotic process automation. According to the source literature (Anagnoste, Robotic Automation Process – The operating system for the digital enterprise, 2018), it takes more time to introduce changes in classically developed IT systems than in the case of RPA. It proves the strength of the latter approach.

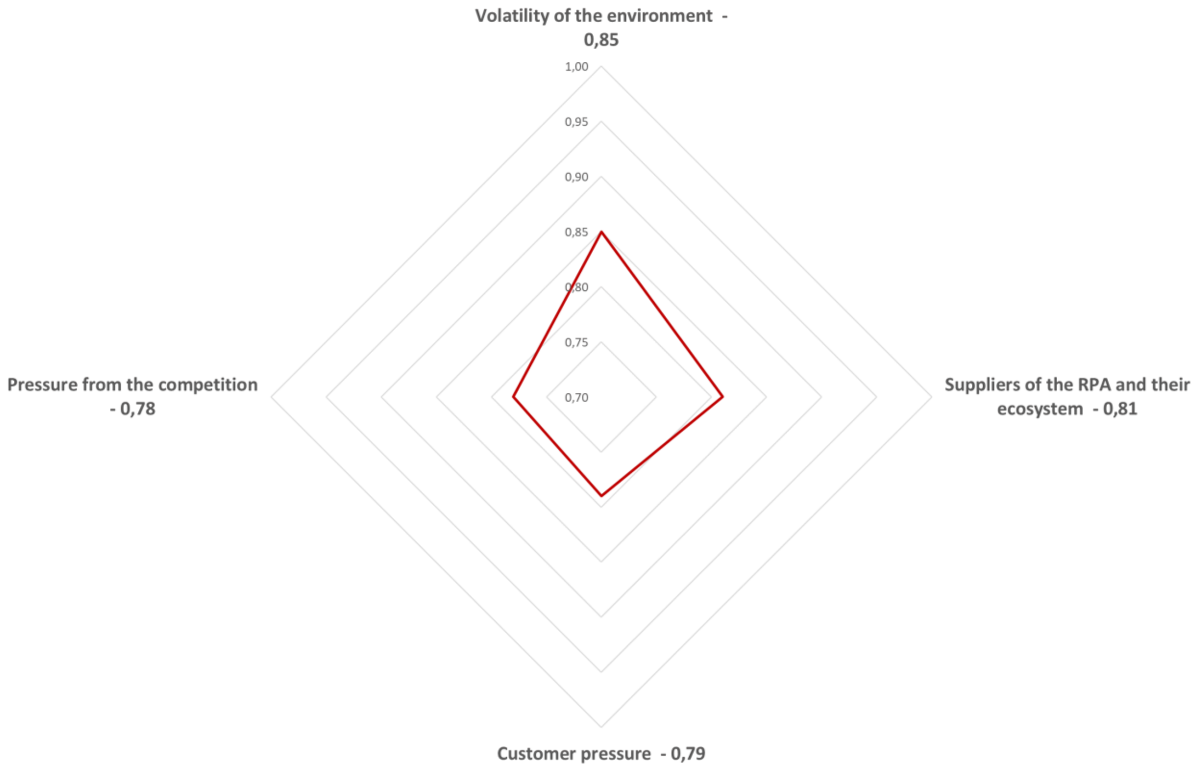

Figure 12. Decomposition a construct defined as "Environment".
Source: own research

The Environment related construct's second sub-area that obtained a high value of factor loadings was the E4 sub-area, covering the issues dealing with the suppliers of the robotic process automation technologies and their ecosystem. The literature pays relatively little attention to the role of technology providers and the support ecosystems which they build. However, these issues are raised in numerous reports of analytical companies – such as Gartner or Forrester. The currently available RPA tools, despite the actions taken by their suppliers, are not the easiest to use. That is why the network of technological partners providing training, certifications and consultants plays such an important role. It is also very important to build an active community of the RPA tool users, which also contributes to enhancing the reputation of the vendor. Finally, the third sub-area that obtained a high value of factor loadings was the E3 sub-area, covering customer expectations. The research results obtained allow for reaching a conclusion that customers who are continuously looking for new, innovative products/services and who expect very high quality of the products/services provided, contribute to the increased assimilation of the robotic process automation.

The research also demonstrates that at those organizations that are characterized by a high level of assimilation of the robotic process automation, business processes are implemented in a different way than they have been implemented thus far. Undoubtedly, this translates into their efficiency, but at the same time it allows for a significant improvement of the already offered products/services or the introduction of new products/services. Ultimately, this may lead to a change of at least one component of the company's business model (for example, the implementation of the key activities, the cost/revenue structure, customer contact methods, etc.). On the one hand, this research demonstrates the flexibility and applicability of the TOE model. On the other hand, the results obtained are a very good starting point for the formulation of the practical recommendations (presented further on in the article). According to the author, this is an additional value of this study. As noted by L. Takayama (Takayama, 2009), a harmonious combination of the development of a scientific approach with practice represents a real challenge in many cases. Practice poses questions to the theory, but theory also demands from practice the implementation thereof – in this case the practical recommendations formulated by the author represent such an implementation.

Limitations Related to the Research Conducted

The author is aware of the limitations of the research procedure completed. Some of these limitations stem from the complexity and multi-faceted nature of the assimilation of the robotic process automation by enterprises. Other limitations, resulting from the research procedure adopted, include:

- restricting the scope of research solely to enterprises operating only in Poland; this limitation resulted from the implementation options available; the author is aware of the fact that research carried out in other countries may produce different results, therefore it would be extremely valuable to conduct the research discussed in the article not only in relation to the enterprises from Poland, but more broadly in the European countries;
- limited size of the research sample and the method applied to select the sample: the results obtained cannot be considered as representative and cannot be generalized – they present the situation only in the analyzed group of enterprises;
- subjectivism of the assessments made by the respondents filling in the questionnaire; in order to minimize this limitation the decision was made to introduce, wherever possible, a precise description of the answers that could be given;
- risk of non-reflective filling of the questionnaires by the respondents; in order to minimize this limitation each completed questionnaire was subjected to a detailed analysis, and in case of any doubts, a clarification procedure was undertaken by e-mail or in an interview with the respondent;
- potential difficulties in understanding the questions contained in the questionnaire; in order to minimize this limitation pilot surveys were carried out and the questionnaire was equipped with a dictionary of key terms;
- possibility of omitting important aspects of assimilating the robotic process automation as a result of using closed-ended questions containing a finite number of potential answers; the author is aware of this limitation, but such an approach ensured the comparability of the results obtained; at the same time the selection of the survey questions was preceded by the author's literature research on both the robotic process automation as well as the assimilation of innovations.
- possibility of a company from outside the group of industries included in the research filling in the questionnaire or the possibility of more than one questionnaire being sent from the given company; in order to minimize this limitation the right to verify (vet) the enterprise from which the questionnaire was obtained, based on the data from

external websites (in particular, the data provided in the online version of the National Court Register), was reserved;
- possibility of the questionnaire having been filled by the wrong person (and thus an incompetent one); in order to minimize this limitation the requirement to provide a business e-mail address of the person completing the survey was introduced and the right to verify (vet) the details of that person using the data from external websites (in this case it was the LinkedIn service) was reserved; if it was not possible, the author asked the respondent by e-mail to confirm that he/she was the right person at the enterprise to complete the questionnaire; only those questionnaires were included in the research pool where such a confirmation had been obtained from the respondent.

Despite the above-mentioned limitations, the research procedure completed allowed for the accomplishment of the adopted goal of the research.

IMPLICATIONS OF THE RESEARCH

The implications of the research conducted by the author are presented below, broken down into the research implications (important from the perspective of scientists) and the practical implications (important from the perspective of the managers responsible for implementing the robotic process automation at their enterprises).

Research Implications

The research presented in this article is an extension of the works carried out with respect to two topics: robotic process automation and assimilation of digital innovations. Both the former topic as well as the latter area are currently explored by a number of researchers, which was emphasized in the first part of this article. At the same time, it is worth pointing out that while a lot of research has been done on the assimilation of traditional IT solutions (e.g. CRM systems, Big data, e-commerce, EDI), there have been no studies addressing the issue of the assimilation of the robotic process automation (according to the author's best knowledge, this is the first research on this topic in Europe). It is all the more important that, as the first part of the article demonstrates, software robots and the process of the development thereof differ significantly from the traditional approach to the implementation of the IT systems. The results of the research completed enhance the knowledge of factors influencing the assimilation of the robotic process automation. At the same time, they also confirm that the TOE model can be used for research on the assimilation of innovative, non-traditional IT technologies.

The results obtained constitute the basis for further research on the assimilation of the robotic process automation by enterprises – which is also due to the fact that an ever growing group of enterprises is beginning to introduce software robots on a mass scale (i.e. they have 100 or more of such robots). Therefore, a number of issues and research questions arise – how employees will be functioning in such a working environment, but also how managers managing hybrid teams (i.e. those in which instead of, for example, 30-40 employees, there will be 10 employees and 40 software robots) will be acting.

Practical Implications

Recent years have been a period of a very rapid spread of the robotic process automation at enterprises. The observations of the developments taking place on the IT market indicate that the Robotic Process Automation (RPA) tools are currently the fastest growing group of digital transformation tools. This is indirectly confirmed by one of the largest IPOs (Initial Public Offering) on the NYSE (The New York Stock Exchange) in 2021. UiPath, the leader in the RPA tools, was established as a startup in 2005 in Bucharest. According to the valuation following its IPO on the NYSE, the company is currently (2022) worth more than USD 10 billion (as recently as in 2017 it was valued at USD 1 billion). Those enterprises that neglect the implementation of solutions in the field of the robotic process automation today may expect a significant deterioration of their market position in the coming years (Gölpek, 2015)

The research completed, the results of which are presented in this article, can be the basis for the formulation of a number of practical recommendations for organizations implementing or wishing to implement the robotic process automation. These recommendations, in accordance with the research model proposed by the author, can be divided into three categories – i.e. technology, organization and environment related. Selected recommendations are presented below, broken down into the above-mentioned categories.

Technological recommendations

- It is important to choose an adequate – in terms of the costs – model of licensing the robotic process automation tools
- It is important to prepare an adequate IT infrastructure, which will be the basis for the functioning of the software robots
- It is important that the robotic process automation tools operate in a stable manner
- It is important to ensure that the robotic process automation tools provide the adequate scope and level of security mechanisms
- It is important to ensure that the robotic process automation tools are compatible with the company’s other IT solutions

Organizational recommendations

- It is important to ensure an adequate level of the management personnel support during the implementation of the robotic process automation
- It is important to build a high level of awareness among members of the company's management board on the role of IT – including the robotic process automation
- It is important to develop adequately high business, IT and process competences among the company's employees.
- It is important to implement a process-based approach at the company – as a basis (foundation) for its operations.

Recommendations related to the environment:

- It is important to implement the robotic process automation for those of the company’s customer segments that are characterized by pro-innovative or pro-quality expectations.
- It is important to provide access to the community of the users of the RPA tools applied by the company.
- It is important to provide access to the ecosystem of partners, training and certifications established by the RPA/RDA tool supplier.

According to the author, the above-mentioned recommendations can be considered to represent the key success factors in the assimilation of the robotic process automation by enterprises.

SUMMARY AND THE DIRECTIONS OF FURTHER RESEARCH

In response to the trend of the robotic process automation becoming more and more widespread as well as its increasing importance, an interdisciplinary area of research dealing with the advanced robotization technologies from the perspective of their impact on the economic and organizational aspects of the functioning of enterprises, which is referred to as Robonomics (Ivanov, 2017), is beginning to take shape. The observation of the RPA tools market, the implementations completed in this area and the research conducted allow us to formulate a conclusion that it may be of major importance in the future – both in terms of research as well as applications. This article is part of this research area.

The author intends to continue research in the field of the robotic process automation, focusing primarily on the development of a research model and practical recommendations regarding the assimilation of the robotic process automation by enterprises, including the use of big data mechanisms, machine learning and NLP (Natural Language Processing) methods as a part of the robotization (robotic automation) processes; as in the study (Lacity & Willcocks, Robotic Process and Cognitive Automation: The Next Phase, 2018), p. 26) it was indicated that the future of the RPA tools was the Cognitive Automation, i.e. one in which automation is implemented using software capable of operating effectively in unforeseen and uncertain situations. As a result of having been equipped with cognitive skills the software robots will be able to use the information they have in a way similar to human reasoning – in particular, they will be able to autonomously evaluate and interpret knowledge. This will be possible thanks to the use of artificial intelligence mechanisms (in particular, machine learning) and ensuring access to sufficiently large data sets (necessary for machine learning processes). It is to be expected that this will require a combination of a specific set of technologies, organizational measures as well as competences. At the same time, this type of robotization will allow companies to achieve benefits from the implementation of RPA that go beyond the financial aspects – in particular, leading to a rise in the quality of the company's products/services or an increase in the innovations offered by the company's products/services.

At the same time, the author is planning to extend the completed quantitative research on the assimilation of the robotic process automation by conducting the qualitative research in the future. As the target group the author is planning to select entities that achieve the above-average results in the implementation of the robotic process automation in Poland. For this purpose the author will be getting in touch with the companies that received awards or honorable mentions in the competition, conducted in 2022, for the most effective implementations in the field of hyper-automation (including the robotic process automation), the effectiveness of which is measured by comparing the business goals set before the implementation with the results obtained after it has been completed.

ENDNOTES

1. In the English language literature on the subject – in the context of the issues discussed in the article – the term "technology adoption" is used very often. However, the research presented in the article has been carried out in Poland, where there is no good, direct translation of this phrase. Some Polish researchers use the linguistic “carbon copy”, i.e. the term "technology adoption", but the author consulted it with the Polish Language Council and this was deemed as the wrong approach (in Poland the term adoption refers to a form of adopting a stranger to the family, developing a relationship similar to kinship). Therefore, the author ultimately decided to use the phrase "technology assimilation" and applied this phrase in this article. The decision had been preceded by the consultations with both the Polish linguists as well as the specialists in the field of automation/robotization/ innovative digital solutions.

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Authors' Note

This research was funded by the Foundation Centre for Studies on Digital Government within the project "Advanced aspects of business process automation".

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Human Technology
ISSN 1795-6889
https://ht.csr-pub.eu