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HOW AUDIT FIRM SIZE MODERATE EFFECT OF TOE CONTEXT TOWARD AUDITOR ADOPTION OF MACHINE LEARNING

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ABSTRACT

The era of industrial revolution 4.0 which is being intensively present today, business is increasingly moving towards digital. More big data companies have emerged, which require audit services. This also makes auditors have to develop, not only using manual systems but also using information technology assistance such as artificial intelligence and machine learning. The research conducted aims to determine the auditor's acceptance of the use of machine learning when dealing with Industry 4.0 which is intended to provide assistance to audit reports in customer finances. The instrument used in the research relates to the Technology Organizations Environment (TOE) approach as well as the size of an audit firm. included in quantitative research, the data used are primary data obtained through questionnaires distributed to the research object that has been determined, namely auditor workers at general accounting firms. In this study, hypothesis testing was conducted between research variables using path analysis, Structural Equation Modeling Partial Least Square (SEM PLS), in which the independent variables in the study were the technological context, organizational context and environmental context, while the moderating variables of the study were firm size and dependent variable is the auditor's adoption of machine learning. The research carried out gives results, namely an understanding of the adoption of auditors in the use of information technology systems used in the audit process, as well as a description given to auditors regarding the use of technology systems that can improve the quality of work that is more effective and efficient both in terms of time and energy deployed. In the research conducted, the researcher hopes to provide a summary of the description of technology adoption by financial auditors related to professionally managed audit firms.
Keywords: *Technology, Organization, Environment, Auditor, Machine Learning*

1. INTRODUCTION

1.1 Research Background

The current state of technological development, where the 4.0 industrial revolution, is certainly very helpful in facilitating the audit process that is routinely carried out by a company. The industrial revolution 4.0 can increase efficiency and facilitate large-scale innovation within companies because they are already utilizing increasingly innovating technology. According to [1], industry 4.0 is a methodology to produce a transformation from physical manufacturing to digital manufacturing. To achieve a successful transformation, [1] emphasized that industry 4.0 must be well understood and must be mapped clearly so that implementation can run as expected. Industry 4.0 which is being intensively present today is marked by new breakthroughs in technology such as Artificial Intelligence (AI), Internet of Things (IoT), automated vehicles, three-dimensional (3D) printing, biotechnology, materials science, quantum computing, and others [2].

Artificial intelligence (AI) is one of the fields of research related to intelligent thinking that can be used as a form to perform calculations [3]. In simple terms, AI is an innovation product that uses certain programming in processing big data so that this technology can think intelligently like humans and can help human work in many ways. Calculations made by AI aim to create information technology systems that are more controlled, can simplify the work of users, and can analyze problems and documents. However, don't think of AI as a robot that has a mind of its own and will then attack humans as its creator.

Over the years, AI is increasingly useful for workers in various fields and can help to create

efficiency and effectiveness. In the audit process, AI can assist auditors in reviewing company documents that need to be reviewed. It is not new for auditors to examine various types of company documents. However, the presence of AI can minimize the time spent by auditors reviewing company financial statements. In addition, AI can also recognize and process documents that are automatically connected to a transaction without the need for auditor intervention in the future (Raphael, 2015).

The research space in this study is the lack of use of Machine Learning by accountants, especially auditors. Auditors are actually familiar with this technology but still don't understand how to use it and what it can be used for. This is due to the lack of exploration of the auditors in the adoption of new technology. Moreover, in the current state of COVID-19, technology is increasingly needed to facilitate human work and be able to predict what a company's financial condition will be based on historical data during the pandemic. Auditors need to have good technical and ethical skills, intelligence in thinking and able to solve problems, ability to adapt to technology, ability to control emotions, and creative vision skills so that they can produce output in accordance with expectations.

[4] have investigated what factors can influence the audit technology that be adopted in audit firms. The research uses the Technology, Organization, and Environment (TOE) Framework because it is believed that the adoption of technology audits is different from the adoption of other information technologies. This is because audit tools are used to make the change of the way the auditors carry out their duties. This study uses a questionnaire method that has been distributed to 1,367 audit firms that have been registered in the Malaysian Institute of Accountants directory.

As from the phenomenon of the problem and the research gap, we conducted research on the factors that influence auditors to adopt machine learning with the Technology Organization Environment theory approach and add audit form size as a moderating variable.

1.2 Problem Statement

As from the background explanation above, it is necessary to conduct research to examine the determinants of the adoption of machine learning in the audit process. The formulation of the problem can be formulated in several questions as follows:

1. Does the technology context affect the auditor adoption of machine learning?
2. Does the organization context affect the auditor adoption of machine learning?
3. Does the environment context affect the auditor adoption of machine learning?
4. Does audit firm size moderate the effect of technology context to auditor adoption of machine learning?
5. Does audit firm size moderate the effect of organization context to auditor adoption of machine learning?
6. Does audit firm size moderate the effect of environment context to auditor adoption of machine learning?

2. LITERATURE REVIEW

2.1 TOE Approach

[5] have developed a framework called TOE (Technology, Organization, Environment). This framework has business aspects that have an impact related with the adoption and implementation of new innovations. According to [6], the TOE Framework is a technology adoption model that combines three main factors which can influence an organization in adopting or accepting technology. The TOE Framework is consistent with the diffusion of information theory developed by [7], which focuses on the characteristics of technology, as well as internal and external characteristics as dynamic forces of technology diffusion. [5] believe that the adoption and assimilation of new technologies in companies is under the influence of the included contexts which are Technology, Organization, and Environment.

In the context of technology, research focuses on the ways and structures of technology that can influence an organization's adoption of Information Technology (IT). In the organizational context, this research focuses on organizational attributes that can influence technology adoption. In the context of the environment, the focus is on investigating how the environment can influence IT adoption [8]. These three contexts affect a company's intention to adopt an innovation, affect the assimilation process, and finally the impact of innovation on an organization's performance. Therefore, the TOE Framework has become the choice of many researchers in adopting technology.

Many researchers also agree that the TOE Framework provides an excellent theoretical basis for exploring Information Technology (IT) adoption behavior in the audit process. For example, the research conducted by [6] adopted the TOE Framework in examining the use of Big Data Analytics in the audit process carried out remotely. Another example of research is [4] who adopted the

TOE Framework to analyze auditors in adopting technology in auditor companies. But keep in mind that the TOE Framework does not aim to offer a concrete model that describes the factors that influence someone in adopting technology. However, it is more of a taxonomy to classify factors in their respective contexts [9].

2.2 Machine Learning

there are several implementations of Artificial Intelligence (AI), one of which is in the form of machine learning that is part of deeper learning in which there are many layers which are also used as opposed to shallow learning. Machine Learning (ML) is defined by computer science in which there are computer algorithms with the use of statistics for identifying patterns in some big data. The results of the pattern identification are used to predict unknowable future events. This technology has been used in various fields including education, health, biology, and accounting [10]. Not only in these fields, actually has machine learning penetrated almost every aspect of human life.

One of the Public Accounting Firms, PricewaterhouseCoopers (PWC), said that there are several advantages to using a data-driven model approach compared to using traditional business rules:

a. If you want to detect fraud patterns, auditors need to write business rules and detect patterns manually. Meanwhile, if using machine learning, machines can infer fraud patterns directly from the data itself.
b. The pattern of fraud continues to change so that if it is detected manually, it is necessary to update business rules and require reliable capabilities and high costs. Meanwhile, if you use machine learning, the machine can be continuously trained until it can get a continuously updated model with less effort.
c. Code related human knowledge into a set of business rules is the most challenging main task.

2.3 Effect of Technology Context on Auditor Adoption of Machine Learning

In the context of technology, the indicators used in this study are Relative Advantage, Compatibility, and Complexity. Relative Advantage is the advantage gained from adopting Information Technology (IT) compared to previous adoptions or activities so that the Relative Advantage felt by users is getting bigger [11]. Compatibility is an important feature of IT adoption because it adapts to the lifestyle of IT users and is believed to drive their use. For example, if certain innovations or new ideas are not in accordance with the prevailing values and standards, the innovation cannot be adopted as easily as compatible innovations [12]. In the research of [8], complexity is defined as the extent to which the use of IT is considered complex by users.

H1: Technology Context has a positive effect on Auditor Adoption of Machine Learning.

2.4 Effect of Organization Context on Auditor Adoption of Machine Learning

[5] explain that informal employee relations and communication, talent quality, top management leadership actions, and internal vacancies have a significant impact in a matter of the adoption for technological innovations. In the context of the Organization, there are three influencing indicators, namely Organization Competency, Top Management Support, and Training and Education. Organizational competence is the ability to manage a company from top management, middle management, to supervisors and managers who meet directly with operational workers [13]. In the research of [4], Top Management Support is proven to have an influence on the level of user confidence that can improve performance when using Information Technology (IT). Meanwhile, Training and Education needs to be implemented according to the needs of each organization in order to influence employee performance.

H2: Organization Context has a positive effect on the Use of Machine Learning.

2.5 Effect of Environment Context on Auditor Adoption of Machine Learning

[14], found that in the face of an increasingly unstable environment, an organization will be more interested in innovations that can make work easier. [15] also said that the environment has high uncertainty, so it will have a positive impact for its relationship that occurs between organizational structure and technological innovation. In the context of the environment, there are two indicators that can influence, namely Competitive Pressure and Trading Partner Support. In [16] research, the role of Competitive Pressure has been proven to be an effective motivator for organizations. [17] also explained that Trading Partner Support can affect the use of Information Technology (IT), because consumers and distributors will feel that they are equally benefited from the service side and also the relationship between organizational functions.

H3: Environment Context has a positive effect on the Use of Machine Learning.

2.6 Audit Firm Size Moderate Effect of Technology Organization Environment Context on Auditor Adoption of Machine Learning

New technologies which can be defined as artificial intelligence and machine learning are for some people categorized as costly. To be able to use this technology, a large amount of financial support is needed. Companies must budget for the procurement of hardware and software supporting technology facilities [18]. In addition, the auditor's computer literacy skills are also very necessary. CPA firms should provide budgets for training or education for their auditors to understand the use of this technology. The terms big four and non-big four are quite famous in the auditing's world. The Big Four are the four largest international public accounting firms, namely: Ernest & Young, KPMG, Deloitte and PwC. A large public accounting firm is synonymous with a large budget, so with a large budget, they are considered more able to buy the latest technology compared to ordinary or non-big four accounting firms.

This opinion is also in line with the results of research from [19]. The formulated hypothesis based on the statements above as follow:

H4a: Audit firm size moderate effect of technology context on auditor adoption of machine learning

H4b: Audit firm size moderate effect of organization context on auditor adoption of machine learning

H4c: Audit firm size moderate effect of environment context on auditor adoption of machine learning

The following is a picture of our research framework, presented in figure 1

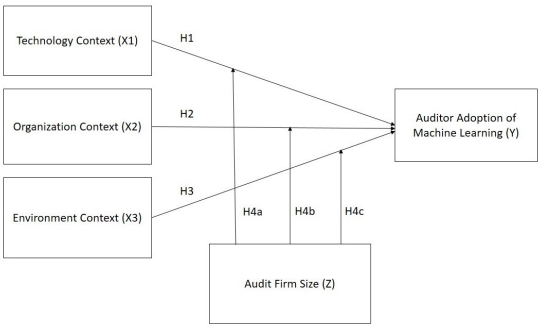

Figure 1: Research Framework

3. RESEARCH METHODOLOGY

3.1 Material and Method

Quantitative method used by the researcher in this study. Quantitative research is research that aims to test theories objectively by presenting data in numerical form and researching and testing relationships between variables [20]. These variables must be measurable so that the resulting numerical data can be analyzed statistically.

3.2 Data Collection, Sample and Data Analysis

The primary data source obtained came from distributing questionnaires to the research object that had been determined by the researcher. The technique used in data collection is using a questionnaire containing written questions that must be answered by correspondents which are distributed through the Google Form platform. Each variable will be represented by several indicators and measured using a Likert Scale to measure the attitudes, opinions, and perceptions of respondents about social phenomena that have been determined as variables in this study.

The data analysis will be analyzed by using a method which is also known as path analysis which can be used for the preparation of hypotheses related to the relationship between the variables tested as well as testing the casual model by using a system of linear equations [21]. partial least square structural equation modeling (SEM PLS) was used to analyze, besides that the Smart PLS 3 device was used for statistical hypothesis testing.

3.3 Operation of Variables

According to [22], Operationalization in a variable is an attribute, value on an object, or activity with certain variations that are built by researchers to be studied and drawn conclusions from it. The purpose of the operationalization of variables is to determine the indicators that will be used to measure the variables in the study. In addition, the operationalization of variables is useful for providing instructions on the scale used for each variable, which can help determine the appropriate measurement tool to be used in measuring hypothesis testing.

The following table 1 is the operationalization of variables:

Table 1: Operation of Variables

Operation of Variables		
Variable	**Main indicator**	**Source**
Technology	*1.Relative*	[8]

Operation of Variables		
Variable	**Main indicator**	**Source**
Context (X1)	*Advantage* *2. Compatibility* *3. Complexity* *4. Cost Benefit*	
Organization Context (X2)	*1. Organization Competency* *2. Top Management Support* *3. Training and Education*	[23]
Environment Context (X3)	*1. Competitive Pressure* *2. Trading Partner Support* *3. Government Intervention*	[8]
Audit Firm Size (Z)	*1. Big four* *2. Non-big four*	[24]
Auditor Adoption of Machine Learning (Y)	*1. Intend to Use* *2. Frequency of Use* *3. Advance Application*	[25]

4. RESEARCH RESULT

4.1 Identity of Respondent

Research object used in our quantitative model were financial auditors worked in public accounting firms, either big four and non-big four. On table 2, we present the details of our respondent identity.

Table 2: Research Respondent Details

	Gender		Firm Size
Male	66	Big Four	52
Female	54	Non-Big Four	50
	Position		Experience
Junior	44	1 – 5 years	40
Senior	51	6 – 10 years	53
Manager	16	11 – 15 years	12
Partner	9	> 15 years	15

Table 2 shows which data can be drawn from which conclusions can be drawn which in the research conducted by correspondents the most are men who are senior auditors who work in general audit offices which are included in the big four which are almost the same as non-big four with work experience ranged from 6-10 years.

4.2 Discriminant and Convergent Validity Test

In order to determine the ability of the research instruments used in measuring what should be measured, it is necessary to conduct a validity test. The discriminant validity carried out is related to the built principle that with different construction sizes being built does not require a high correlation to it. The existence of discriminant validity is used if the occurrence of two different measurement instruments used in measuring the predicted construct has no correlation resulting in differences in the score results. the measurement is carried out using the outer model test (external relationship or measurement model) which can provide a definition of the performance of the indicator block in accordance with its latent variables.
passing on the discriminant validity test, namely if the value on the loading outer is greater than the number 0.5. As shown by table 5 which describes that the indicators contained in the study can represent constructs or variables because the value on the outer loading is above 0.5.

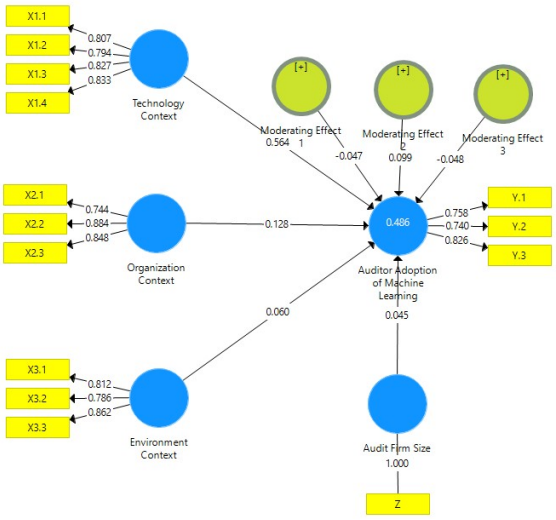

Figure 2: Outer Loading Value

The correlation contained in the indicator score with the variable score can be used as a reference in convergent validity in the measurement model. the validity of the existing indicators is determined by the value shown in the Average Variance Extracted (AVE), which must be above 0.5, thus the

measurement can meet the criteria for convergent validity. It can be seen in table 3, that based on the convergent validity test carried out, the research variables used have passed the test with an AVE number above 0.5. The variables of moderation and size of audit firm Z were not validated because they were categorized as binomial dummy variables.

Table 3: Convergent Validity

Variable	Average Variance Extracted (AVE)
X1 – Technology Context	0.665
X2 – Organization Context X2	0.685
X3 – Environment Context X3	0.673
Y-Auditor Adoption of Machine Learning	0.601

4.3 Cronbach's Alpha and Composite Reliability Test

Reliability is a measurement consistency of indicators or instruments in measuring a variable/construct. It can also use to measure the consistency of respondents when they are answering each question in the research questionnaire. Measurement reliability can be determined if the value obtained is higher than the number 0.7 in its Cronbach alpha and composite reliability. The indicators' reliability that usually appears in research model measured by the Cronbach's alpha and its composite reliability.

As shown on the table 4, the variables used by researcher in this study can be concluded have met with the conditions of the reliability test, which the Cronbach's Alpha and its composite reliability higher than the number 0.7.

TABLE 4: CONVERGENT VALIDITY

Variable	Cronbach's Alpha	Composite Reliability
Technology Context (X1)	0.766	0.802
Organization Context (X2)	0.803	0.809
Environment Context (X3)	0.871	0.826
Auditor Adoption of Machine Learning (Y)	0.868	0.859

4.4 Determination of Coefficient

The implementation of the coefficient test carried out aims to find out the scale of the influence of the independent variables in research on the dependent variables. In our research we used R-Square Adjusted (R^2 Adjusted). R^2 adjusted is more often used than R2 for research cases that use more than one independent variable or exogenous construct. R Square (R^2) adjusted can also show the strengths of a research model. On table 5 it can be interpreted that our model has R^2 adjusted value of According to [26] the value of R-Square (R^2) of 0.648 classified as has a strong model.

Table 5: Determination of Coefficient

Variable	R Square	R Square Adjusted
Auditor Adoption of Machine Learning (Y)	0.686	0.648

Table 5 shows that the R^2 adjusted value of Auditor Adoption of Technology is 0.648, it means that technology context, organization context and environment context give as much 64.8 percent for the explanation for auditor adoption of technology, while the rest, 35.2 percent explained by the others variables.

4.5 Hypothesis Test

In hypothesis test and path analysis, hypothesis alternative can't be rejected when the sig value is < 0.05 (or the t statistical value > 1.96 if the test is with level of significance 0.05).

Table 6: Hypothesis Test

Variable	Original Sample	T arithmetic	p-value sig.
Technology Context X1 → Auditor Adoption of Machine Learning	0.564	4.653	0.000
Organization Context X2 → Auditor Adoption of Machine Learning	0.156	2.288	0.023
Environment Context	0.660	4.792	0.000

X3 → Auditor Adoption of Machine Learning			
Moderating Effect Z, X1 → Y	0.547	3.326	0.000
Moderating Effect Z, X2 → Y	0.199	3.089	0.005
Moderating Effect Z, X3 → Y	-0.048	1.897	0.058

Hypothesis 1, the technical context has a significant influence on the auditor's use of technology. As shown in the table 6 which the value significantly in the number of 0.000 is less than the number 0.05, and the t value of 4.653 is greater than that of t table, 1.96. The direct impact of technical context on the use of machine learning by auditors is 0.564. This result is consistent with previous studies [27], [28]

Hypothesis 2, the organizational context owns its prominent impact for the adoption for the technology by the auditor. As shown in the table 6 which the value significantly in the number of 0.023 is less than the number 0.05, and the t value of 2.288 is greater than that of t table, 1.96. The direct impact of organizational context on the use of machine learning by auditors is 0.156. This result is consistent with previous studies [29], [30]

Hypothesis 3, the environmental context owns its prominent impact for the adoption for the technology by the auditor. As shown in the table 6 which the value significantly in the number of 0.000 is less than the number 0.05, and the t value of 4.288 is greater than that of t table, 1.96. The direct impact of environmental context on the use of machine learning by auditors is 0.660. This result is consistent with previous studies [31], [32].

Hypothesis 4a, the size of the audit company can mitigate the impact of technical context on auditors' adoption of machine learning. As shown in the table 6 which the value significantly in the number of 0.000 is less than the number 0.05, and the t value of 3.326. This result is consistent with the valuable research of [33]. Hypothesis 4b, the size of the audit company can mitigate the impact of the organizational context on the auditor's use of machine learning. According to Table 6, which the value significantly in the number of 0.005 is less than the number 0.05, and the t value of 3.089 is greater than that of t table, 1.96. Our research supports the previous research in [27]. Hypothesis 4c, the size of the audit company cannot mitigate the impact of environmental context on auditors' adoption of machine learning. As shown in the table 6 which the value significantly in the number of 0.058 is less than the number 0.05, and the t value of 1.897 is greater than that of t table, 1.96. This result supports the previous study [34].

5. CONCLUSION AND SUGGESTION

5.1 Conclusion

The research that has been done shows empirical results which are related to the readiness for the application of machine learning by auditors in corporate financial audits. The Grand Theory used in this research is the Technology Organization Environment (TOE) which has also been tested empirically. The results of the existing research provide statistics on the unanimous statements of auditors regarding the technological, organizational and environmental context for the adopted process of machine learning in the audit process. Thus, firm size provides reinforcement in the affect that appears in the context of technology as well as organizational context in the adoption of machine learning in auditing. whereas, audit firms in the big four are common with the larger amount of its budget than firms from the non-big four, therefore, the size of the existing budget can be used to upgrade both hardware and software to provide support for technology adoption. Which is found in the research results, that the context variables of technology, another effect on the adaptation of the machine learning can be sourced from the organization and environment, the partner of the Public Accounting Firm can increase its conditions in the work environment that can provide support for machine learning adoption.

In this era of industry 4.0, the auditor's challenges are also increasing with the existence of big data, cloud computing and all the opportunities and risks that come with it, so auditors need additional tools and skills to face these challenges, and audit technology using machine learning is one of the solutions.

5.2 Suggestion

Suggestions that can be given by researchers that can be used as consideration for researchers and practitioners next are actual testing on machine learning in the process that occurs in audit work, where the research can include the auditors who work for companies or government auditors as its object research. In addition, further research can be in the form of a study on the tier to which systems

in software can assist auditors in a higher quality audit process. Or, a study of variables that have not been tested in research that has been carried out, in such things like the support that gives by the highest management and or the activities that carrying the training.

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REFRENCES:

[1] F. Veerankutty, T. Ramayah, and N. A. Ali, "Information Technology Governance on Audit Technology Performance among Malaysian Public Sector Auditors," *Soc. Sci.*, vol. 7, no. 8, p. 124, 2018, doi: 10.3390/socsci7080124.

[2] S. J. Devitt, W. J. Munro, and K. Nemoto, "High performance quantum computing," *Prog. Informatics*, no. 8, pp. 49–55, 2011, doi: 10.2201/NiiPi.2011.8.6.

[3] B. Xue and T. Liu, "Research on emotional model of sports arena based on artificial intelligence emotion calculation," *Cluster Comput.*, vol. 22, pp. 14927–14933, 2019, doi: 10.1007/s10586-018-2458-7.

[4] K. Rosli, E.-G. Siew, and P. H. P. Yeow, "Technological, Organisational and Environmental Aspects of Audit Technology Acceptance," *Int. J. Bus. Manag.*, vol. 11, no. 5, p. 140, 2016, doi: 10.5539/ijbm.v11n5p140.

[5] L. Tornatzky and M. Fletscher, "The Deployment of Technology," in *The Processes of Technological Innovation*, 1990, pp. 118–147.

[6] M. S. Kamarulzaman and N. H. Hassan, "A Review on Factors for Big Data Adoption towards Industry 4.0," *Open Int. J. Informatics*, vol. 7, no. 2, pp. 200–207, 2019.

[7] M. J. A. Bick, : "Diffusion of Innovations . Everett M. Rogers.," *Am. Anthropol.*, 1963, doi: 10.1525/aa.1963.65.5.02a00230.

[8] K. Rosli, P. H. P. Yeow, and E. G. Siew, "Computer-assisted auditing tools acceptance using I-TOE: A new paradigm," *Proc. - Pacific Asia Conf. Inf. Syst. PACIS 2012*, no. July, 2012.

[9] N. K. Haslinda Hassan,Mohd Herry Mohd Nasir, "Factors Influencing Cloud Computing Adoption in," *J. ICT*, vol. 1, no. 1, pp. 21–41, 2017.

[10] J. O. S. Hunt, D. M. Rosser, and S. P. Rowe, "Using machine learning to predict auditor switches: How the likelihood of switching affects audit quality among non-switching clients," *J. Account. Public Policy*, no. xxxx, p. 106785, 2020, doi: 10.1016/j.jaccpubpol.2020.106785.

[11] D. Ferreño *et al.*, "Prediction of mechanical properties of rail pads under in-service conditions through machine learning algorithms," *Adv. Eng. Softw.*, vol. 151, no. September 2020, 2021, doi: 10.1016/j.advengsoft.2020.102927.

[12] M. Meuldijk, "Impact of digitization on the audit profession," *KPMG AG Audit Comm. News*, vol. 58, pp. 1–3, 2017, [Online]. Available: https://assets.kpmg.com/content/dam/kpmg/ch/pdf/ac-news-8-impact-digitization-en.pdf.

[13] T. T. H. Le and M. D. Tran, "The effect of internal control on asset misappropriation: The case of Vietnam," *Bus. Econ. Horizons*, vol. 14, no. 4, pp. 941–953, 2018, doi: 10.15208/beh.2018.64.

[14] B. Y. Moeliodihardjo, B. W. Soemardi, S. S. Brodjonegoro, and S. Hatakenaka, "University, Industry, and Government Partnership: Its Present and Future Challenges in Indonesia," *Procedia - Soc. Behav. Sci.*, 2012, doi: 10.1016/j.sbspro.2012.09.468.

[15] S. A. Hammad, R. Jusoh, and I. Ghozali, "Decentralization, perceived environmental uncertainty, managerial performance and management accounting system information in Egyptian hospitals," *Int. J. Account. Inf. Manag.*, 2013, doi: 10.1108/IJAIM-02-2012-0005.

[16] J. Nagy, J. Oláh, E. Erdei, D. Máté, and J. Popp, "The role and impact of industry 4.0 and the internet of things on the business strategy of the value chain-the case of hungary," *Sustain.*, vol. 10, no. 10, 2018, doi: 10.3390/su10103491.

[17] J. G. Fernald, E. Hsu, and M. M. Spiegel, "Reprint: Is China fudging its GDP figures? Evidence from trading partner data," *J. Int. Money Financ.*, vol. 114, no. xxxx, p. 102406, 2021, doi: 10.1016/j.jimonfin.2021.102406.

[18] A. Ali Dafine Abazi, A. Ahmed Ali, D. Abazi, S. Ulf Larsson Examiner Andreas Jansson, and T. Umans, "Conformity pressure and auditors' judgement How peers affect one another in audit firms in Sweden? Title Conformity pressure and auditors' judgement How peers affect one another in audit firms in Sweden?," 2018.

[19] R. Widuri, O. Brendan, and Y. Prem, W.S., "Adopting generalized audit software : an Indonesian perspective," *Manag. Audit. J.*, vol. 31, no. 8/9, pp. 821–847, 2016, doi: 10.1108/MAJ-10-2015-1247.

[20] G. Imam, *Aplikasi Analisis Multivariate Dengan Program IBM SPSS 23. Update PLS Regresi. Edisi Delapan.* 2016.

[21] I. Ghozali and L. Hengky, *Concept, Technique and Appliaction to Use Program of Smart PLS 3.0*. 2015.

[22] Sugiyono, *Metode Education Research. Approach Quantitative, Qualitative, and R & D*. Bandung: Alfabeta, 2011.

[23] E. G. Siew, K. Rosli, and P. H. P. Yeow, "Organizational and environmental influences in the adoption of computer-assisted audit tools and techniques (CAATTs) by audit firms in Malaysia," *Int. J. Account. Inf. Syst.*, vol. 36, no. xxxx, p. 100445, 2020, doi: 10.1016/j.accinf.2019.100445.

[24] M. K. Harris and L. T. Williams, "Audit quality indicators: Perspectives from Non-Big Four audit firms and small company audit committees," *Adv. Account.*, vol. 50, p. 100485, 2020, doi: 10.1016/j.adiac.2020.100485.

[25] J. Bierstaker, D. Janvrin, and D. J. Lowe, "What factors influence auditors' use of computer-assisted audit techniques?," *Adv. Account.*, vol. 30, no. 1, pp. 67–74, 2014, doi: 10.1016/j.adiac.2013.12.005.

[26] I. Ghozali, "Moderated Structural Equation Modeling," in *Model persamaan struktural. Konsep dan aplikasi dengan program AMOS 19.0*, 2011.

[27] H. J. Kim, A. Kotb, and M. K. Eldaly, "The use of generalized audit software by Egyptian external auditors: The effect of audit software features," *J. Appl. Account. Res.*, vol. 17, no. 4, pp. 456–478, 2016, doi: 10.1108/JAAR-10-2015-0079.

[28] D. W. Arner, J. Barberis, and R. P. Buckley, "FinTech, regTech, and the reconceptualization of financial regulation," *Northwest. J. Int. Law Bus.*, 2017.

[29] L. Gao and A. G. Brink, "Whistleblowing studies in accounting research: A review of experimental studies on the determinants of whistleblowing," *J. Account. Lit.*, vol. 38, no. May, pp. 1–13, 2017, doi: 10.1016/j.acclit.2017.05.001.

[30] M. Y. Yusof. K, A. Khair A.H., and J. Simon, "Fraudulent Financial Reporting: An Application of Fraud Models to Malaysian Public Listed Companies," *Macrotheme Rev.*, 2015.

[31] R. Widuri, B. L. Handoko, and I. C. Prabowo, "Adoption of Information Technology in Public Accounting Firm," 2019, doi: 10.1145/3335484.3335500.

[32] K. Rosli, P. H. P. Yeow, and S. Eu-Gene, "Adoption of audit technology in audit firms," *Proc. 24th Australas. Conf. Inf. Syst.*, no. December, 2013.

[33] D. Janvrin, J. Bierstaker, and D. J. Lowe, "Accounting Horizons," *Account. Horizons*, vol. 30, no. 4, pp. 525–528, 2016, doi: 10.2308/1558-7975-30.4.525.

[34] D. J. Lowe, J. L. Bierstaker, D. J. Janvrin, and J. G. Jenkins, "Information technology in an audit context: Have the big 4 lost their advantage?," *J. Inf. Syst.*, vol. 32, no. 1, pp. 87–107, 2018, doi: 10.2308/isys-51794.