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Research Article

The impact of artificial intelligence on audit profession

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ABSTRACT

There is an expectation that the introduction of artificial intelligence (AI) will bring about profound changes in the current paradigm of the audit profession, ensuring better reliability and security in the analysis of financial statements. This paper reports the results of a questionnaire survey to ascertain the perceptions of certified auditors, from two Portuguese districts, regarding the impact of artificial intelligence on the audit profession. Findings reveal that the respondents believe that the profession's future depends on the implementation of AI, namely in the efficiency and effectiveness of audit procedures, sampling techniques, cost-benefit relationship and recognizing material distortions.

Keywords: Audit, Artificial Intelligence, profession, Management System, Industry 4.0

INTRODUCTION

The beginning of the 21st century was marked by significant technological progress and, at the same time, by the growth of the world economy and development of the structure and complexity of organizations. In addition, the level of requirement on the part of users of financial statements has also grown, who increasingly seek to know exactly whether they represent the company's financial position and whether they are free from material distortion due to fraud or error. In this context, as some of the audit procedures, in particular manual procedures, are inefficient and ineffective in the current scenario for the fulfilment of the profession's objectives, the need inevitably emerges from integrating auditing in the path of new technologies to develop tools that perform automation of various audit processes.

The audit dates back to ancient civilizations, has since taken on various objectives and undergone several changes to adapt to the economic reality of different times. However, the science of auditing can currently be defined as a continuous and objective process carried out by an independent expert aiming to analyze whether the financial statements are free from material distortion due to fraud or error and if they reliably represent the true image and appropriate company.

Nevertheless, based on the development of the global economy and, consequently, on the growth of multinational companies with decentralized activities and increasingly complex structures and transactions, it becomes very difficult for the auditor to effectively fulfil the objectives of the profession, making it difficult to guarantee reasonable security levels about the veracity of the financial statements. For that reason, at the beginning of the 21st century, with the exponential growth of technology, several work tools began to appear to automate some of the audit procedures. For instance, the concept of continuous Assurance in audit is defined by Vasarhelyi et al. (2010), as the application of modern information technologies to the standard audit products, be they the mandated annual audit opinion or internal IT audit. According to these authors, (Vasarhelyi et al., 2010:27), "in the early days of Continuous Auditing, the ultimate ideal was the eventual development of the — push button audit‖, in which auditing functions somewhat analogously to the way in which virus protection software automatically protects a

PC today with little intervention from the user". This conduct us to the big question, pointed out by GCMA (2019:8) as the main debate across organizations from all sectors and industries is this: "will the technology lead to augmented human intelligence, or will it lead to the rise of autonomous intelligence and machine automation?".

According to Sherif & Mohsin (2021), the application of AI in financial and accounting field harks back to the 1980s, focused on report analysis, fraud detection, and prediction. AI is used in automating traditional working processes, and it also allowed accounting and audit companies to extend their products and services. Its current applications in audit and accounting are well documented (Omoteso, 2012; Moudud-Ul-Huq, 2014; Kokina & Davenport, 2017; Zemánková, 2019; Zhang et al, 2020; Zhang, et a.l., 2022). However, concerning the impact of AI on the future of the audit profession, the literature in not clear. This study aims to assess the impacts related to the application of AI in this domain. It reports the results of a questionnaire survey to ascertain the perceptions of certified auditors, from too Portuguese's districts, regarding the impact of artificial intelligence on audit profession.

In the next session, presents the literature review on the topic. The paper continuous with an explanation of methodologic procedures. In session 4 the results are presented and discussed, followed by the final consideration in session 5.

LITERATURE REVIEW

AI is an increasingly present theme in our daily lives, as the automation of professional and social processes arises at a unique pace, contributing to significant changes in the social and professional paradigm of human beings. However, although AI has assumed greater magnitude in the last years, its origin is distant in time. As mentioned by Gabriel (2018), the existence of clastic men and artificial beings dates back to Ancient Greece.

Besides that, for Rossi (2019), nowadays AI is defined as a scientific discipline, intended to the construction of systems capable of performing diversified tasks that integrate human intelligence to fulfill its objectives. Oliveira (2019) states that artificial intelligence concentrates a special difficulty in characterizing and reproducing, as over time, there have been numerous proposals for replicating the cognitive capacity of human beings in a computer. However, he defines that AI consists in the ability of the human being to create languages and manipulate symbols through the creation of systems composed of culture and technology, unique characteristics of the human species. For Mijwel (2015: 5), AI "consists in the development of machines created entirely by artificial means that can exhibit behaviors like human beings without taking advantage of any living organism."

In terms of productivity, according to Szczepański (2019), AI is a tool with the ability to leverage economic and productivity growth, as the development of more efficient production processes can result in the creation of new products and services, contributing to an increase consumption and, at the same time, additional revenue channels.

Gillham, Rimmington, Dance, Verwij, Rao, Barnard & Paich (2018) estimate that by 2030, AI will be responsible for global GDP growth of around 14%, equivalent to 15.7 trillion dollars, resulting from the increase in production and continuous production, the quality of manufactured products (lesser quantities of defective products), the efficiency and effectiveness of production time and product customization.

In terms of the employment market, Szczepański (2019) argues that the implementation of AI in the economy will contribute to job creation, but also to its destruction. Job creation will be the result of the emergence of new business areas, resulting from the implementation of AI in the economy, while its destruction will be based on the replacement of labor by mechanized processes, more efficient, more innovative, and above all, profitable for their organizations. In this sense, Verma (2018) states that all technological revolutions have corresponding costs and collateral damage, however, policies are needed that feed the growth and potential of AI, but that simultaneously take into account the possible risks that this issue involves.

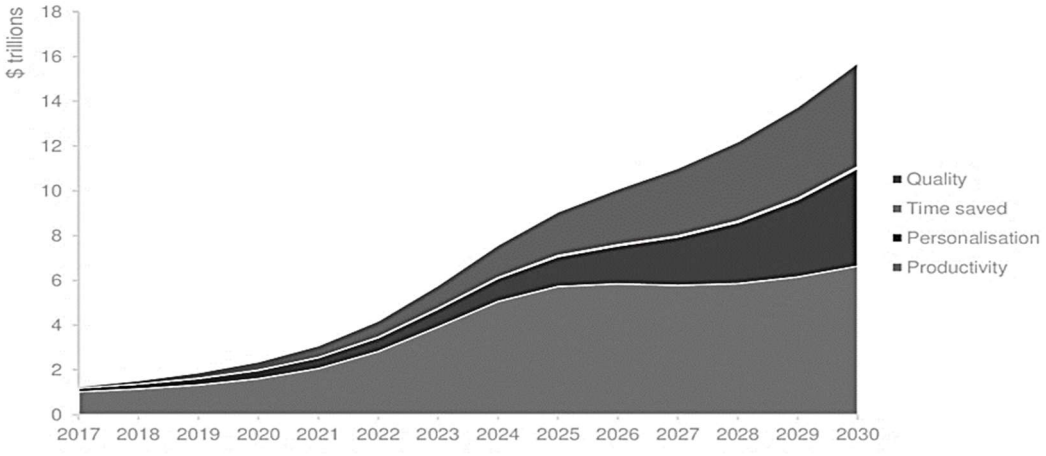

Figure 1. Impact of AI on GDP
Source: Adapted from Gillham, Rimmington, Dance, Verwij, Rao, Barnard & Paich (2018: 6).

There is no doubt that AI support accountants and auditors in their main function of provide, and critical analyze economic and financial information (Gulin et al., 2019). In that sense, it is expected that, accountants and auditors perceive AI as a partner which augments their intelligence with the ability to exploit complex, voluminous, and volatile data (Sherif & Mohsin, 2021). Nevertheless, the concern that AI will limit accounts actions and reduce their role and their power in organizations still exist (Faraj et al., 2018; Beerbaum & Puaschunder, 2019).

According to (Teck-Heng & Ali, 2008), the roots of auditing date back to ancient civilizations where the term "audit", originating from the Latin word "audire", meant to listen. In this period, according to Brown (1962), it was common to hear the accounting of the patrimony registered by the scribes, in order to prevent possible fraudulent acts against the kingdom's patrimony.

However, nowadays according to Duarte (2010: 9), auditing as we know it today can be defined as "a service that is characterized by the expression of an objective opinion on the financial statements of an entity, referring to a set of standards that have the nature of public interest and that contribute to increasing the credibility of financial information". Although, with the growth of the world economy, development of the structure and complexity of companies and the growing need to transmit real and true information to the various users of financial statements, it is expected that with the introduction of AI in the profession these changes will continue.

For this reason, Byrnes et al. (2018) refer that auditing is going through a critical situation, resulting from the progress of information technologies (IT) as well as the adoption of new management models. Dalal (2015) argues that the significant increase in the world population, as well as the complexity and nature of economic transactions, will contribute to auditors becoming increasingly dependent on software, making the execution of manual audit procedures an increasingly unusual approach and inefficient in most organizations. Nunes, Leite, & Pedrosa (2020) have the same understanding, who state that with the growing difficulty in obtaining information or conclusions about the financial and non-financial performance of the audited entity, it will be essential to introduce tools with cognitive abilities in order to minimize the risk of material misstatement and ensure the value and credibility of the audited financial statements. For (Kokina & Davenport 2017), the introduction of AI in the audit profession will be an increasingly recurrent fact, as only in this way will auditors be able to analyze large sets of data and, consequently, ensure the reliability and veracity of financial statements.

It is concluded that it is generally assumed that the development of technology as well as of organizations will make it difficult to carry out manual auditing tasks and, therefore, will be inevitably lead to the adoption of tools endowed with cognitive abilities in order to assist auditors. Thus, in the following points, it is intended to identify how these tools can be used in the different stages of auditing, identify the possible impacts of their use, and finally, compare the traditional audit approach with the approach supported by tools with cognitive capabilities.

AI is not yet dominant in the auditing profession, but there are several authors who present some of the possible consequences related to its use. For Agnew (2016), the application of AI in the area of auditing will not lead to the replacement or extinction of the profession, however, it will give rise to profound changes to the current approach, allowing auditors to better manage time in low-value tasks and greater emphasis on the areas that present the greatest risk of material distortion. Byrnes et al., (2018), defends that some of these consequences are based on the automation of audit tasks and on the possibility of fully analyzing an organization's datasets. This translates into the uselessness of sampling techniques, which, according to the same author, are characterized as more extensive and less efficient compared to examining entire populations of data.

Furthermore, an American Institute of Certified Public Accountants (AICPA) study indicates that the use of AI can mitigate the risk of human fatigue in the repetitive analysis of an organization's data. Simultaneously, recognizes that these tools may present the ability to analyze huge volumes of data and recognize patterns, relationships and distortions that are not always evident to auditors, but that require their knowledge and professional experience to assess that the results are true and materially relevant to the overall audit context (AICPA, 2020).

Given the above, Nunes et. al, (2020: 3) conclude that when auditors "allocate more resources to more complex areas, or investigate items that are potential anomalies, obtaining more scope for functions with a greater critical sense and professional judgment". Issa, Sun, & Vasarhelyi (2016) states that the auditing profession can guarantee higher levels of quality, efficiency and effectiveness in obtaining results and a better cost-benefit ratio. For Ghanoum & Alaba (2020), it is possible that technological evolution will convert the auditing profession into a more proactive rather than a reactive perspective. Citing (Brennan et al., 2017), it is plausible that the profession will take a continuous and real-time approach, something contrary to what is currently seen, where the highest incidence of work occurs after the accounting close of organizations.

Thus, the issue of an opinion about the financial statements by the auditor should become more opportune in relation to the client's accounting closing (Issa et al., 2016). At the same time, it is likely that the profession will have a lower level of human interaction, that some audit procedures will become obsolete and that the existence of fraudulent activities and/or materially material misstatements will be significantly less. In the study of (AICPA, 2020), it is also mentioned that it is possible that the expectations of users of the financial statements can be increasingly higher in relation to the conclusions of the audit and, therefore, translate into a higher audit expectation gap. Even so, Agnew (2016) states that despite technological developments in this field, the profession's regulators should develop mechanisms that ensure correct data extraction and analysis by auditors, in order to allow them to obtain reasonable security regarding the true view of financial position based on financial statements.

Table 1. Traditional Audit Approach VS Audit Approach supported by AI Systems
Fonte: Adaptado de Issa, H., Sun, T., & Vasarhelyi, M. A. (2016).

Phase	Assisted approach to AI systems	Traditional Audit Approach
Planning	Analysis of large amounts of data related to the company's organizational structure and its accounting and financial system.	The auditor collects and analyzes information related to the company's organizational structure and its accounting and financial system.
Contract	Following the previous phase, the level of risk is estimated, as well as the estimate of hours needed to work.	A commitment letter is prepared by the auditor, based on the estimated audit risk.
Identification of risk factors	Pattern detection and analysis to identify risk factors.	The auditor aggregates the information and uses his professional judgment to identify risk factors.
Control risk assessment	Monitoring of controls continuously.	Review of customer's CI policies and procedures. Test the controls.
Substantive Tests	Conducting detailed tests continuously and on 100% of the population, performed on the company's financial position (balance sheet). Several economic years can be analyzed. Continuous pattern recognition.	Details tests are carried out by sampling, where their nature, extent and timing depend on the IC tests. They are run only over one economic year. Analytical procedures are performed.
Evidence Assessment	This phase is integrated into the previous phase.	The auditor assesses the sufficiency and clarity of the evidence gathered with a view to obtaining reasonable assurance of the entity's financial position.
Audit report	The audit report can be continuous rather than categorized (clean, qualified, adverse)	Based on the information collected in the previous phase, a clean, qualified or adverse opinion is issued.

As mentioned in the previous point, the introduction of AI in the audit profession will bring several changes in the current approach ensuring significant improvements in the qualitative and quantitative panorama of the auditing profession. In this sense, **Table 1** (Supported AI approach vs. traditional audit approach) presents the comparison of the use of an assisted audit approach of AI systems with the traditional audit approach.

Concerning the planning, contracting and risk identification phases, although the two approaches have the same purpose, it is concluded that the use of an AI assisted approach allows the collection and analysis of data that make it possible to estimate the risk of auditing, estimate the hours of work required and identify patterns that allow for the recognition of risk factors that the auditor should take into account.

In the phases of substantive testing and evaluation of evidence, in the audit approach through AI, the possibility of performing tests continuously and on 100% of the population is highlighted, while in the traditional approach, tests are performed by sampling and in function of the trust established in the internal control.

Finally, although the conclusion of the audit is carried out in the same way for both approaches, the possibility is highlighted that, through the use of tools endowed with cognitive abilities, one can benefit from the possibility of issuing an opinion with a more opportune date in relation to the account closing of customers.

METHODOLOGY

In order to continue the discussion of the subject of study, an empirical study was carried out in order to assess the consequences resulting from the use of these tools. To achieve the objectives defined in this work, the qualitative method was used through a survey in the form of a questionnaire, whose target audience includes statutory auditors limited to the auditing area of the Porto and Braga regions. This methodology seemed more sensible and adequate, to allowing easy comparability of data and being able to carry out quantitative analyses, it presents greater simplicity to treat the data statistically. Thus, the questionnaires were carried out with respect to the Likert scale measured at five points.

For the constitution of the sample, were inquired auditors registered in the Ordem dos Revisores Oficiais de Contas (OROC) and in the Comissão do Mercado e dos Valores Mobiliários (CMVM) whose professional activity is exercised in Portugal, headquartered in the regions of Braga and Porto. The population of this study is constituted of 37 statutory auditors (OROC) from a universe of 60 distributed by 31 auditing societies, having obtained a response rate of 61.67%.

RESULTS AND DISCUSS

In this point, the answers of the auditors to the questionnaire referring to artificial intelligence in the field of auditing will be analysed. Through the use coefficients of correlation, which aim to measure the relationship between variables and what they represent, the relationship of the responses obtained with the respondents' gender, age and years of experience will be analyzed. For this purpose, the Pearson Coefficient was used, which supports results between -1 and 1, and if the result is closer to -1, the greater the negative correlation between variables, whereas if it is closer to 1, the higher the positive correlation between variables. If the correlation coefficient approaches 1, there is a positive relationship between variables, that is, if one variable increases, the other increases as well. On the other hand, if the correlation coefficient approaches is -1, there is a negative or inverse relationship between variables, that is, when the value of one variable increases, the other decreases. It should be noted that since the gender variable is a nominal variable, i.e., a variable where respondents can only assume male or female gender, values of “1” for males and “2” for females were defined.

1. *Do you consider that the future of the auditing profession will entail the implementation of artificial intelligence.*

	Gender	*Q1*
Gender	1	,138
Q1	,138	1
Significance Level		,416
N	37	

	Age	*Q1*
Age	1	,090
Q1	,090	1
Significance Level		,598
N	37	

	Experiencie	*Q1*
Experiencie	1	,023
Q1	,023	1
Significance Level		,892
N	37	

2. *Artificial intelligence will reduce audit risk*

	Gender	*Q1*
Gender	1	-,120
Q1	-,120	1
Significance Level		,481
N	37	

	Age	*Q1*
Age	1	,034
Q1	,034	1
Significance Level		,481
N	37	

	Experiencie	*Q1*
Experiencie	1	,128
Q1	,128	1
Significance Level		,451
N	37	

3. *Artificial intelligence will allow auditors to gauge the veracity of financial statements more effectively and efficiently.*

	Gender	*Q3*
Gender	1	-,122
Q3	-,122	1
Significance Level		,471
N	37	

	Age	*Q3*
Age	1	,051
Q3	,051	1
Significance Level		,764
N	37	

	Experiencie	*Q3*
Experiencie	1	-,091
Q3	-,091	1
Significance Level		,593
N	37	

4. *Artificial intelligence will allow you to perform an audit on an ongoing basis.*

	Gender	*Q4*
Gender	1	-,004
Q4	-,004	1
Significance Level		,982
N	37	

	Age	*Q4*
Age	1	,020
Q4	,020	1
Significance Level		,908
N	37	

	Experiencie	*Q4*
Experiencie	1	,109
Q4	,109	1
Significance Level		,520
N	37	

In question 1 (“Do you consider that the future of the auditing profession will involve the implementation of artificial intelligence”), we observed that for the variables defined in the questionnaire, the Pearson Coefficient, always assumed a positive value , namely, 0.138 for the gender variable, 0.090 for the age variable and 0.023 for the years of experience variable. In light of the above, although both results were positive, the values are relatively closer to the value 0 than to the value 1, which means that the two variables do not present a perfect negative or perfect positive correlation. In this sense, having registered in this question a percentage of 72.97% for the options "agree" and "strongly agree", it can be concluded that there is agreement by the sample that the future of the auditing profession will depend on AI implementation.

With regard to question 2 (“Artificial intelligence will reduce audit risk”), Pearson's r was -0.120 for the gender variable, 0.034 for the age variable and 0.128 for the years of experience variable. Although the correlation between the gender variable and the answers obtained for this question resulted in a negative Pearson's r, this is closer to 0 than -1. The same happens for the other variables, which despite assuming positive values, the results are closer to the value 0 than to the value 1, thus translating into the inexistence of dependence between variables, that is, that as a variable increases, does not increase on average the respondent's degree of response or, on the other hand, as the variable age increases, the respondent's degree of response does not decrease on average. Thus, although there is general agreement among the respondents, it is not possible to say that the audit risk will be reduced through the AI, since for this question the percentage of 24.32% was recorded for the options "disagree" and “totally disagree”, 35.14% for the option “I neither agree nor disagree” and 40.54% for the “agree” and “totally agree” options.

Regarding question 3 ("Artificial intelligence will allow auditors to assess the veracity of financial statements more effectively and efficiently"), a Pearson's r of -0.122 was obtained for the gender variable, 0.051 for the age variable and -0.091 for the variable years experience. Thus, despite the correlation between the responses obtained and the variables gender and years of experience assuming negative values, the results are

much closer to 0 than to -1. The same happens for the age variable, which, although it assumes a positive value, is closer to 0 than to 1, thus demonstrating the inexistence of a perfect positive or perfect negative correlation.

In this sense, having registered a percentage of 67.57% for the levels "agree" or "agree a lot", we were able to conclude that there is agreement among the respondents for this question.

In question 4 ("Artificial intelligence will allow you to perform a continuous audit"), a Pearson Coefficient of -0.004 for the gender variable, 0.020 for the age variable and 0.109 for the years of experience variable was obtained. Given the results obtained, we can conclude that there is no perfect positive or perfect negative correlation and that the variables do not depend linearly on each other. Nevertheless, although the options "agree" and "strongly agree" reached a percentage of 54.05%, it is important to mention that the option "neither agree nor disagree" registered a percentage of 40.54%. Thus, although a significant part of the sample agrees that AI will allow a continuous audit to be performed, another one abstains from electing a position, certainly, largely because of the uncertainty that currently exists related to the use of these systems, since it still they are not fully introduced to the profession.

FINAL CONSIDERATIONS

It is evident that over the years, technological evolution has generated significant impacts on the social and professional level of human beings. However, through the development of AI, major changes are in prospect in the most diverse areas of human knowledge, especially in the audit profession, where through the evolution of the economy and, consequently, the size of organizations, it becomes increasingly unfeasible the execution of manual procedures. In addition, the demands on the part of the users of the DF are increasing, seeking to know with greater accuracy and reliability the state of the financial position of the audited entity.

It appears that it is generally accepted that the AI will have an impact on the current audit approach and, consequently, will generate repercussions in terms of the efficiency and effectiveness of audit procedures, audit sampling, in the recognition of material misstatements due to fraud or error, as well as in the cost-benefit ratio of the profession. Additionally, auditors recognize that the introduction of these mechanisms into the profession may make it possible to carry out an audit in a continuous approach.

It should be noted that the above conclusions were verified regardless of the age, gender or years of experience of the respondents, that is, throughout this study there was no positive or negative correlation between the responses obtained and the different variables, thus reflecting that professionals audit recognize that new technologies will change the current paradigm of the profession.

Even so, although in some points of this study the results were not as expressive, this result can be justified by the fact that these tools are not yet fully inserted in the profession, and, therefore, there is some reservation about the impact of AI in some dimensions.

Although this study is dedicated to analyzing the impact of AI on the audit profession, in a broad sense AI will contribute to significant impacts at the level of productivity as well as the employment market.

With regard to future research, as there are further developments in the field of AI applied to auditing and, simultaneously, the corresponding application of these mechanisms in the context of the profession, there will be greater visibility of the impacts related to the use of these tools and, therefore , it will be possible to analyze whether there will be repercussions at the level of the employment market, at the level of relations between audit teams and/or between auditor and auditee, as well as at the level of independence of auditors regarding these tools.

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