ROBOTIC PROCESS AUTOMATION AND AUDIT QUALITY

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Abstract

This study aims to explain the Jordanian state of the implementation of robotic process automation RPA in auditing, and to examine the expected impact of RPA implementation on audit quality from the views of Jordanian auditors, furthermore, the study aims to define the challenges of RPA implementation in Jordanian auditing firms. The study employed a survey method to collect data by using questionnaires. Three hundred (300) questionnaires were supplied to the sample of the study of which two hundred and seven (207) questionnaires from retrieved questionnaires were valid for analysis. The results of the study showed that Jordanian auditing firms do not apply RPA despite the expected impact of implementation on audit quality, this may be justified by the challenges that the auditors believe, the most important as they indicated are the initial investment for creating or purchase RPA, and the changing resistant by auditors for different purposes. The contributions of this paper are by enriching the theoretical side by shedding light on RPA and knowing the state of RPA implementation in Jordanian auditing firms and examining the impact of RPA implementation on the quality of audit. This paper also identifies the main challenges of the implementation of RPA in the Jordanian environment.

Keywords: Robotic Process Automation, RPA, Audit, Quality, Jordan

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1. INTRODUCTION

Those who follow the subject of auditing during recent years will find an increase in interest in auditing, especially after the financial scandals of many global companies, such as the bankruptcy and collapse of the US energy giant Enron, and WorldCom, and the ensuing spread of immoral reputation for the global auditing and legal accounting firm Arthur Anderson. All this places a greater burden on the audit firms themselves and on professionals and academics working in the field of accounting to improve this negative image and recover the confidence in the audit profession, this will not be achieved without focusing on enhancing the quality of audit, quality may be achieved by utilizing advanced technology such as robotic process automation (RBA).

Robotic process automation is expected to have a significant impact on auditing by achieving significant benefits for the auditors to improve the quality. In the area, where accounting is done using manual implements, such as basic ledgers, auditors use statistically acceptable sampling or similar techniques to validate processes and transactions. Currently, financial automation software is being adopted by many companies (Gepp, Linnenluecke, O'Neill, & Smith, 2018). The automation effectively analyzed the greater volume of data generated by a firm's businesses and its risks (KPMG, 2016). Now, where data is exploding around digital systems and networks, new capabilities are

available to mine piles of data to find audit risks, highlight outliers, and perform analysis. Robot process automation analyzes information and makes it easy for auditors to identify significant areas requiring more focus (Sun & Vasarhelyi, 2017). Already, new technologies have dramatically improved the analytical power of audits. The auditor judges the automation outcomes by applying the professional information of auditing (Rezaee, Sharbatoghlie, Elam, & McMickle, 2018). Robotic process automation allows the analysis of a particular dataset through a variety of audit lenses. This shows that it can instantly detect outliers that need further investigation. For instance, when the audit engagement team analyzes the complete set of approximately 250 million transactions that separated 50–60 transactions identified as outliers, it submitted them to the organization for further discussion. The automation system is more reliable and faster, which ensures accuracy and saves auditors time in completing assignments (Noor & Mansor, 2019).

This paper will attempt to identify the state of the application of RPA by audit firms in Jordan, review the most prominent challenges that prevent implementation (if any), and review the impact of the RPA implementation on audit quality.

The contributions of this paper are by enriching the theoretical side by shedding light on RPA and knowing the state of RPA implementation in Jordanian auditing firms and examining the impact of RPA implementation on the quality of audit. This paper also identifies the main challenges of the implementation of RPA, the subject of this paper is considered one of the relatively recent topics in the world, and it may be the first paper conducted in Jordan, according to the researcher's knowledge, that deals with RPA in Jordanian auditing firms.

The structure of this paper is as follows. Section 2 reviews the relevant literature. Section 3 produces the research methodology. While the results of paper presented in Section 4, Section 5 contains the discussion. Finally, Section 6 summarizes the conclusion.

2. LITERATURE REVIEW AND FORMULATION OF HYPOTHESIS

2.1. Robotic process automation (RPA)

Robotic process automation or "bots" is defined as the automation of the repetitive and routine process to enhance the effectiveness and efficiency of operations (Rainey, Brown, & Kirk, 2017). The automation process provides outcomes by completing all required aspects (Kokina & Davenport, 2017). One of the main advantages of using RPA in auditing is to reduce human error. Robotic process automation not only reduces human interference but, in some cases, detects unauthorized intrusions and issues warnings at headquarters. Robotic process automation focuses on understanding financial transaction trends (Raji & Buolamwini, 2019). Robotic process automation uses machine learning models to categorize messages and increase auditors' confidence level in completing error-free audits. It can examine all the datasets involved in transactions throughout the year instead of making

sampling in result, delivering the clear advantage of allowing auditors to concentrate their efforts on anomalies and outliers, agreeing to spend more time in high-risk areas. Automation analysis is also reliable for the auditors and the clients or firms (Commerford, Dennis, Joe, & Ulla, 2021). Another benefit of automation is by entering accounting information into the RPA; auditors can collect data processed in the background (van Liempd, Quick, & Warming-Rasmussen, 2019). In this automation, auditing basics remain the same, as there is always a need for human judgment and expert skepticism. A practical use case for new technology is to make it easier, faster, more accurate, and more extensive than ever to obtain the supporting evidence needed for auditing. This directs to improved quality, reduced risk, and time savings, not to mention increased risk. The automation process is transforming auditing by providing auditing evidence (Yoon, Hoogduin, & Zhang, 2015).

Gami, Jetly, Mehta, and Patil (2019) showed that RPA implementation will reduce the cost and the cycle time, at the same time it will increase productivity. Despite the benefits of RPA, it may have challenges such as employees' resistance and the process of selecting the appropriate processes that are suitable for RPA and the challenges related to setting realistic expectations that are consistent with companies' status (Ostdick, 2016).

Ansari, Diya, Patil, and Patil (2019) overviewed the advantages and disadvantages of RPA, they confirmed the ease of configuration, safety, non-invasive, interfaces work in a simple way and do not affect other software, while the disadvantages are the high cost of implementation, the technical ability of end-user is required, worry to decline the human as it may take their positions.

Gotthardt et al. (2020) examined the state and challenges of RPA implementation in accounting and auditing in Finland, by using case study approach and literature reviews, the researchers concluded that RBA implementation in auditing and accounting required cross-departmental support and a clear mindset, in addition, to reduce the risks when dealing with errors or inadequacies companies must define clear strategies and problem statements.

Boersma (2020) examined the appropriate framework to transform a manual data process of audit service to a smart automated process, the study relied on a literature review to reach a framework, then the framework was evaluated by experts to reach a reviewed framework that was useful to the process of the audit company. The proposed framework has four stages of automation which are process determination and workflow analysis and workflow connections and automation technology selection.

Moffitt, Rozario, and Vasarhelyi (2018) relied on a literature review to present the impact of RPA, they concluded that RPA would change the auditor's role by replacing routine tasks with more thinking skills which will be reflected positively on audit quality. Furthermore, the authors believed that auditors will rely more in the future on the RPA, the benefits of RBA are the reduction of time consumed for routine tasks and between application and loan approval, or purchase order and fulfillment or invoice and payment, and the improvement of security and audit quality with reliable records.

Osman (2019) examined ten companies that implemented RPA to define the considerations according to five criteria, she concluded that not all processes are consistent with automation, companies need to identify processes consistent with RPA. Implementation benefits are the cost reduction and a higher volume of executed cases.

Eulerich, Pawlowski, Waddoups, and Wood (2021) examined the impact of using RBA "six" bots to perform audit tasks on the audit performance within a large-listed audit company, the study used a design science methodology, then a three-step evaluation framework was used to help auditors identify the priorities of RPA activities, authors concluded that the half of the bots affect positively the audit performance, whereas the other half faced difficulties to achieve its objectives. The study suggested a framework to help in prioritizing bot contribution in internal and external auditing.

Cooper, Holderness, Sorensen, and Wood (2019) studied the usage and implementation of RPA and its impact on the work experience of leader employees and lower-level employees in Big 4 accounting companies. The study used interviews with 14 leaders and 139 employees as a technique to define their comprehension of RPA. It is concluded the two groups agreed on the positive influence of RPA on the profession. Specifically, on RPA influence on changing positively the employee career and the performance of employee work. However, while leaders believe RPA will increase work satisfaction, employees at a lower level believed do not.

2.2. Audit quality

Audit quality does not have a unified and coherent definition throughout studies and has unsettled theorists for many years (Herrbach, 2010). Researchers strive to define the quality of audit or the requirements of the quality, they follow two approaches. The first one is the quantitative approach, in this approach researchers use the size of auditor, audit fees, discretionary accruals, auditor tenure, auditor independence, and other measures as a proxy for audit quality. For example, Enofe, Mgbame, Aderin, and Ehi-Oshio (2013) found a positive significant association between audit quality and the board independence showed a significant association with audit quality. Ndubuisi and Ezechukwu (2017) indicated a significant positive relationship between audit quality in Nigerian banks and the following factors: audit fees, audit tenure, audit firm size.

The other approach, which this study follows, to measure audit quality is the qualitative approach. In this approach, researchers use content analysis or questionnaire to judge the quality. According to Arens, Beasley, Best, Shailer, and Fielder (2011), the quality of the audit may be defined as follows: "Audit quality means how well an audit detects and report material misstatements in financial statements, the detection aspects are a reflection of auditor competence, while reporting is a reflection of ethics or auditor integrity, particularly independence" (p. 105). Audit quality depends according to the previous definition on auditor competence and independence.

The previous definition complies with the viewpoints of DeAngelo (1981), Eilifsen and Willekens (2008), those who determined two main requirements to achieve the quality of audit, the first one is the detection of material misstatements, the second one is the reporting of the material misstatements. While Mock and Michael (1982) defined five main elements for the quality of audit: planning, administration, procedures, evaluation, and conduct. Carcello, Hermanson, and McGrath (1992) measured audit quality with indicators related to client's experience, industry awareness, sensitivity to client needs, and commitment to auditing standards. Sutton (1993) measured audit quality with indicators related to three dimensions: planning, fieldwork, and administration, while Duff (2004) used two dimensions to define the quality: technical quality (reputation, capability, expertise, experience, and independence) and service quality (non-audit service, responsiveness, empathy, and client service). Later, Duff (2009) found that audit quality can be defined by four dimensions: competence, independence, relationship (technical audit), and service qualities. The International Auditing Standard (IAS) No. 220 which is effective on or after December 15, 2009, and IAS 220 (revised) (IFAC, 2020) focused on quality control procedures for auditing, the standard defines the quality requirements as follows: responsibilities of leadership, applicable ethical requirements, the relationship with a client, which is characterized by acceptance and continuity, engagements of audit, task of engagement teams, the performance of engagement, monitoring, and documentation.

Al-Nawaiseh (2006) studied the determinants of audit quality in Jordan. He found that the most important factor affected audit quality from the perspective of Jordanian auditor related to audit work team with a relative importance of 74.4%, fieldwork procedures have relative importance of 73.8%, audit fees 71.6%, while the lowest effect was 64.6% for the organizing of audit firm. Hien, Tram, Ha, Huong, and Hang (2019) used a survey to determine the audit quality, audit quality was determined by labor qualification and management capacity, financial capacity and the size, capability to connect with other enterprise and international economic combination, and the level of technology, marketing capacity, and equipment.

The researcher employs mainly two dimensions to measure audit quality: *competence* and *independence*.

According to a literature review, the researcher formulates the following hypotheses:

H1: There is an expected statistically significant impact at the level of (α ≥ 05.0) for implementing RPA on the quality of audit.

H1 is divided into the following hypotheses:

H1a: There is an expected statistically significant impact at the level of (α ≥ 05.0) for implementing RPA on the competence of the auditor.

H1b: There is an expected statistically significant impact at the level of (α ≥ 05.0) for implementing RPA on the independence of the auditor.

3. RESEARCH METHODOLOGY

The article depended on the inferential and descriptive method and to recognize the expected effect of applying RPA on the quality of auditing from the perception of auditors in Jordan, this method is based on a precise and complete clarification of the problem to generalize facts (Sekaran & Bougie, 2012).

3.1. Sample and data collection

The population of the study contained the certified auditors "as legal persons" that are working in Jordan, whose number according to Jordanian Association of Legal Accountants, 2021, is 402 auditors (offices and companies), the researcher then drew a "simple random sample". Three hundred (300) questionnaires were distributed to them, and 211 questionnaires were retrieved, 4 of them were not filled out and were ignored. The total of questionnaires applicable for statistical analysis were 207. The period of data collection by distributing and retrieval of questionnaires was during March 2021.

3.2. Reliability

The study depended on Cronbach's alpha to determine the reliability of the study paragraphs; the results of reliability are shown in the following table.

Table 1. Cronbach's alpha

	RPA expected impact on competence	RPA expected impact on independence	RPA expected impact on quality	Challenges	General index
Cronbach's alpha	0.788	0.731	0.828	0.792	0.835
No. of paragraphs	10	10	20	7	27

Table 1 indicates that the value of the Cronbach's alpha for the study's paragraphs tool varied between 73.1% and 82.8% and a degree of stability amounted to 83.5% for all the paragraphs. Sekaran and Bougie (2012) indicated that the minimum limit of coefficient of reliability is 0.70 and whenever the value is close to 1, this shows higher degrees of reliability for the study tool and its validity to statistical analysis.

3.3. Normal distribution

The collected data was examined to ensure that it falls under the normal distribution or not, as a Kolmogorov-Smirnov (K-S) test was performed to pinpoint the normal distribution of data and if the value of Sig. is greater than 0.05 indicates that the data is normally distributed (Hair, Black, Babin, Anderson, & Tatham, 2018).

Table 2. Test (K-S)

	RPA impact on competence	RPA impact on independence	Challenges
K-S	1.238	1.342	1.283
Sig.	0.093	0.055	0.074

Table 2 shows the normality of data distribution, where the value of Sig. for all study axes, has a value greater than 0.05.

4. RESEARCH RESULTS

4.1. Descriptive results

4.1.1. Application of PRA and their knowledge of them

Table 3 shows the results of frequency and percentage of the respondents' answers towards applying PRA and their knowledge of it.

Table 3. Application of RPA

Variable	Answer	Frequency	Percentage
Does the company implement RPA?	Yes	–	–
	No	207	100%
	Total	207	100%
Do you have knowledge of RPA?	Yes	164	79.2%
	No	43	20.8%
	Total	207	100%

It is noted from Table 3 that all audit firms do not apply PRA, and it was found that 79.2% of them have knowledge of the RPA system, and their number is 164, while 20.8% of them do not know PRA system. Note that RPA was defined in the questionnaire so those without sufficient knowledge could complete the answers.

4.1.2. Descriptive results of study axes

The descriptive measures were considered to find out the views of the study's sample for the variables of the study, and the degree of approval was defined by the following equation: *Category length = the higher perimeter of the choices,* which is 5 – *the lower perimeter of the choices,* which is 1 / *the number of levels,* which is 3 = 1.33. If the arithmetic mean surpasses 3.66 it is reflected a high level while it is reflected a low level if the value between 1–2.33, the average level is achieved if the value ranges between 2.34–3.66 (Subedi, 2016). The following tables express the next results.

The expected effect of RPA on competence

Table 4 expresses the main measures of respondents' answers about application of RPA in audit competence, which was measured based on 10 items.

Table 4. Descriptive results of expected impact of RPA on competence

Para. No.	Paragraph	Mean	Standard deviation	Relative %weight	Approval degree	Rank
1	Using RPA in routine work directs auditors toward work that requires high thinking.	4.49	0.565	89.8	High	1
2	RPA implementation promotes and supports the continuous learning of auditors.	4.05	0.765	81	High	7
3	RPA implementation reduces the possibility of manual errors, especially entry errors, which increases accuracy.	4.37	0.617	87.4	High	2
4	RPA saves time on the business, directing auditors to gather evidence and complete the audit process.	4.31	0.639	86.2	High	3
5	RPA implementation leads to more accurate and complete business performance.	4.14	0.783	82.8	High	6
6	Using RPA will assist auditors at the planning stage in preparing the interim and final audit program and plan.	4.23	0.627	84.6	High	4
7	The use of RPA will assist in obtaining objective conclusions by properly documenting the audit process.	4.16	0.670	83.2	High	5
8	Implementing RPA will increase the efficiency of auditors in assessing client business risks.	3.88	0.818	77.6	High	8
9	Implementing RPA will increase the materiality and audit risk assessment.	3.76	0.782	75.2	High	10
10	Implementing RPA will help in performing of the initial analytical procedures and access to financial indicators.	3.79	0.876	75.8	High	9
General index		**4.12**	**0.423**	**82.4%**	High	

Table 4 shows that the expected impact of RPA on competence achieved an arithmetic mean (4.12) and the relative weight reached 82.4% of the area of the overall index, with a standard deviation of 0.423. Paragraph 1, which states, "Using RPA in routine work directs auditors toward work that requires high thinking" ranked first with a high degree, the arithmetic mean (4.49) and a standard deviation (0.565), whereas paragraph 9 achieved the last rank with a high degree, which states that "Implementing RPA will increase the materiality and audit risk assessment" with arithmetic mean (3.76), a standard deviation (0.782).

The expected effect of RPA on independence

Table 5 displays the main measures of respondents' answers about the expected application of RPA on audit independence, which was measured based on 10 items.

Table 5. Descriptive results of expected impact of RPA on independence

Para. No.	Paragraph	Mean	Standard deviation	Relative %weight	Approval degree	Rank
11	Implementing RPA will enhance adherence to policies and procedures regarding objectivity and integrity.	3.92	0.699	78.4	High	5
12	In the future implementation of RPA will reduce audit fees compared to competitors.	4.40	0.605	88	High	1
13	The RPA implementation will ensure mental independence in training and supervision programs and follow-up audits.	3.96	0.709	79.2	High	3
14	RPA will not enhance non-audited services.	2.30	0.688	46	Low	9
15	RPA implementation will not affect the auditor's ability to independently develop their estimates despite the difficulty and complexity of the models used to analyze large amounts of data.	2.13	0.659	42.6	Low	10
16	Implementing RPA will reduce threats of conflicts of interest and objectives between the auditor and the client.	3.74	0.842	74.8	High	8
17	The implementation of RPA will increase the skills in dealing with such technology, thus increasing the eligibility of the auditor, and reflecting positively on his independence.	4.32	0.673	86.4	High	2
18	RPA implementation helps create neutral and unbiased judgment when doing the job.	3.96	0.706	79.2	High	4
19	Implementing RPA will not lead to the provision of audit services for a longer period.	3.75	0.535	75	High	7
20	The RPA implementation frees the auditor from unprofessional influences in the performance of his work.	3.92	0.360		High	6
General index		**3.64**	**0.356**	**72.8%**	Medium	

Table 5 shows that the expected implementation of RPA on the independence achieved arithmetic mean (3.64) and the relative weight reached 72.8% of the area of the overall index, with a standard deviation of 0.356. It came within the medium level from the point view of the Jordanian certified accountants, as it achieved paragraph 12 which states "In the future implementation of RPA will reduce audit fees compared to competitors" on the first ranking with a high degree and with a mean (4.40) and a standard deviation (0.605), whereas

paragraph 15 achieved the last rank, which states that "RPA implementation will not affect the auditor's ability to independently develop their estimates despite the difficulty and complexity of the models used to analyze large amounts of data" with a mean of 2.13 and a standard deviation (0.659), with a low degree.

The challenges of RPA implementation

Table 6 displayed the main measures of respondents' answers about the challenges, which were measured based on 7 items.

Table 6. The challenges of RPA implementation

Para. No.	Paragraph	Mean	Standard deviation	Relative weight%	Approval degree	Rank
21	The auditors lacked technical capabilities to deal with RPA.	3.92	0.516	78.4	High	3
22	Initial cost of creating or purchasing RPA and costs of setting up the necessary infrastructure.	4.28	0.645	85.6	High	1
23	Resistance to change by auditors for various reasons.	4.06	0.718	81.2	High	2
24	Legal limitations related to cross-border transfer of data.	3.54	0.742	70.8	Medium	6
25	The inability of auditors to define the appropriate processes for the RPA.	3.71	0.827	74.2	High	4
26	Lack of belief in the usefulness of RPA.	2.28	0.995	45.6	Low	7
27	Determinants related to cross department support.	3.62	0.707	72.4	Medium	5
General index			**3.63**	**0.499**	**72.6%**	

Paragraph 22 states "Initial cost of creating or purchasing RPA and costs of setting up the necessary infrastructure" on the first rank with a high degree and with a mean (4.28) and a standard deviation (0.645) while paragraph 26 achieved the last rank, with a low degree, which states "Lack of belief in the usefulness of RPA" with a mean (2.28) and a standard deviation (0.995).

4.2. Hypothesis testing

The study hypotheses were subjected to the one-sample t-test, and the subsequent results were achieved:

Table 7. Results of hypothesis testing

Hypothesis	T "calculated"	T "table"	DF	T.Sig.	Mean	Standard deviation	Result
H1	37.864	1.960	206	0.00	3.88	0.334	There is an expected impact
H1a	38.067	1.960	206	0.00	4.12	0.356	There is an expected impact
H1b	25.845	1.960	206	0.00	3.64	0.334	There is an expected impact

It is noted from Table 7 that it is expected that there will be an impact of the application of RPA on the quality of the audit, which represents the results of the main hypothesis test. It is also expected that there will be an impact of the application of RPA on competence and independence, which represents the sub-hypotheses. In terms of the probability value (T.Sig) for all hypotheses that achieved a value less than 0.05, and in terms of T "calculated". for all hypotheses that were greater than their tabular value.

5. DISCUSSION OF THE RESULTS

The study concluded that Jordanian audit firms do not implement RPA in their work, this may be justified if the most important challenges that limit the possibility of RPA implementation are reviewed from the auditors' point of view, who indicated that the most important challenges are the initial cost of creating or purchasing RPA and costs of setting up the necessary infrastructure, these challenges are consistent with Ansari et al. (2019) who overviewed disadvantages of RPA, and another important challenge that may be one of the reasons why RPA is not applied in Jordan which is the changing resistance by auditors for various reasons, this challenge is consistent with Gami et al. (2019) who address the challenges of RPA implementation.

It is found also that there is a significant impact of the expected implementation of RPA on the quality of audit, the author believed that the implementation of RPA expects to reduce the likelihood of manual errors and unintended human input errors, RPA will improve audit accuracy and audit quality, taking in to account that the implementation of RPA in routine work will

direct auditors toward high thinking missions and saves time necessary to gather evidence and complete the audit process, RPA also will increase the eligibility of the auditor and enhancing neutral and unbiased judgment of auditors, all of this will improve the audit quality, this result is consistent with Eulerich et al. (2021), Moffitt et al. (2018), Gotthardt et al. (2020), Yoon et al. (2015) who found that the use of RPA directs to improve the quality of audit.

6. CONCLUSION

This paper has examined the state of RPA implementation in Jordanian auditing firms, and the expected impact of RPA implementation on the quality of audit from the viewpoint of auditors, furthermore, the challenges of RPA implementation were defined.

It demonstrated that Jordanian audit firms do not implement RPA despite its expected impact on the quality of the audit from the respondents' point of view, the study demonstrated a significant impact of the expected implementation of RPA on competence and independence of the auditor, therefore, on the quality of audit. Most respondents believe that RPA implementation in routine work directs auditors toward work that requires high thinking, and will reduce the possibility of manual errors, especially entry errors, which increases accuracy, also RPA will save time on the business, directing auditors to gather evidence and complete the audit process. Furthermore, RPA implementation will reduce audit fees compared to competitors in the future, which enhance independence and will increase the skills in dealing with such technology, thus increasing the eligibility of the auditor, and

reflecting positively on his independence, RPA also will ensure mental independence in training and supervision programs and follow-up audits. All this will reflect positively on audit quality.

Most important challenges facing the application were identified at the high initial cost of creating or purchasing RPA and costs of setting up the necessary infrastructure, resistance to change by auditors for various reasons, and lack of auditors' technical capabilities to deal with RPA.

This paper contributed by enriching the theoretical side by shedding light on RPA and emphasizing the importance of implementing RPA because of its impact on the quality of auditing. It also identified the main challenges that prevent the implementation of RPA.

The author suggests the researchers to conduct a future research to present an appropriate framework to transform a data process of audit service in Jordan to a smart automated process.

REFERENCES

1. Al-Nawaiseh, M. I. (2006). Factors affecting audit quality: an empirical study from the perspective of Jordanian auditors. *Jordan Journal of Business and Administration, 2*(3), 390–415. Retrieved from https://journals.ju.edu.jo/JJBA/article/view/1307
2. Ansari, W. A., Diya, P., Patil, S., & Patil, S. (2019). A review on robotic process automation — The future of business organizations. Paper presented at the *2nd International Conference on Advances in Science & Technology (ICAST)*. https://doi.org/10.2139/ssrn.3372171
3. Arens, A. A. E., Beasley, R. J., Best, M. S., Shailer, P. J., & Fielder, G. E. P. (2011). Audit responsibilities and objectives. In *Auditing, assurance service and ethics in Australia* (pp. 108–141). Pearson.
4. Boersma, E. (2020). *Intelligent process automation framework: Supporting the transformation of a manual process to an automation* (Master's thesis, University of Twente). Retrieved from https://essay.utwente.nl/83139/
5. Carcello, J. V., Hermanson, R. H., & McGrath, N. T. (1992). Audit quality attributes: The perceptions of audit partners, preparers, and financial statement users. *Auditing, 11*(1), 1. Retrieved from https://www.proquest.com/openview/3c614634d67b0236a32fd7fcd12f6f79/1?pq-origsite=gscholar&cbl=31718
6. Commerford, B. P., Dennis, S. A., Joe, J. R., & Ulla, J. W. (2021). *Man versus machine: Complex estimates and auditor reliance on artificial intelligence.* https://doi.org/10.2139/ssrn.3422591
7. Cooper, L., Holderness, D. K., Jr., Sorensen, T., & Wood, D. A. (2019). Perceptions of robotic process automation in public accounting. *Accounting Horizons, 23*(4), 15–35. https://doi.org/10.2308/acch-52466
8. DeAngelo, L. E. (1981). Auditor size and audit quality. *Journal of Accounting and Economics, 3*(3), 183–199. https://doi.org/10.1016/0165-4101(81)90002-1
9. Duff, A. (2004). *Auditqual: Dimensions of audit quality.* Institute of Chartered Accountants of Scotland. Retrieved from https://www.researchgate.net/publication/263995388_AUDITQUAL_Dimensions_of_audit_quality
10. Duff, A. (2009). Measuring audit quality in an era of change: An empirical investigation of UK audit market stakeholders in 2002 and 2005. *Managerial Auditing Journal, 24*(5), 400–422. https://doi.org/10.1108/02686900910956784
11. Eilifsen, A., & Willekens, M. (2008). In the name of trust: Some thoughts about trust, audit quality and audit regulation in Europe. In R. Quick, S. Turley, & M. Willekens (Eds.), *Auditing, trust and governance* (pp. 19–36). Routledge. https://doi.org/10.4324/9780203936016-8
12. Enofe, A. O., Mgbame, C., Aderin, A., & Ehi-Oshio, O. U. (2013). Determinants of audit quality in the Nigerian business environment. *Research Journal of Finance and Accounting, 4*(4), 36–43. Retrieved from https://core.ac.uk/download/pdf/234629455.pdf
13. Eulerich, M., Pawlowski, J., Waddoups, N., & Wood, D. A. (2021). A framework for using robotic process automation for audit tasks. *Contemporary Accounting Research.* https://doi.org/10.2139/ssrn.3651028
14. Gami, M., Jetly, P., Mehta, N., & Patil, S. (2019). Robotic process automation — Future of business organizations: A review. Paper presented at the *2nd International Conference on Advances in Science & Technology (ICAST)*. https://doi.org/10.2139/ssrn.3370211
15. Gepp, A., Linnenluecke, M. K., O'Neill, T. J., & Smith, T. (2018). Big data techniques in auditing research and practice: Current trends and future opportunities. *Journal of Accounting Literature, 40*(1), 102–115. https://doi.org/10.1016/j.acclit.2017.05.003
16. Gotthardt, M., Koivulaakso, D., Paksoy, O., Saramo, C., Martikainen, M., & Lehner, O. (2020). Current state and challenges in the implementation of smart robotic process automation in accounting and auditing. *ACRN Journal of Finance and Risk Perspectives, 9,* 90–102. https://doi.org/10.35944/jofrp.2020.9.1.007
17. Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2018). *Multivariate data analysis* (8th ed.). Cengage Learning EMEA.
18. Herrbach, O. (2010). Audit quality, auditor behaviour and the psychological contract. *European Accounting Review, 10*(4), 787–802. https://doi.org/10.1080/09638180127400
19. Hien, N. A., Tram, H. V. B., Ha, D. T. N., Huong, N. C. T., & Hang, N. P. T. (2019). Factors affecting the audit quality and the competitive capability of auditing enterprises in Ho Chi Minh City. *International Journal of Entrepreneurship, 23*(3), 1–11. Retrieved from https://www.proquest.com/openview/6ebf4a7c51895994b1016c220aaeca0f/1?pq-origsite=gscholar&cbl=29727
20. Kokina, J., & Davenport, T. H. (2017). The emergence of artificial intelligence: How automation is changing auditing. *Journal of Emerging Technologies in Accounting, 14*(1), 115–122. https://doi.org/10.2308/jeta-51730
21. KPMG. (2016, November 23). How technology is transforming the audit. *Forbes.* Retrieved from https://www.forbes.com/sites/kpmg/2016/11/23/how-technology-is-transforming-the-audit/
22. Mock, T. J., & Michael, G. S. (1982). Multi-attribute model for audit evaluation. In *Auditing Symposium VI: Proceedings of the 1982 Touche Ross/University of Kansas Symposium on Auditing Problems* (pp. 105–126). Retrieved from https://egrove.olemiss.edu/cgi/viewcontent.cgi?article=1134&context=dl_proceedings
23. Moffitt, K. C., Rozario, A. M., & Vasarhelyi, M. A. (2018). Robotic process automation for auditing. *Journal of Emerging Technologies in Accounting, 15*(1), 1–10. https://doi.org/10.2308/jeta-10589

24. Ndubuisi, A. N., & Ezechukwu, B. O. (2017). Determinants of audit quality: Evidence from deposit money banks listed on Nigeria Stock Exchange. *International Journal of Academic Research in Accounting, Finance and Management Sciences, 7*(2), 117–130. https://doi.org/10.6007/IJARAFMS/v7-i2/2877

25. Noor, N. R. A. M., & Mansor, N. (2019). Exploring the adaptation of artificial intelligence in whistleblowing practice of the internal auditors in Malaysia. *Procedia Computer Science, 163,* 434–439. https://doi.org/10.1016/j.procs.2019.12.126

26. Osman, C. C. (2019). Robotic process automation: Lessons learned from case studies. *Informatica Economica, 23*(4), 66–75. https://doi.org/10.12948/issn14531305/23.4.2019.06

27. Ostdick, N. (2016, November 3). The benefits and challenges of RPA implementation. *UiPath.* Retrieved from https://www.uipath.com/blog/the-benefits-and-challenges-of-rpa-implementation

28. Rainey, S. K., Brown, B., & Kirk, D. B. (2017, September 21). Bots, natural language processing, and machine learning. *Tax Executive.* Retrieved from https://taxexecutive.org/bots-natural-language-processing-and-machine-learning/

29. Raji, I. D., & Buolamwini, J. (2019). Actionable auditing: Investigating the impact of publicly naming biased performance results of commercial AI products. In *Proceedings of the 2019 AAAI/ACM Conference on AI, Ethics, and Society* (pp. 429–435). Association for the Advancement of Artificial Intelligence. https://doi.org/10.1145/3306618.3314244

30. Rezaee, Z., Sharbatoghlie, A., Elam, R., & McMickle, P. (2018). Continuous auditing: Building automated auditing capability. In D. Y. Chan, V. Chiu, & M. A. Vasarhelyi (Eds.), *Continuous auditing (Rutgers studies in accounting analytics)* (pp. 169–190). Emerald Publishing Limited, Bingley. https://doi.org/10.1108/978-1-78743-413-420181008

31. Sekaran, U., & Bougie, R. (2012). *Research methods for business: A skill building approach* (7th ed.). New York, NY: John Wiley & Sons Inc.

32. Subedi, B. P. (2016). Using Likert type data in social science research: Confusion, issues and challenges. *International Journal of Contemporary Applied Sciences, 3*(2), 36–49. Retrieved from http://www.ijcar.net/assets/pdf/Vol3-No2-February2016/02.pdf

33. Sun, T., & Vasarhelyi, M. A. (2017). Deep learning and the future of auditing: How an evolving technology could transform analysis and improve judgment. *CPA Journal, 87*(6). https://doi.org/10.1111/j.1540-5915.1993.tb00464.x

34. Sutton, S. G. (1993). Toward an understanding of the factors affecting the quality of the audit process. *Decision Sciences, 24*(1), 88–105. https://doi.org/10.1111/j.1540-5915.1993.tb00464.x

35. The International Federation of Accountants (IFAC). (2020). *International Auditing and Assurance Standards Board IAS 220 (revised), quality management for an audit of financial statements.* Retrieved from https://www.iaasb.org/publications/international-standard-auditing-220-revised-quality-management-audit-financial-statements

36. van Liempd, D., Quick, R., & Warming-Rasmussen, B. (2019). Auditor-provided nonaudit services: Post-EU-regulation evidence from Denmark. *International Journal of Auditing, 23*(1), 1–19. https://doi.org/10.1111/ijau.12131

37. Yoon, K., Hoogduin, L., & Zhang, L. (2015). Big data as complementary audit evidence. *Accounting Horizons, 29*(2), 431–438. https://doi.org/10.2308/acch-51076