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Benefits of and Obstacles to RPA Implementation in Accounting Firms

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Abstract

This paper describes the concept of a novel research planned to be carried out in Polish accounting firms providing accounting services to micro and small enterprises. The accounting firms consist of around 36,000 active entities providing services to as many as about 2 million entrepreneurs. The principal objective of this research is to determine the extent of robotic process automation in Polish accounting firms, as well as to identify the benefits of and obstacles to its implementation. The research is to be structured into 6 tasks, while the methods to be applied include a literature review, interviews with the owners and accountants working in accounting firms, survey methods/pen-and-paper personal interview and computer-assisted web interview, as well as raw data collection and statistical analysis. The results of a preliminary pilot study in two accounting firms are also presented in the paper.

Keywords: Accounting processes management, Robotic Process Automation, accounting firms

1. Introduction

In the era of digital economy, the role of robotization and automation has been constantly growing. Robotization and automation are entering new sectors of the economy, such as business services, which include, among others, financial and accounting processes, customer services, sales and delivery, human resources management [1], [2], [3] [4].

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The term 'Robotic Process Automation' (RPA) emerged around early 2000. It sounds like a physical robot that runs human operations. In fact, it is a software that replaces humans in doing a task [5]. Nowadays, the literature presents many definitions of RPA. According to the Institute of Electrical and Electronics Engineers Standards Association, RPA is "a preconfigured software instance that uses business rules and predefined activity choreography to complete the autonomous execution of a combination of processes, activities, transactions, and tasks in one or more unrelated software systems to deliver a result or service with human exception management'' [6]. The Institute for Robotic Process Automation defines RPA as "the use of technology that enables employees in a company to configure computer software or 'robots' to capture and interpret existing applications to process transactions, manipulate data, and communicate with other digital systems" [7]. The advisory and analytical company Gartner [8] describes business process automation as "the automation of complex business processes and functions beyond conventional data manipulation and record-keeping activities, usually through the use of advanced technologies". A Financial Express in 2016 in an article has defined RPA as "a set of automated software tools used by firms for repeat processing and complex tasks (low-end) without any human involvement" [9].

RPA is seen as a technological imitation of an employee's actions within one or several systems, with the aim to streamline structured work tasks [10]. According to Cohen [11]: "Robotic process automation is software that interacts with other application software at the user interface level (i.e., in the same way as a human) and is used to automate processes that are structured, rule based, and repetitive, as well as those with machine-readable data. RPA can automate tasks that are executed across different software applications." Boulton [12] states that in the service industry RPA "is to be understood as the application of technology leading to automating business processes, when a company develops and configures software, or a 'software robot,' to capture and follow same steps in transaction processing, data manipulation, response triggering and even communicating with other digital systems, as a human worker." Dumas et al. [13] define RPA as a "novel class of software tools that automate tasks, or entire business processes, which are heavily based on clerical work".

Robotic process automation can be understood as a combination of mutually related technologies such as autonomic systems, machine learning, artificial intelligence and robotics [14]. It works merely by replicating the activities that today's workforce currently undertake, using specifically developed applications, existing core applications, accessing websites, and manipulating spreadsheets, documents and email to complete simple and complex tasks [15]. RPA essentially builds on software robots that replicate human tasks ([16].

RPA is strictly linked with Artificial Intelligence (AI). The effective use of RPA requires an application of AI algorithms and makes intelligent process automation possible [18], and as a consequence, it has a big impact on and will continue to have a growing importance for accounting practices. An important augmenting technology for AI is OCR (Optical Character Recognition), which can be used to convert typed or handwritten texts into machine-readable texts [19].

RPA service providers claim that, in small enterprises like accounting firms, RPA can be implemented even more efficiently than in large firms, such as Global Accounting Services [19]. Small accounting firms in Poland consist of around 36,000 active entities providing services to as many as about 2 million entrepreneurs.

This paper aims at presenting the main findings derived from a preliminary literature review as well as the concept of a novel research on RPA application in accounting firms offering accounting and finance services mainly for micro and small enterprises (MSEs) in Poland. The results of a preliminary pilot study in two accounting firms are also provided.

2. Main findings derived from a literature review

The preliminary literature review covered RPA in accounting processes. In order to find articles addressing the topic researched, the Authors used a multi-search engine, by courtesy of the library of the UTP University of Science and Technology in Bydgoszcz, Poland. Various bibliographic databases (among others: *Academic Search Ultimate, Business Source Ultimate, Springer Nature Journals, IEEE Xplore Digital Library, Social Sciences Citation Index, Scopus, Directory of Open Access Journals*) were searched using keywords "robotic process automation" and "accounting". Only a few dozens of scientific papers were found, available in such periodicals as the *Journal of Emerging Technologies in Accounting, International Journal of Accounting Information Systems, Journal of Accounting and Finance, Journal of Accountancy, CPA Journal, Technology Accounting, Strategic Finance, ACRN*

Oxford Journal of Finance and Risk Perspectives, AI & Society, and in other domestic journals. Most were published between 2017 and 2019. This proves that the application of RPA in accounting is a new research topic and, so far, not many scientific studies have been conducted in this field. Other general conclusions, drawn based on the literature review, are as follows:

- Most of the studies were performed using case studies or multiple-case studies [19], [20], [21], [22], [23], [24], [25], [26] while only a few researchers used surveys [1].
- Out of all business processes, finance and accounting processes are most often robotized [1], [27].
- RPA is used in finance and accounting processes for accounts receivable and accounts payable, billing and collection, account reconciliations, transactions and invoice-to-PO (purchase order) matching, allocations and adjustments, closing and consolidation activities after reconciliations of bank accounts, credit cards, credit recordings, and financial reporting both for internal and external purposes, [19], [28], planning and budgeting activities in the controlling function and cost accounting [28], audit [29], [30], [31], tax [32], VAT settlements [33], finance and treasury management [34].
- RPA yields such benefits like: cost reduction [19], [28], [35], [36] faster processing [37], improved process control and performance visibility, higher quality of data (accuracy, consistency, compliance) [21], [38], [39]; continuous operation (24 hours a day) [40], positive impact on employees – repetitive, mundane tasks are taken over by robots, freeing up employee time, [9], [41], [42], [43].
- RPA affects the role of accountants, who should metamorphose into management accountants and focus on strategic activity [44], [45], [46], [47], [48]. In consequence, they must demonstrate design and analytical skills to be able to prepare analyses and develop reports for the management [49], [50].
- RPA implementation is relatively easy, while only a few months of training are required in order to equip employees with the skills of software-robot configuration and manual-task automation; they do not need to possess software-engineering or programming skills [51].

3. Research justification

As mentioned above, not many scientific studies have been conducted so far on the application of RPA in finance and accounting processes. According to Kokina and Blanchette, “Little is known about the adoption of this transformative and disruptive technology and the organizational implications surrounding the implementation of RPA for accounting and finance tasks” [21]. Studies on RPA have been mainly performed by consulting companies, such as Capgemeni Consulting [1], Deloitte [52] or Accenture Operations [53]. The review of the applicable world literature also shows that there seems to be no research on RPA implementation in accounting firms operating in the micro and small enterprise (MSE) sector. What is more, RPA application in Poland has not been examined at all. The literature review also shows that RPA is primarily applied in Global Business Sector/Business Service Sector (GBS/BSS) [9]. For over a decade, this sector has been developing very dynamically in Poland. It was estimated that at the end of the first quarter of 2020, GBS/BSS would consociate 112,000 persons offering, among others, accounting and financial services [27]. Unlike the corporations and large enterprises that use the services offered by Global Accounting Services, MSEs often outsource their bookkeeping to accounting firms. In Poland, there are approximately 71,500 accounting firms, about half of which are active, offering their services to 2 million entrepreneurs [54]. As per KPMG [55], 65% of Polish companies outsource accounting. According to the authors' knowledge, some firms in Poland have attempted to introduce RPA, however, so far, no studies have been carried out as to determine how many such projects have been made and what their effects were. The above arguments justify the research planned by the authors.

4. Methodology of the research planned

4.1. The objective and the research questions

The primary objective of this research is to determine the extent of robotic process automation in Polish accounting firms, as well as to identify the benefits of and obstacles to its implementation.

The detailed objectives include finding answers to the following research questions:

- How many and what kind of accounting firms have implemented RPA?

- What is the level of RPA knowledge among the owners and accountants in accounting firms?
- Which processes/procedures are robotized most often?
- What benefits has RPA implementation brought?
- What are the main problems in RPA implementation?
- What is the effectiveness of using RPA software in reading and entering documents?
- Did accountants fear that RPA would result in loss of employment and how is it in practice?

After the first and the second stages of the research, which are the preliminary pilot study in two accounting firms and the in-depth literature review, the above list of questions can be modified and expanded.

4.2. Hypotheses

The following primary hypothesis has been formulated:

- The level of RPA implementation in Polish accounting firms is low.
- The accountants working in accounting firms have little knowledge of the RPA possibilities and functionalities as well as the cost and the duration of RPA implementation.
- The approach of the accountants working in accounting firms to robotic process automation is rather skeptical.
- Technical problems are the main obstacle to the effective use of RPA.
- RPA efficiency in reading documents and posting transactions is not high at present.

4.3. Work plan

The research is planned to be executed in 6 stages (Table 1). It will begin with a preliminary pilot study in two accounting firms of different size which aims to identify the major aspects of RPA implementation. Together with the in depth literature review of the research results available on Robotic Process Automation, its aim is to give the underlying foundation for the preparation of the first draft of the final questionnaire to be developed for the main study. After that, a pilot study will be conducted among a few accounting firm owners. The survey will be executed via pen-and-paper personal interview to collect information that will provide the grounds for the final version of the questionnaire to be used in the main study. In the main study, a survey is planned to involve the owners of and the accountants working in Polish accounting firms. A Computer-Assisted Web Interview (CAWI) survey technique will be applied. The authors intend to ask the Accountants Association in Poland (AAP) for help with the survey. The AAP has 26 branches and about 26,000 members, who, in most part, work in accounting firms. At the last stage, analysis of the results will be performed in order to reach the research objectives and to verify the hypotheses.

Tab. 1. Study phases

Research stage	Task	Method/technique
Preliminary pilot study	Identification of the most important aspects of RPA implementation in practice	Free-form interview
Literature analysis	Recognition of the most important issues related to the applications of RPA in the light of previous scientific research	In-depth literature analysis
Questionnaire development	To develop the initial version of the questionnaire	Synthesis, deduction
Pilot study	Survey involving the owners and accountants of accounting firms	Survey method/Pen-and-Paper Personal Interview
Main study	Survey involving the owners and accountants of accounting firms	Survey method/Computer-Assisted Web Interview
Result analysis	Estimation of RPA knowledge and implementation benefits as well as obstacles in accounting firms	Raw data collection and analysis

5. Preliminary pilot study

Prior to the commencement of the in-depth literature review and the development and performance of the empirical research planned, the authors decided to carry out a preliminary study using the free-form interview method. The study was aimed at a preliminary identification of the most important aspects of RPA implementation and to assist in the preparation of the main study. The interviews were conducted with the owners of two accounting firms. The results of the interviews showed some interesting aspects related to the process automation the authors had not considered.

5.1. The first case study

The first accounting firm employs only 3 people (including the owner) and provides services approximately to 30 clients. It uses three financial accounting systems developed by Sage, Insert and Reset. To manage the document flow, the firm uses the same software as the one used by the clients, which facilitates an automatic import of data from the purchasing and inbound delivery system and the selling and distribution system of the clients who use the software from the three providers. In the middle of 2020, the robot software named Saldeo from yet another provider (Comarch) was installed. However, after a short period of use, the firm owner intends to test a newly developed RPA software offered by Sage, which should be better integrated with one of the accounting systems currently applied by the firm.

The firm processes approximately 7,000 documents per month, mainly invoices. About 5,000 invoices come from 2 major customers. They use the Insert invoicing system and send in electronic invoices that are automatically imported and posted to the same manufacturer's accounting system in the accounting firm. Out of the remaining 2,000 invoices processed monthly, about 700 are sent in the pdf format, and the other 1,400 invoices are delivered to the accounting firm in a paper form. The second very important type of documents which need to be posted to many different posting accounts is the monthly cash report, which can contain several thousand lines (e.g. cash payments from wholesalers).

Initially, efforts were made to apply the RPA software to all documents, i.e. the sent-in pdf files and those in a paper form. There were no major problems with invoices and cash reports in pdf files. Most of the data was and is automatically posted. Only about 10% of the data has to be manually completed. It applies, for example, to the purchase of fuel for passenger cars, which depends on the type of vehicle, which is not included in the invoice. However, major problems appeared with the reading of data from paper invoices, especially those printed using dot matrix printers. The main problems were the misread sale and payment dates, and confused net and gross amounts (with VAT). The accounting firm owner decided that using RPA software for those documents did not make sense as it did not reduce the processing time. As a consequence, approximately 1,400 invoices and several dozen cash reports are entered manually to the accounting system.

According to the authors, two additional comments provided by the accounting firm owner are very valuable. When interviewed, he pointed out that it was very difficult to convince the clients to the invoices in the form of pdf files, stating that, ‘you need to spend a lot of time to train the client to learn digital archiving.’ At the same time the firm owner emphasized that ‘as an accountant, I “trust” the electronic exchange of data much more than scanning data from paper to pdf.’ Both statements lead to the conclusion that a better solution would be to standardize the tools used by accounting firms and their clients (or use electronic data exchange standards) than to use RPA software for "intelligent" reading of the paper document or pdf files.

5.2. The second case study

The second accounting firm is a larger company which employs 12 people, including a chartered accountant, 7 accountants, 2 HR staff and 2 lawyers. It processes tens of thousands of documents monthly, mainly purchase and sales invoices from about 300 clients. The Comarch ERP Optima system, one of the largest providers of management support software in Poland, is used for client accounting. RPA software was introduced in 2018. Scanye, an intelligent OCR (Optical Character Recognition) program, was selected. However, problems appeared unexpectedly and the software has been changed twice due to a low paper invoice reading efficiency. The use of another software, Invoice Digitizer, and the purchase of a special scanner to read invoice data without having to remove the binders, allowed one employee to enter about 80 invoices per hour into the system and send. However, it only worked for legible

invoices, mainly pdf files. Again, similarly as in the first firm, in the case of paper invoices, especially those printed using dot matrix printers, the software resulted in many errors due to an incorrect recognition of invoice numbers, confusing invoice issue dates with due dates and net amounts with gross amounts.

Therefore, the approach to RPA was changed. First of all, the software was replaced with Saldeo, which is an intelligent add-on to the Optima ERP system and which is offered by the same Comarch provider. Second of all, all clients who also use Comarch systems (about 10% of all the clients) have remote access to Saldeo. The task of those clients is to retrieve the sales and purchase invoices, and the accounting firm only verifies the data, introduces modifications and approves for further processing in the Optima accounting system. As for the other customers who use systems other than Optima, the following solution was adopted: 1) for the clients who provide more than 50 documents per month, the Saldeo software is used (the accounting firm scans the documents), 2) the documents from all other clients are entered into the accounting system manually. The reasons for the decision were the employees having no software competence, a lack of people who could only scan the documents which must be first properly filed, scanned and their accuracy must be verified once the documents are entered in Saldeo. According to the accounting staff, it is faster to enter data from documents manually than to file, scan and to verify them.

The staff claims that about 10% of the documents entered with Saldeo require correction. These are usually the documents with two categories of assignment (e.g. 50% car fuel, when it is necessary to split between two specific categories, e.g. 11 and 12, resulting form the local tax provisions) or when the issue date is confused with the delivery date, etc. In the latter case, the program learns; after introducing the changes 2 or 3 times, the next batches of documents (from the same contractor, i.e. with the same data layout on the document face) are correctly entered by the program.

As in the case of the first firm, the owner believes that the most optimal solution for its clients is to use the software from the same provider as the accounting firm does and to perform automatic data import, instead of scanning and processing documents using RPA. So far, only 8 (out of about 300!) clients have been persuaded to such cooperation, and they provide around 360 documents per month in total.

Yet another issues to necessarily be taken into account is the real needs of a significant number of clients. Namely, due to the existing income tax and value added tax regulation, about a half of them fall into the category of non-VAT subjected micro-entities which additionally use the simplified lump sum income tax clearing. Such clients do not really require any advanced accounting procedures in terms of both the number of invoices to be processed and the relaxed regulations concerning the issuance of VAT-exempt sales invoices. In such circumstances the use of RPA software is not economically justified.

The interview also shows that the use of RPA software was affected by the pandemic, which calls for remote work. Currently, at the end of 2020, Saldeo processes documents of about 30% of all the clients, as compared to only 8% in 2019. However, remote work is limited. It is true that when an employee is in the office to scan documents and to upload them to Saldeo, another employee can verify those documents from home by accessing the Saldeo website. However, they can only be sent to the accounts from the device on which Optima is installed, i.e. from the firm's office, making the entire process require a rotational presence of a dedicated employee in the spot.

Conclusions

The accounting firms in Poland, operating on the market of micro and small enterprises, are micro and small enterprises themselves. They usually employ up to 10 persons. The types of the jobs they offer are rather simple, mediocrely remunerated, and focused on manual processes, such as: bank statement reconciliation, posting simple and typical transactions, drawing simplified balance sheets and income statements, clearing VAT and income tax returns. Often, the accounting software used for this purpose is not very sophisticated, while the processes are performed with an intensive use of spreadsheet-based and self-deducted devices, not linked with each other, not to mention any partial or full integration. The clients of such accounting firms are sole traders and owners, limited liability micro companies of 2-3 shareholders and sometimes medium enterprises having to rearrange their strategies by creating own accounting departments, due to expansion of their operations.

Nowadays Poland faces a rapid upturn swing in accounting technology and IT, towards a reorganization of accounting processes in the sector of micro and small accounting firms due to significant changes provided for in the Accounting Act amendments introduced in 2018. It mostly results from the introduction of the Standard Audit File

for Tax System in 2015. Effective since 2019, all the financial statements and accounts must be submitted to court and tax authorities via the governmental repository system. Also, the Polish Ministry of Finance plans to introduce an obligation for the structured e-invoices to be issued using a unified web system, mainly for the VAT supervision. It is also considered to make the retail shops and outlets issue electronic bills of sale at the moment of sale and to send them immediately to customers and to report the sale to the tax authorities. The first idea has been introduced for companies rendering public services and for the public sector entities in 2019. However, issuing or receiving an electronic invoice is yet far from accounting robotics or any kind of e-accounting, as only issuing an electronic invoice does not stand for any robotization of accounting activities which are normally further than just managing document inflow or outflow. The art of robotizing the accounting activities only begins with entering data. The key challenge really starts here: how to enter the general journal and sub-journals, how to post to appropriate accounts and allocate to profit centers and costs centers (if applicable), how to reconcile sums of entries and balances and to detect and report imbalances, how to make necessary corrections and perform end-of-period procedures, upkeep the audit trail, and how to possibly automatize processes leading to setting out internal and external statements of various kinds.

All that justifies the necessity of substantial research of micro and small accounting firms in terms of accounting services robotization. After conducting the described preliminary pilot study, the authors intend to prepare an appropriate questionnaire and conduct a survey that will answer the research questions posed. This study is intended to be of a pioneering nature when considering studies of this type performed in Poland.

References

[1] Kroll, Christian, Bujak, Adam, Darius, Volker, Enders, Wolfgang and Esser, Marcus. (2016) “Robotic Process Automation: Robots Conquer Business Processes in Back Offices,” https://www. capgemini.comuploads/sites/ 32/2017/08/robotic-process-automation-study.pdf., Capgemini Consulting, 1-48.

[2] Kokina, Julia and Davenport, Thomas. (2017) “The emergence of artificial intelligence: How automation is changing auditing.” *Journal of Emerging Technologies in Accounting* **14** (**1**): 115–122.

[3] Davenport, Thomas and Kirby Julia. (2016) “Only Humans Need Apply: Winners and Losers in the Age of Smart Machines.” New York, NY: HarperCollins Publishers.

[4] Tschakert, Norbert, Kokina, Julia, Kozlowski, Stephen and Vasarhelyi, Miklos. (2016) “The next frontier in data analytics.” *Journal of Accountancy* **222** (**2**): 58–63.

[5] Willcocks, Leslie, Lacity Mary and Craig, Andrew. (2015). “The IT function and robotic process automation. The Outsourcing Unit Working Research Paper Series , The it Function and Robotic Process Automation.” The Outsourcing Unit Working Paper Series 15/05, The London School of Economics and Political Science, London.

[6] IEEE. (2017) IEEE Guide for Terms and Concepts in Intelligent Process Automation. New York, IEEE.

[7] IRPA. (2019.)What is Robotic Process Automation? https://irpaai.com (accessed on 20.01.2020).

[8] Gartner (2019) "Business Process Automation (Bpa)." Retrieved 10 April, 2019, from https://www.gartner.com/it-glossary/bpa-business-process-automation.

[9] Fernandez, D., and Aman, A. (2018) “Impacts of Robotic Process Automation on Global Accounting Services,” *Asian Journal of Accounting and Governance* (**9**): 123-132.

[10] Asatiani, Aleksandre and Penttinen, Esko. (2016) "Turning Robotic Process Automation into Commercial Success – Case Opuscapita," *Journal of Information Technology Teaching Cases* **6** (**2**): 67-74.

[11] Cohen, Michael and Rozario, Andrea. (2019) “Exploring the Use of Robotic Process Automation (RPA) in Substantive Audit Procedures.” *The CPA Journal*, **89** (**7**): 49-53.

[12] Boulton, Clint. (2018) "What is RPA? A revolution in business process automation." Computerworld Hong Kong (May 2017).

[13] Dumas, Marlon, La Rosa, Marcello, Mendling, Jan and Reijers, Hajo A. (2018) "Process-Aware Information Systems", in Dumas, M., La Rosa, M., Mendling, J. and Reijers, H. A. (Eds.) Fundamentals of Business Process Management, Springer Berlin Heidelberg: 341-369.

[14] Mazilescu, Vasile and Micu, Adrian. (2019) “Technologies that through Synergic Development can support the Intelligent Automation of Business Processes.” Annals of the University Dunarea de Jos of Galati: Fascicle: I, *Economics & Applied Informatics,* **25** (**2**): 91-100.

[15] Lamberton, Chris, Brigo, Damiano and Hoy, Dave. (2017) “Impact of Robotics, RPA and AI on the insurance industry: challenges and opportunities,” *Journal of Financial Perspectives* **4** (**1**): 8-20.

[16] Geyer-Klingeberg, Jerome, Nakladal, Janina, Baldauf, Fabian, and Veit, Fabian. 2018. "Process Mining and Robotic Process Automation: A Perfect Match," 16th International Conference on Business Process Management, CEUR Workshop Proceedings 2196, Sydney, 124-131.

[17] van der Aalst, Will. M., Becker, Jorg, Bichler, Martin, Buhl, Hans. U., Dibbern, Jens., Frank, Ulrich, Hasenkamp, Ulrich, Heinzl, Armin,• Hinz Oliver, Hui, Kai-Lung, Jarke, Matthias, Karagiannis, Dimitris. Kliewer, Natalia, Konig, Wolfgang, Mendling, Jan, Mertens, Peter, Rossi Matti, Voss, Stefan, Weinhardt, Christof, Winter, Robert... and Zdravkovic, Jelena. (2018). Views on the past, present, and future of business and information systems engineering. Business & information systems engineering, 60(6), 443-477.

[18] Lin, Paul. (2018) "Adapting to the new business environment: The rise of software robots in the workplace." The CPA Journal **88** (**12**): 60-63.

[19] Gotthardt, Max, Koivulaakso, Dan, Paksoy, Okyanus, Saramo, Cornelius, Martikainen, Minna and Lehner, Othmar. (2019) "Current State and Challenges in the Implementation of Robotic Process Automation and Artificial Intelligence in Accounting and Auditing," *ACRN Oxford Journal of Finance & Risk Perspectives* (**8**):31-46.
[20] Kedziora, Damian and Kiviranta, Hanna-Maija. (2018) "Digital Business Value Creation with Robotic Process Automation (RPA) in Northern and Central Europe," *Management* **13** (**2**): 161-174.
[21] Kokina, Julia and Blanchette, Shay. (2019) "Early Evidence of Digital Labor in Accounting: Innovation with Robotic Process Automation," *International Journal of Accounting Information Systems* **35**, 100431.
[22] Osman Cristina-Claudia. (2019) "Robotic Process Automation: Lessons Learned from Case Studies," Informatica Economica, **23** (**4**): 66-75.
[23] Koch, Julian, Trampler, Michael, Kregel, Ingo, Coners, André. (2020) "Mirror, mirror, on the wall': Robotic Process Aautomation in the public sector using a digital twin." ECIS 2020 Proceedings, AIS Electronic Library, 1-11.
[24] Vitharanage Denagama, Imesha Manuraji, Bandara, Wasana, Syed, Rehan, and Toman, Denise. (2020, June). An empirically supported conceptualisation of robotic process automation (RPA) benefits. In Proceedings of the 28th European Conference on Information Systems (ECIS2020). Association for Information Systems.
[25] Ranerup, Agneta. (2020) "Translating Robotic Process Aautomation in social work: aspirational changes and the role of technology".
[26] Güner, Evrim Oya; Han, Shengnan; and Juell-Skielse, Gustaf. (2020) "Robotic Process Aautomation as routine capability: a literature review", Research Papers. 153.
[27] ABSL. (2020) Business Service Sector in Poland 2020. https://shop-absl.pl/index/s_lang/en. ABSL, Warsaw, Poland, pp. 1-176 (accessed on 2.01.2021).
[28] Kaya, Can Tansel, Turkyilmaz, Mete, and Birol, Burcu. (2019) "Impact of RPA Technologies on Accounting Systems," *Journal of Accounting & Finance* (**82**): 235-250.
[29] Huang, Feiqi and Vasarhelyi, Miklos A. (2019) "Applying Robotic Process Automation (RPA) in Auditing: A Framework," *International Journal of Accounting Information Systems* (**35**): 1-11.
[30] Moffitt, Kevin C., Rozario, Andrea M. and Vasarhelyi, Miklos A. (2018) "Robotic Process Automation for Auditing," *Journal of Emerging Technologies in Accounting* **15** (**1**): 1-10.
[31] Rozario, Andrea M and Vasarhelyi, Miklos A. (2018) How robotic process automation is transforming accounting and auditing. The CPA Journal, **88** (**6**): 46-49.
[32] Mezzio, Steven, Stein Robin, Stein Scott, (2019) "Robotic process automation for tax." *Journal of Accountancy*. December, 18-21.
[33] Okoń, Jan. (2018). "Zaangażowanie centrów usług wspólnych i robotyki w procesy księgowe," Studia Ekonomiczne **369**: 184-194.
[34] Polak, Petr, Nelischer, Christof, Guo, Haochen and Robertson, David C. (2019) "Intelligent Finance and Treasury Mana¬gement: What We can Expect," *AI & Society*: 1-12.
[35] Davenport Thomas H., Brain David. (2018) "Before Automating Your Company's Processes, Find Ways to Improve Them," *Harvard Business Review*, 13 June 2018, https://hbr.org/2018/06/before-automating-your-companys-processes-find-ways-to-improve-them# (accessed 20.04.2019).
[36] Bourgouin, Audrey, Leshob, Abderrahmane and Renard, Laurent. (2018) "Towards a Process Analysis Approach to Adopt Robotic Process Automation," in: 2018 IEEE 15th International Conference on e-Business Engineering (ICEBE): 46-53.
[37] Chakroborty, Aviruk. (2017) "Robotic Process Automation for transforming Financial KPO Industry", *Imperial Journal of Interdisciplinary Research,* **3** (**3**).
[38] Aguirre, Santiago and Rodriguez, Alejandro. (2017) "Automation of a business process using robotic process automation (RPA): A case study", *Communications in Computer and Information Science:* 65-71.
[39] Syed, Rehan, Suriadi, Suriadi, Adams, Michael, Bandara, Wasana, Leemans, Sander J.J., Ouyang, Chun, ter Hofstede, Arthur H.M., van de Weerd, Inge, Wynn, Moe Thandar and Reijers, Hajo A.(202). "Robotic Process Automation: Contemporary themes and challenges", Computers in Industry, Vol. 115, p. 103162.
[40] Driscoll, Timothy. (2018) "Value Through Robotic Process Automation: Replacing Labor-and Transaction-Intensive Processes with RPA can Reduce Costs while Improving Efficiency and Quality," *Strategic Finance* **99** (**9**): 70-72.
[41] Raju, Pradeep and Koch, Rod. (2019) "Can RPA Improve Agility?," *Strategic Finance* **100** (**9**): 68-69.
[42] Ivančić, Lucija, Vugec, Dalia Suša and Vukšić, Vesna Bosilj. (2019) "Robotic Process Automation: Systematic Literature Review", in International Conference on Business Process Management: 280-295.
[43] Vallor, Shannon. (2015) "Moral Deskilling and Upskilling in a New Machine Age: Reflections on the Ambiguous Future of Character," *Philosophy & Technology* **28** (**1**): 107-124.
[44] Lavinia-Mihaela, Cristea. (2019) "How AI Can Be Part of Solving Accounting and Business Issues ?" 19th International Multidisciplinary Scientific GeoConference SGEM, 28 June - 7 July 2019, Albena Bulgaria: 305-312.
[45] Lawson, Raef. (2019) "New Competencies for Management Accountants," *The CPA Journal* **89** (**9**): 18-21.
[46] Kruskopf, Shawnie, Lobbas, Charlotta, Meinander, Hanna, Söderling, Kira, Martikainen, Minna and Lehner, Othmar. (2019) "Digital Accounting: Opportunities, Threats and the Human Factor," *ACRN Oxford Journal of Finance and Risk Perspectives* (**8**): 1-15.
[47] Zhang, Chanyuan (Abigail), Dai, Jun and Vasarhelyi, Miklos A. (2018) "The Impact of Disruptive Technologies on Accoun¬ting and Auditing Education: How Should the Profession Adapt?," *The CPA Journal* **88** (**9**): 20-26.
[48] Schmitz, Manfred, Dietze, Christian, Czarnecki, Christian. (2019) "Enabling digital transformation through robotic pro-cess automation at Deutsche Telekom." In: Digitalization Cases: How Organisations Rethink Their Business for the Digital Age, Management for Professionals. Ed. by, N. Urbach, M. Röglinger. Springer International Publishing, Cham: 15–33.
[49] Jędrzejka, Dariusz. (2019) "Robotic process automation and its impact on accounting." *Zeszyty Teoretyczne Rachunkowości* **161(105)**: 137-166.

[50] Johansson, Björn, Engberg, Sandra, Lindgren, Ida, and Sördal, Therese. (2020) "Impacts of RPA on employees' skill variety" AMCIS 2020 Proceedings.

[51] Fersht, Phil and Selby, James R. (2012) "Robotic Automation Emerges as a Threat to Traditional Low-Cost Outsourcing." *Horses for Sources, London*: 1-18.

[52] Wright, David, Witherick, Dupe and Gordeeva, Marina. (2017) "The Robots Are Ready. Are you? Untapped Advantage in your Digital Workforce. Global RPA Survey," https://www2.deloitte.com, Deloitte (accessed on 20.01.2020).

[53] Patel, Paresh P. (2018) "Putting Intelligent Automation to Work for Federal," https://www.accenture.com. Accenture Operations, pp. 1-15. (accessed on 20.01.2020).

[54] INFOR. (2018) „Wpływ cyfryzacji księgowości na biura rachunkowe." https://www.infor.pl/biura-rachunkowe/prowadze-biuro/778380,Wplyw-cyfryzacji-ksiegowosci-na-biura-rachunkowe.html (accessed on 20.01.2020).

[55] KPMG. (2018) „Outsourcing usług księgowych, podatkowych i prawnych w firmach w Polsce." https://assets.kpmg/content/dam/kpmg/pl/pdf, KPMG, Warsaw, Poland, pp. 1-20. (accessed on 20.01.2020).