

NOVA

IMS

Information
Management
School

MGI

Master Degree Program in
Information Management

**A study on the impact of Artificial Intelligence
in the role of the accountant**

The continuous growth of Artificial Intelligence tools in
Accounting

Catarina Alexandra Martins Teixeira

Master Thesis

presented as partial requirement for obtaining the Master Degree in Information Management

NOVA Information Management School
Instituto Superior de Estatística e Gestão de Informação

Universidade Nova de Lisboa

NOVA Information Management School
Instituto Superior de Estatística e Gestão de Informação
Universidade Nova de Lisboa

**A study on the impact of Artificial Intelligence in the role
of the accountant**

The continuous growth of Artificial Intelligence tools in accounting

By

Catarina Alexandra Martins Teixeira

Dissertation submitted as partial fulfillment of requirement for the degree of
Master in Information Management with specialization Knowledge Management
and Business Intelligence.

Dissertation supervised by

Prof. Doutor Vitor Manuel Pereira Duarte dos Santos

November 2023

DECLARATION OF ORIGINALITY

I declare that the work described in this document is my own and not from someone else. All the assistance I have received from other people is duly acknowledged and all the sources (published or not published) are referenced. this work has not been previously evaluated or submitted to nova information management school or elsewhere.

ACKNOWLEDGEMENTS

To overcome the various difficulties faced during the completion of this dissertation, I want to express gratitude to several people.

My boyfriend, David, who always encouraged me to finish my thesis, even in the most difficult and unmotivated moments.

My parents and my sister for their support and encouragement.

My friends for their motivation and incentive.

To my grandfather, who wasn't able to be here through all this journey but was anxious for me to get this done. I want to dedicate this essentially to him.

And finally, to Professor Vitor Santos, for his patience, guidance, motivation and all his availability to me during this period.

ABSTRACT

Artificial Intelligence (AI) has revolutionized the economy and with its constant growth it's necessary an adaptation, not only from organisations but also from professionals. In this context, and as I am currently working in the accounting field, I became interested in delving deeper into this topic and carrying out a study on the role of Artificial Intelligence in accounting and the role of the accountant in the future.

A survey was carried out for this purpose and 240 responses were collected for data collection purposes. After analyzing the results, the conclusions made were that there is a belief that Artificial Intelligence will fulfil a large part of routine tasks, but that the role of the accountant will always be necessary, but more in the area of supervision.

KEYWORDS

Artificial Intelligence; Accounting; Business Intelligence; Business Development; Business Strategy

ACRONYMS

AI - Artificial Intelligence

HTML - HyperText Markup Language

HTTP - Hypertext Transfer Protocol

KPMG - Klynveld Peat Marwick Goerdeler

PWC - PricewaterhouseCoopers

NLP - Natural language processing

RPA - Robotic Process Automation

WWW - World Wide Web

INDEX

1.	Introduction	1
1.1	Objectives.....	2
1.2	Importance And Relevance	3
2	Methodology.....	4
3	Literature Review	6
3.1	Accounting.....	6
3.1.1	Concepts.....	6
3.1.2	History	7
3.1.3	The Role of Technology.....	8
3.1.4	The Accountant	9
3.2	Artificial Intelligence.....	9
3.2.1	Overview	9
3.2.2	Use of AI In Accounting	10
3.2.3	Challenges And Benefits.....	11
3.2.4	Tools And Technologies – Big Four.....	12
4	Study.....	14
4.1	Research Assumptions	14
4.2	Study Execution.....	14
4.3	Characterization Of the Sample	15
4.4	Descriptive Analysis.....	18
4.4.1.	Sectorial Potential for Automation	18
4.4.2.	Most Important Aspect of Artificial Intelligence.....	18
4.4.3.	Most important disadvantage of Artificial Intelligence	19
4.4.4.	The necessity of the Accountant role in 10 years	20
4.4.5.	The impact of Artificial Intelligence in companies	21
4.4.6.	The replacement of the Accounting profession.....	24
4.4.7.	The relationship between Accounting and Artificial Intelligence	25
4.5	Comparing other variables from the survey	25
4.5.1	Comparing the previous question with the profession of the participants.....	26
4.5.2	Comparing the previous question with the participants' age.....	27
4.5.3	Comparing the participants' profession with the belief of accounting being replaced by AI.....	27

4.5.4	Comparing the participants' age with the belief that humans and AI can complement each other.....	28
4.6	Correlational Analysis.....	29
4.6.1	Level of Knowledge of Artificial Intelligence	29
4.6.2	The replacement of the Accounting profession.....	30
4.6.3	The knowledge of Artificial Intelligence.....	31
5	Discussion.....	32
6	Conclusions	34
6.1	Synthesis of the developed work	34
6.2	Limitations.....	35
6.3	Future work.....	35
	References.....	36
	Appendix	38

INDEX OF TABLES

Table 1 – Gender of the participants	15
Table 2 – Age of the participants	15
Table 3 – Occupation of the Participants.....	17
Table 4 – Sectors most likely to automate their functions.	18
Table 5 – Statistics of the most important aspect of Artificial Intelligence.....	19
Table 6 – Statistics of the least to worst disadvantage.....	19
Table 7 - Distribution of the knowledge of AI by Age of the Participants	26
Table 8 - The expectation of the accounting role in 10 years comparing to the participant’s profession.....	26
Table 9 – The expectation of the accounting role in 10 years comparing to the participant’s age.	27
Table 10 – Will accounting be replaced by AI compared to the participant’s age profession. ..	27
Table 11 – Will humans and AI co-exist compared to the participant’s age.	28
Table 12 - Analysis between the belief of Humans and AI complement each other and other variables.	30
Table 13 - The replacement of the Accounting profession.....	31
Table 14 - The level of knowledge of Artificial Intelligence	31

INDEX OF FIGURES

Figure 1 – Methodology used.	4
Figure 2 - Distribution of Age by Gender	16
Figure 3 - Knowledge of Artificial Intelligence	17
Figure 4 - The accounting role in 10 years	20
Figure 5 - AI positively impacts the labor market.	21
Figure 6 - In 10 years, AI will replace the human being in most analytical tasks.....	22
Figure 7 – AI performs more automatic tasks and therefore allows the worker to prioritize different tasks.	22
Figure 8 - The use of AI will allow business to grow, leaving the ones unable to adopt it at a disadvantage.	23
Figure 9 - Artificial Intelligence brings more advantages than disadvantages.	24
Figure 10 - Will the accounting profession be replaced by AI?	24
Figure 11 - Humans and AI can co-exist and complement each other in the work assignments?	25

1. INTRODUCTION

The development of Artificial Intelligence has had an overwhelming pace, becoming an essential tool for all professions worldwide, making it hard to imagine our lives without these solutions (Nnenna Chukwuani & Egiyi, 2020)

Companies are trying to keep up with the fast evolution of Artificial Intelligence, increasing their digital transformation, and connecting business intelligence tools to their business purposes (Mui Kim Chu & Kevin Ow Yong, 2021). The investment in new tools is increasing, especially in the Big Four companies that have departments specifically dedicated to Artificial Intelligence (Yingying et al., 2020)

This evolution of digital technologies caused a dramatic change in the economy, essentially in the organizational structures and business models. Therefore, and consequently, it had a major impact on the activities inherent to this realm, including the accountants, where paper and pencil have been replaced by computers (Das, 2021) and where the information that was once carried by human beings is now being carried by computers. However, the history between Artificial Intelligence and accounting can be traced back 25 years ago, though it was in 2016 that the rapid growth of the application of these systems started (Siau, 2022)

Accounting was considered a very traditional activity and with the contribution of Artificial Intelligence it has become possible to automate and simplify its processes improving work efficiency, reducing work error and improving the competitiveness of the accounting industry (Yoon, 2020). Instead of days being spent analyzing a large amount of data, with the help of Artificial Intelligence the accountant only needs the click of a button to process the information, thus saving time and providing more accurate data.

Although there are many benefits to be had with the usage of Artificial Intelligence, there are also some concerns with it dividing opinions in the business world: many consider it a great addition for every organization as it provides efficiency and accuracy but, on the other hand, many sees it as an expense and a way to contribute to unemployment (Johnson et al., 2021).

According to several studies, the accountant role, in 20-30 years, will be taken over by Artificial Intelligence. Michael Osborne and Carl Frey, two investigators from the University of Oxford, in 2015 made a research that concluded that accountants have a 95% risk of their jobs being replaced by robots and machines (Hasan, 2022). There was also a study carried out by the BBC where out of a total of 366 other professions the accountant profession ranked 21st among the

activities most likely to be eliminated with the development of Artificial Intelligence (Yingying et al., 2020).

Having established the major influence already known of the development of Artificial Intelligence tools, as well as some of its benefits and limitations, there is the necessity to verify its impact in every role and the necessary developments for its correct implementation within the professions, specifically, in accounting.

Although we can recognize the benefits of Artificial Intelligence, they do not replicate human intelligence (Icaew Thought Leadership, 2018)

If the growth of Artificial Intelligence continues to develop at this rhythm, how can the accountant still be relevant in accounting? How can he adapt his skills to this new era of his profession?

Therefore, the Research Questions of this study are the following:

RQ1 – How can the accountant role still be important in accounting while the presence of Artificial Intelligence is increasing in this sector?

RQ2 – How can accountants adapt their skills and techniques to the new era of accounting?

1.1 OBJECTIVES

The objective of this research is to contribute to a better understanding of the future role of the accountant with the ever-growing presence of Artificial Intelligence in accounting and how can their skills adapt to this new era.

With the aim of helping to answer the research questions the following objectives are defined for the current investigation:

- Analyze the evolution of the use of Information Technologies over the years in accounting and its impact;
- Discuss and explore the current Artificial Intelligence tools that are being used in accounting and envision potential developments;
- Understand the limitations of the accountant himself;
- Realize the challenges and opportunities of this new intelligent world in this profession;
- Build and run survey;
- Analyze the results;

- Outline the future role of the accountant in a few years;

1.2 IMPORTANCE AND RELEVANCE

This study intends to explore and analyze the influence and acceptance of Artificial Intelligence in the accounting sector, giving concrete examples of its presence in this activity. Additionally, this study will allow us to comprehend how organizations can adjust the skills of their employees to this technological growth.

It will also explain the history between Artificial Intelligence and accounting and how the accountant has adapted his role to every step of the evolution of his sector.

Additionally, with the development of this research, it will aim not only to help with understanding how efficient and accurate the Business Intelligence tools are but also how they can be complemented with the accountant's skills.

The main goal is to enhance the continuous importance of this relationship between Artificial Intelligence and accounting and how not only the professional adjusts, but also helps companies to evolve without dismissing the importance of the work produced by the accountant, ensuring the teamwork between computers and humans (Icaew Thought Leadership, 2018)

2 METHODOLOGY

The methodology used for this study will be the Quantitative Research Method, which is focused on gathering data through different methods to determine a relationship between variables (K & S, 2014). For this study, the methodology applied will be divided into three phases: exploration, analytical and conclusive as it is illustrated in Figure 1.

In the exploration phase, for a better understanding of the accounting profession and Artificial Intelligence, within the literature review there will be approached some the concepts and background of both areas. This is an important step as a well-conducted literature review must create the foundation of the study, through discovering unknown facts, synthesizing research findings and providing an overview of the research problem.

The analytical phase will focus essentially on the relationship between accounting and Artificial Intelligence nowadays and which techniques and instruments are being applied to this profession. In this stage, a survey will be conducted with the goal of collecting more reliable data among the real contributors of this study: the accountants.

In the conclusive phase the results gathered from the previous part will be analyzed, treated, and presented.

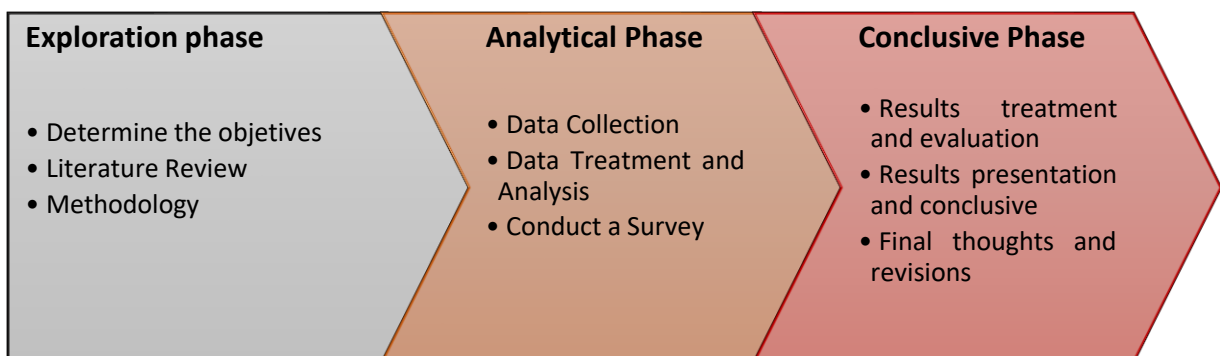


Figure 1 – Methodology used.

Through these phases, these are some of the necessary steps that will be carried out:

- It's necessary to conduct research. This investigation intends to highlight the importance and growth of Artificial Intelligence in the accounting field. For that goal, after the objectives are defined, in the literature review there will be summarized a brief overview of the background and history from both areas, the evolution of the presence of Artificial Intelligence tools in the accounting profession over the years

and in what way, and through what methods, it has influenced this activity. In this step will also be enhanced the challenges and opportunities in the accounting field, as well as an overview through Artificial Intelligence tools;

- Subsequently, it's important to evaluate the role of the accountant whilst looking at what it was in the past and the projection of this profession's future, outlining a strategy where the professional's skills are adjusted to the new intelligent tools used, so that they complement each other;
- Following this analysis, it is necessary to understand the individual himself and what he believes was, is and will be his role. To this end, a survey will be carried out through which it's essential to comprehend which Artificial Intelligence tools are the accountants mostly familiarized with, the main advantages and obstacles in the usage of these tools and what can be expected to be the role of the accountant in the future, from their point of view;
- After collecting the survey's results follows the process of analyzing the data. Once this analysis is concluded, there is a chance to start answering the research questions and state some remarks;
- Finally, it's important to interpret the different visions and state conclusions about the influence of the accountant with the Artificial Intelligence presence and in what ways accounting can be impacted by this tool.

3 LITERATURE REVIEW

As mentioned earlier, the literature review is an extremely important step as it creates the foundation for a well-structured project, recognizing the relevant information and synthesizing it according to the research questions. The construction of the literature review will be divided into two phases: the concepts of accounting and the concepts of Artificial Intelligence.

3.1 ACCOUNTING

3.1.1 CONCEPTS

Accounting can be defined as the activity of reporting, analyzing and recording financial transactions of an organization according to the government rules of the economic practice (Republic of South Africa, 2010)

The main goals of this profession are to measure and determine economic results, control the revenues and expenses of a company, avoid losses or liquidity deficiencies, process information into reports and present those results to the decision makers. In sum, accounting is known as the language of business as it serves the purpose of communicating financial information about a company (Brock, T. & The Investopedia Team, 2022).

There are three types of accounting:

- Financial accounting: its main goal is the preparation of reports and financial statements, focused essentially on the income, expenses and the balance sheet. The main purpose of this activity is to provide the decision-makers the results of the company, in a consolidated form of the organization itself;
- Management accounting: this type of accounting is dedicated fundamentally to planning and control. Its goal is to analyze the difference between the initially planned and the actual performance;
- Cost accounting: it is often associated to the management accounting, however, it's the process of calculating costs, margins and the profitability of the different cost centers and products of the company. This class of accounting is important to determine future decisions like the price of the products, expansion of businesses, etc (Shekhar, 2021).

3.1.2 HISTORY

The history of accounting can be traced to ancient Mesopotamia, in the 13th century, associated with the development of writing, counting, money and trading. According to many scholar sources, writing and accounting grew together (Babington, 2022).

As a consequence of this evolution, resulted the expansion of business and, therefore, accounting methods were slowly being integrated into human being's daily life (Paris, 2016), taking different forms differing on the progress of tools and information that civilizations had at the time.

The history of accounting can be summed up in four stages:

- Emergent (primitive age up to 1494): The necessity for the trading of goods or services was present, however, at this time, there was no accounting system and therefore there was a gradual evolution of the necessity for accounting in the daily life of civilizations due to trading. Each object corresponded to a specific quantity of different forms of products such as food, clothes or even labor. In these situations, the need to keep a record of the goods emerged and currencies started to evolve (Babington, 2022);
- Pre-analytical stage (1495 – 1799): With the rapid evolution of the business and the number of transactions, the concept of debit and credit started to emerge. This stage was important for the evolution of the industry and, because of it, the importance of the currency as a measure, and a system, that recorded transactions with monetary value was created;
- Development i.e. analytical stage (1800-1950): During this period started the need to analyze in order to find solutions for some of the problems that were emerging. The Industrial Revolution was the foundation for some concepts like capital, depreciation, and cost accounting. To increase and accelerate production efficiency, it was developed a standard control system to control the costs. In this stage also began the government regulations of business, where there were implemented some mechanisms of regulation and taxes. The definition of accounting, at this time, was centered essentially as “the art of recording, classifying and summarizing in a significant manner, and in terms of money, transactions”;
- Modern age (1951-onward): From 1951 until today, accounting has been evolving and is going through, what is considered by many, its "modern period". Control and

accounting systems have evolved significantly, as have governmental controls and their rules. During this period the concepts of inflation, crisis, accounting reporting systems and various accounting automation programs were developed (University, 2022). Nowadays, and with this development, accounting is seen not only as a recording and classifying profession, but also as a reporting and controlling tool, allowing the prediction of results, analysis of costs and revenues and a way to present results and avoid setbacks for organizations.

It's important to highlight the role of the government in the accounting evolution as they brought forward the concept of income through the income tax that they applied to companies. Their demands and rules in this sector, forced the accounting process to be formal, efficient and as transparent as it can be (Shekhar, 2021).

3.1.3 THE ROLE OF TECHNOLOGY

The accountant profession was considered traditional and was forced to modernize itself by following modern solutions, and as such the development of technology had a huge impact in the accounting industry and the accounting process.

The beginning of this evolution started in 1985, when Microsoft introduced Microsoft Excel. This tool came to eliminate the need for paper and calculators, allowing accountants to prepare financial statements, reconciliations and cash flow calculations all through the computer. After this, a wave of applications and new programs started to emerge to help perform the most time-consuming tasks.

Considering that the most time-consuming tasks could now be executed with this new wave of software by just clicking on a button, accountants were now able to concentrate effectively on value-added activities that are more rewarding and valuable to companies. Instead of having to input data into a spreadsheet and depend on paper, accountants can optimize their workflow.

For accounting firms, the investment in technology can not only save time but also increase the profit and the staff engagement levels. It can also help decrease the error margin, improve the efficiency of the workflow (Reuters, 2022) and access to real-time financial information. *"Today's accounting industry relies on technology to provide more efficient services to its clients"* (J. Quinto II, 2022)

3.1.4 THE ACCOUNTANT

An accountant is the professional in charge of keeping the records of every transaction updated and to present the financial statements to the managers, such as balance sheets, profits, liabilities and other reports.

The advice of an accountant is very important from a business perspective as he has a viewpoint of every part of the organization. Some of his tasks include:

- Advise on business structure: He can help fill some legally necessary paperwork and inform which additional documentation is needed. He can also discuss previous results from a company and analyze which items can be improved;
- Prepare tax return: every company must do their taxes and the accountant will make sure that they are submitted on time and efficiently;
- Manage and pay invoices from suppliers: invoices must be recorded and paid to the suppliers;
- Handle payroll: the accountant is normally in charge of the organization's payroll, as well as employee expenses;
- Verify and certify the accounts of the company (Solutions Ramsey, 2022).

3.2 ARTIFICIAL INTELLIGENCE

3.2.1 OVERVIEW

The first concept of Artificial Intelligence can be traced back to the 1950s. However, its biggest evolution has been in recent years (Icaew Thought Leadership, 2018).

Artificial Intelligence is a branch of computer science focused on building machines that are capable of performing human tasks (Schroer, 2023) also known as the simulation of human intelligence into technologies. Artificial Intelligence is a unification of various technologies that work together to support systems to learn and execute a combination of related tasks. Currently, Artificial Intelligence is an extension of human abilities, therefore it's important to establish a valuable relationship between humans and automation.

Artificial Intelligence technologies are very powerful and provide outputs in a faster and more efficient way. They can improve quickly however, human intelligence is still needed, and not

replaceable, as we need to recognize the limits and strengths of this evolution and to comprehend in which way artificial and human intelligence can work side by side.

The concepts of automation, machine learning and machine intelligence are often associated and related to Artificial Intelligence, and so Artificial Intelligence can be divided into the following subsets (Keserer, 2022):

- Machine learning: This is the part of AI that allows computers to learn from data and apply that learning without human intervention. Machine learning is already present in multiple industries, such as finance, healthcare and manufacturing, in order to solve complex problems;
- Deep learning: This model is a subset of the Machine Learning model. Deep learning model uses a neural system that can learn how to execute difficult tasks by adapting and training the strength of the connections between the neurons in each layer. This model can be trained to identify patterns in complex data, which may be complicated for humans to detect;
- Robotic Process Automation (RPA): These robots are used to assist humans with complex tasks through the automation of the processes;
- Neural networks: This model was created to imitate the human mind and to learn and make decisions like it. It can also improve the accuracy of predictions made by machine learning algorithms. They are similar to deep learning models as their nodes can be trained to perform a task;
- Natural Language Processing (NLP): This model deals with the manipulation and comprehension of human language, and is used to treat and interpret the text that is inserted into other applications (Keserer, 2022)

3.2.2 USE OF AI IN ACCOUNTING

Accounting is a profession that works with a large amount of data and Artificial Intelligence is a tool that can treat such a large amount of data in seconds. Artificial Intelligence has the capability to gather, organize and interpret information, and therefore allows the accountant to use his time on more valuable tasks (Stancheva-Todorova, 2018).

Artificial Intelligence tools can support accounting activities in innumerable ways. For example:

- Prediction function: Artificial Intelligence tools can perform the forecast of the company performance, predicting the income and revenue by analyzing historical data and identifying patterns amongst the data;
- Extraction: These tools can extract the relevant information and present it in various ways, thus facilitating the analysis of this information. It also supports the preparation of necessary reports and other legal obligations;
- Scanning and keeping the reports: Artificial intelligence allows the information to be compartmented. It can scan and save the invoices, transactions and other purchases or documents necessary in accounting, keeping them available for the auditors to consult them. Using this system, auditors can capture the errors in a more efficiently;
- QR Code: Currently, every document, to be legally accepted, must have a QR code. When reading this code, we have all the information of the invoice and so do the legal authorities. It's a control system implemented by the authorities and, in Portugal's case, a recent acquisition to its accounting structure;
- Reduce fraud: there are many Artificial Intelligence tools connected to cybersecurity and that are being used by organizations to help detect fraudulent activities. Its algorithms can analyze data in a much more efficient and quick manner, identifying anomalies and preventing fraud.

3.2.3 CHALLENGES AND BENEFITS

Several studies have shown that Artificial Intelligence can bring various advantages from using its tools, however they have pointed out many concerns as well.

According to Omoteso (2012) these benefits include, besides the efficiency and effectiveness previously mentioned, the improvement of the consistency of the decision making and thus the growth of efficiency through access to large amounts of data in real-time, the increase of the quality of financial information by accessing more detailed data in real-time, the cost reducing of the company and changes in the accounting profession due to the requirement of knowledge and skills in computer science, data and information flow in the enterprise. Additionally different studies reveal other advantages, more inherent to accounting tasks, as the automation of inserting and processing transactions, the improvement of the budgeting, forecasting and product pricing processes, facilitating the audit of financial statements in real-time through process automation and the growth of employee productivity.

Nevertheless, there are many concerns and disadvantages raised in the use of these tools. The main disadvantages are, essentially, the high investment in Artificial Intelligence tools and its maintenance, employees' resistance to transformation and innovation, cyber security threats and the risk of violating privacy regulations, the lack of employees with the knowledge and necessary skills to use this tools, as well as the lack of motivation from the employees because of the fear of losing their job as a result of progressing automation and the recurrent changes in law and regulations that would involve the updating of the AI systems (Huang, 2018).

3.2.4 TOOLS AND TECHNOLOGIES – BIG FOUR

Because of the advantages and efficiency of applying Artificial Intelligence tools, Big Four Companies have made several investments in this technological innovation, creating projects and teams dedicated essentially to this development, allowing Artificial Intelligence tools to be applied in a more efficient way and guaranteeing its continuous growth (Ucoglu, 2020).

The Big Four companies started to launch their own robots to recognize and analyze data. Below, I will mention some examples of Artificial Intelligence tools for each Big Four:

- **Earnest and Young (EY):** One important tool that is used by EY is drones – they use them to meet the business needs and to assist with the inventory counting and observation. Additionally, they use Machine Reading and NLP technology, for example, when a new regulation emerges instead of having to analyze the pre-existing contracts, NLP extracts information and validates the outcome (Ucoglu, 2020). As well for their safety concerns, EY uses Machine Learning technology to detect fraud (with an accuracy of 97%).
- **Klynveld Peat Marwick Goerdeler (KPMG):** KPMG works in collaboration with Microsoft and it's always trying to develop their skills and technologies to this new era, wanting to adopt a set of Artificial Intelligence abilities using a single platform. One of the Artificial Intelligence tools used by KPMG was created in house and it's a tax analytic program named K-analyzer based on the RPA technology that can assess thousands of transactions in a span of minutes (Yingying et al., 2020)
- **Deloitte:** One example of Artificial Intelligence in Deloitte is their development of an insight-driven organization framework (IDO). IDO can help organizations to achieve their strategic goals by daily providing analysis and data into the decision-making process, improving its quality and speed. They have also developed a platform that can read and automatically identify certain fields in a set of documents.

- **PricewaterhouseCoopers (PWC):** PWC uses RPA technology to analyze business data assisting the preparation and revision of the tax responsibilities and its payments. They also use Halo to analyze accounting journals (Kokina & Davenport, 2017) and created the Cash.ai that automates cash audits which includes, for example, cash balances, bank reconciliations and the bank's financial health (Zemánková, 2019)

4 STUDY

4.1 RESEARCH ASSUMPTIONS

After concluding the literature review, in view of the research questions, it's possible to define the following conclusions:

- How various studies conclude that the accounting profession will be replaced by automatization and machines in a few years;
- There are several benefits to implementing artificial intelligence tools however there are also several worrying downsides;
- Nowadays, there are several artificial intelligences tools implemented in accounting companies;
- Accountants are concerned about the continuous growth of artificial intelligence in the business world;
- Besides the investment that companies must do in these tools, they also have to invest in their employees that will have the necessity to learn how to work with these tools.

4.2 STUDY EXECUTION

Within the scope of this study, a survey was prepared containing 11 questions with the aim of assessing the perception and public opinion regarding the presence of artificial intelligence in the labour market and, with a particular focus, in accounting. This survey was distributed in an academic scenario, with colleagues and professors and its publication date was April 10th with its completion date being on April 25th. The initial proposed sample was at least 200 responses, the final number of responses obtained was 240.

The survey is presented at appendix I.

4.3 CHARACTERIZATION OF THE SAMPLE

The first four questions of the survey were prepared with the objective of characterizing the sample population: the participant's gender, age, occupation, and their level of knowledge of Artificial Intelligence.

Gender and Age

As shown in Table 1, half of the respondents are male, 48% are female and 2% prefer not to say.

	Gender		
	Female	Male	Prefer not to say
Responses	116 (48%)	120 (50%)	4 (2%)

Table 1 – Gender of the participants

In Table 2, we can conclude that almost half of the participants are between the ages of 25 and 33 (41%), followed by the 18 to 24 age group which represents 20% of the sample, with the 34 to 43 age group, and the 44 to 53 age group, representing 16% and 13% respectively. Finally, the 54 to 65 age group (5%) and only one participant was older than 65.

		No of Participants
Age	18 to 24	59
	25 to 33	98
	34 to 43	38
	44 to 53	33
	54 to 65	11
	> 65	1

Table 2 – Age of the participants

Comparison between Age and Gender

Through Figure 1, we can see the distribution between the variable gender with the variable age. Hence, the groups in which a greater discrepancy between gender stands out are the “25 to 33” and “34 to 43”. Also, we can conclude that the only participant with more than 65 years of age was a female.

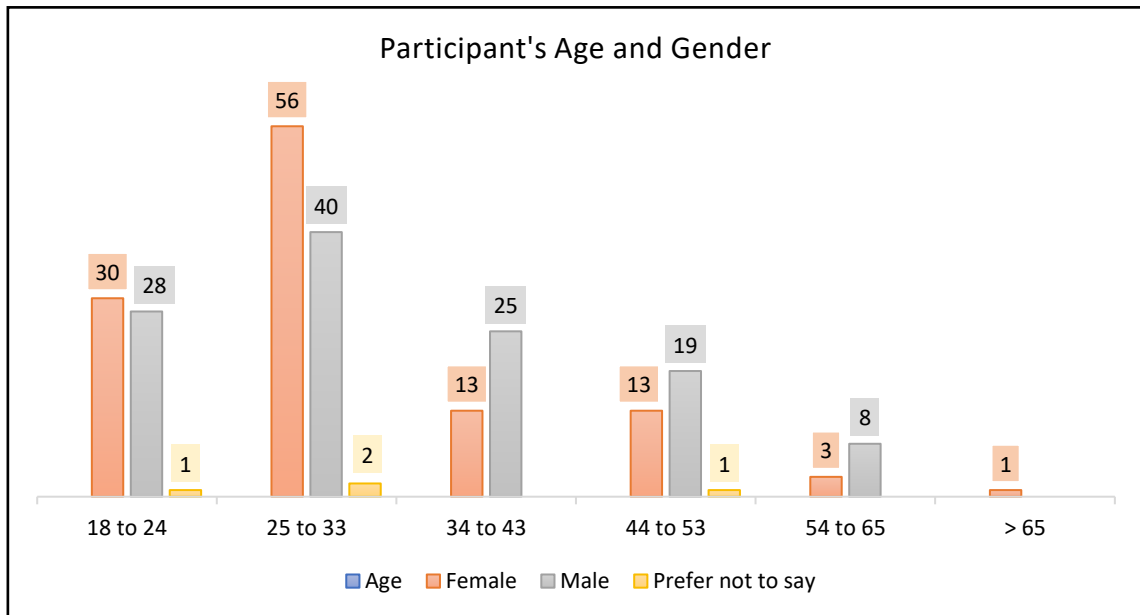


Figure 2 - Distribution of Age by Gender

Occupation

This survey was shared with teachers, students, accounting colleagues and other groups. Therefore, from the options provided to establish the occupation of the participants, according to the table 3, 106 of the participants replied that their profession is in business, finance or insurance, 48 are still studying, 28 of the participants work in education and the remaining are divided into Retail, Hospitality and other areas. From this group, there are also 3 unemployed and 1 retired participant. This information is summarized in Table 3.

What is your profession/occupation?	Number of participants
Work in Finance or Insurance, Business and Other Services	106
Work in Education	28
Work in Health or Social Care	8
Work in Transport, Retail or Wholesale	8
Work in Hospitality, Catering or Leisure Services	6
Unemployed	3
Student	48
Retired	1
Other	32
Total	240

Table 3 – Occupation of the Participants

Level of knowledge of Artificial Intelligence

As shown in Figure 3, more than half of the participants (66%) demonstrated to know some concepts about Artificial Intelligence, 27% (65 participants) mention that they are be comfortable with the subject and only 8 participants consider themselves as Artificial Intelligence experts. Finally, 7 participants admit to not having any knowledge in this area.

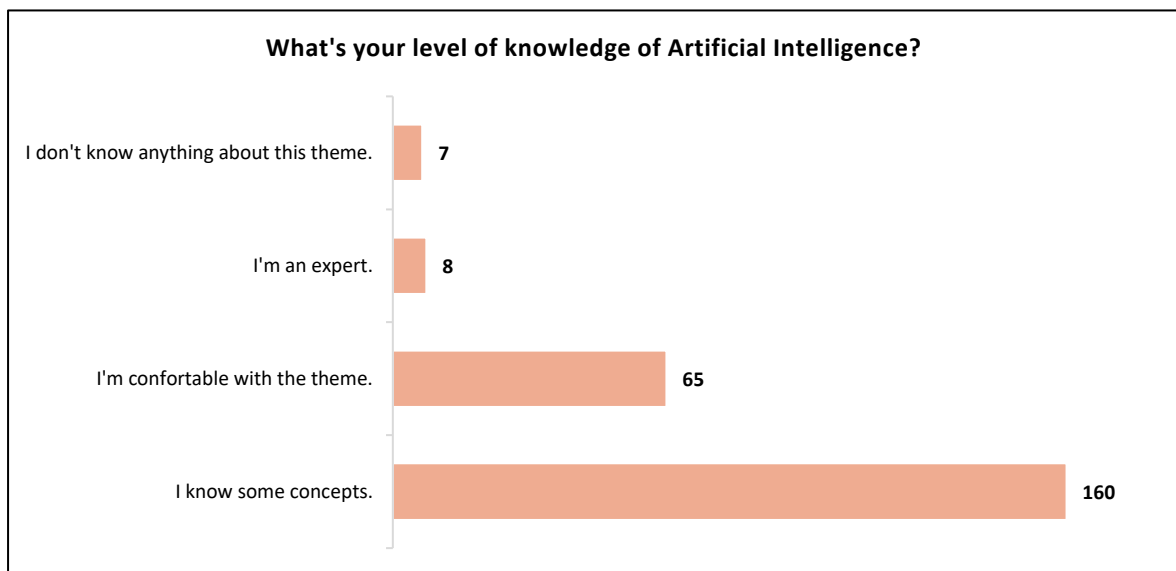


Figure 3 - Knowledge of Artificial Intelligence

4.4 DESCRIPTIVE ANALYSIS

4.4.1. SECTORIAL POTENTIAL FOR AUTOMATION

Survey question:

Which sectors do you consider most likely to automate their functions?

Analysis of the results:

The main sectors that participants believe are most likely to have their functions automated are Finance/Accounting, Insurance, Manufacturing, Science and Retail. The sectors that are least likely to be automated are Human Resources, Health Care and Education. This analysis is present in Table 4.

Sectors	Percentage of participants
Finance/Accounting	26%
Insurance	15%
Manufacturing	14%
Science	12%
Retail	12%
Human Resources	8%
Health Care	7%
Education	2%
Other	4%

Table 4 – Sectors most likely to automate their functions.

4.4.2. MOST IMPORTANT ASPECT OF ARTIFICIAL INTELLIGENCE

Survey question:

Rate from most important aspect of Artificial Intelligence to the least one. Consider 1 as the most important a 5 the least important.

Analysis of the results:

From Table 5, we can conclude that people were divided amongst the 2 most important, "Solve complex problems" and "Automation of the more routine tasks.". These were closely followed by the statements " Analyze data in real time." and " Improvement of decision making and thus

growth of efficiency". On the contrary, it was clear that the least important was the imitation of human behavior.

	N	Min	Max	Average	Standard deviation
Improvement of decision making and thus growth of efficiency.	240	1	5	2,86	1,262
Imitating human behavior.	240	1	5	4,58	1,036
Solve complex problems.	240	1	5	2,42	1,193
Automation of the more routine tasks.	240	1	5	2,42	1,271
Analyze data in real time.	240	1	5	2,73	1,034

Table 5 – Statistics of the most important aspect of Artificial Intelligence.

4.4.3. MOST IMPORTANT DISADVANTAGE OF ARTIFICIAL INTELLIGENCE

Survey question:

From the disadvantages presented below, rate from most to least negative. Consider 1 as the worst disadvantage and 5 the least negative.

Analysis of the results:

The participants had to rate from 1, as the worst, to 5, as the least bad, the disadvantages proposed to them. So, as presented in Table 6, one disadvantage stood out as the worst: privacy concerns. Of the remaining disadvantages none stood out.

	N	Min	Max	Average	Standard deviation
Unemployment.	240	1	5	2,92	1,687
Shortage of employees with knowledge and skills in the field.	240	1	5	3,19	1,266
Privacy concerns.	240	1	5	2,39	1,327
Workers' resistance to change and innovation.	240	1	5	3,29	1,257
Difficulty in explaining the information acquired.	240	1	5	3,21	1,304

Table 6 – Statistics of the least to worst disadvantage

4.4.4. THE NECESSITY OF THE ACCOUNTANT ROLE IN 10 YEARS

Survey question:

Do you believe that the accounting role will still be necessary in 10 years, with the continuous evolution of Artificial Intelligence (AI)?

Analysis of the results:

According to Figure 4, more than half of the participants believe that the role of the accountant will always be necessary, even as artificial intelligence continues to evolve, however, 167 of the participants believe it will be more of a supervisory role. Yet, 16 of the participants believe that Artificial Intelligence will be autonomous enough to perform and supervise all tasks and 20 of the participants, contrary to the previous ones, consider that the development of this area will still take time. Additionally, 7 of the participants do not have an opinion about this topic.

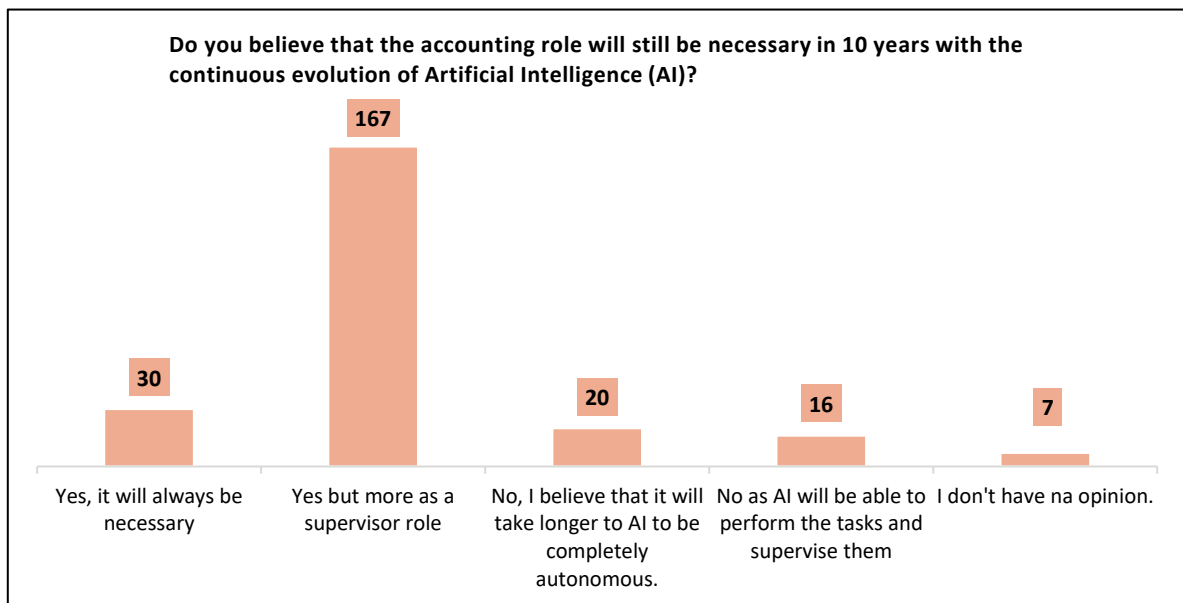


Figure 4 - The accounting role in 10 years

4.4.5. THE IMPACT OF ARTIFICIAL INTELLIGENCE IN COMPANIES

Survey question:

Considering your knowledge of Artificial Intelligence (AI), please rate the following statements:
AI positively impacts the labor market.

Analysis of the results:

As presented in Figure 5, most participants agree and partially agree that Artificial Intelligence contributes positively to the labor market.

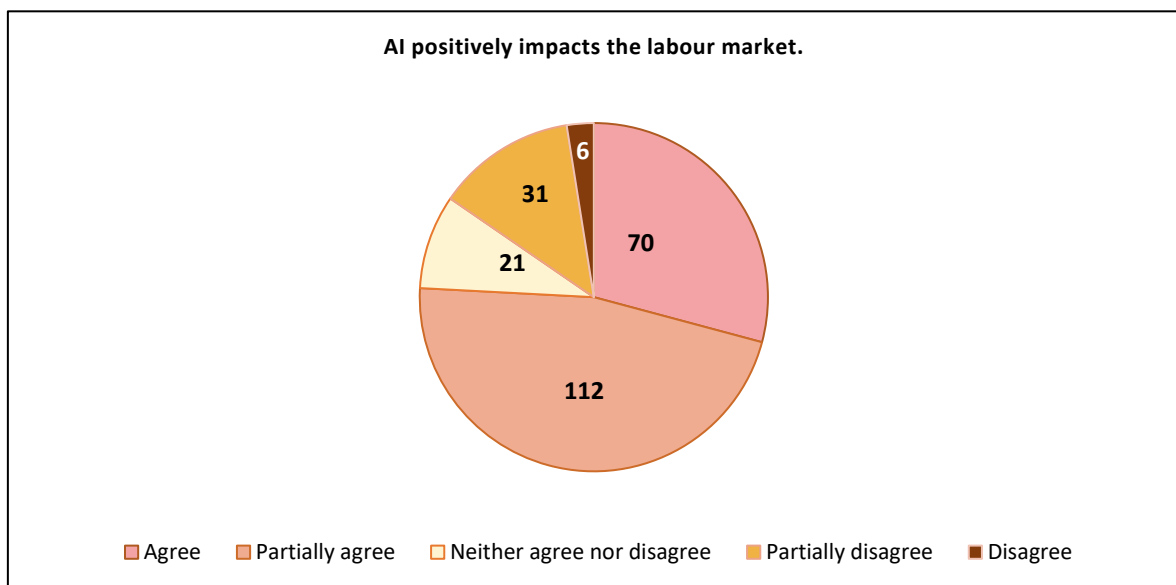


Figure 5 - AI positively impacts the labor market.

Survey question:

Considering your knowledge of Artificial Intelligence (AI), please rate the following statements:
In 10 years, AI will replace the human being in most analytical tasks.

Analysis of the results:

The participants are divided on this statement. As demonstrated in Figure 6, a large portion (40%) only partially agrees, contrasting with a portion of the sample that partially disagrees (24%). Another portion of the participants neither agree nor disagree (15%). Finally, 13% totally agree and 8% totally disagree.

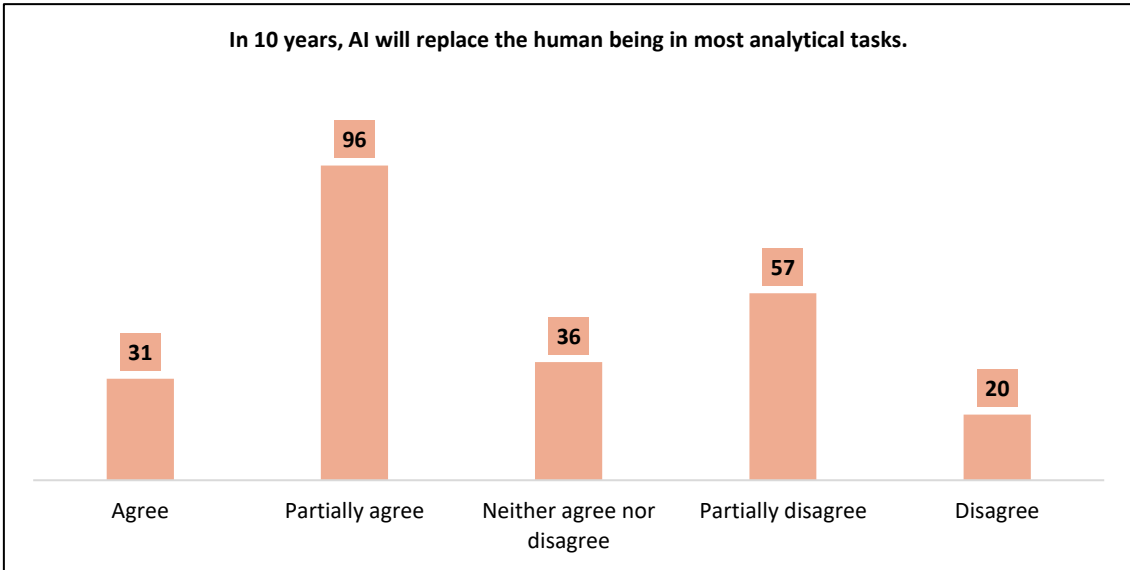


Figure 6 - In 10 years, AI will replace the human being in most analytical tasks.

Survey question:

Considering your knowledge of Artificial Intelligence (AI), please rate the following statements:
AI performs more automatic tasks and therefore allows the worker to prioritize different tasks.

Analysis of the results:

In this statement and as it can be concluded by Figure 7, the positive response is almost unanimous, with 53% of the participants totally agreeing and 38% partially agreeing.

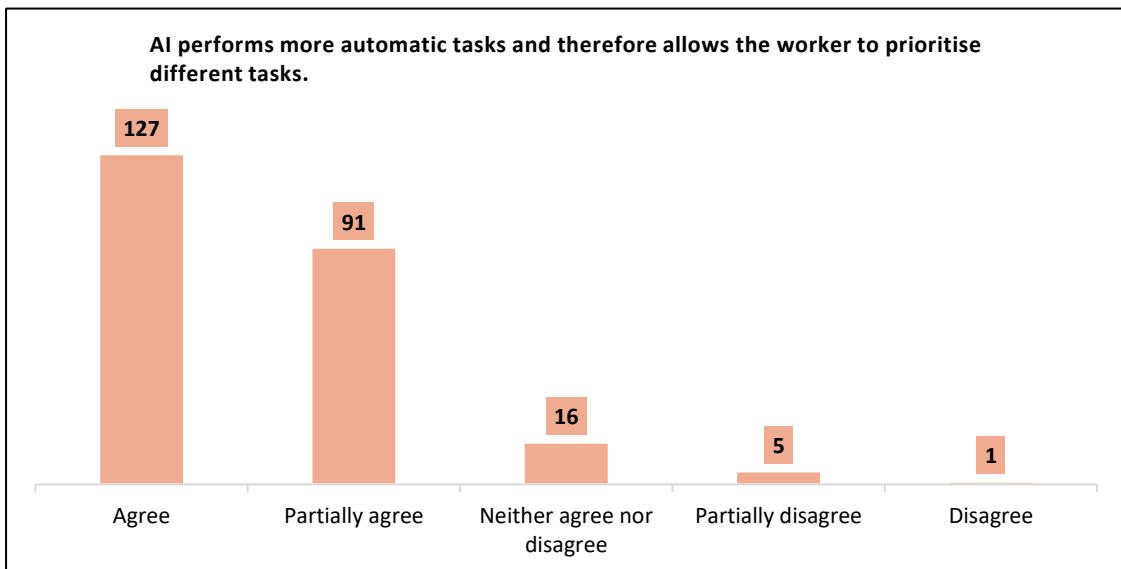


Figure 7 – AI performs more automatic tasks and therefore allows the worker to prioritize different tasks.

Survey question:

Considering your knowledge of Artificial Intelligence (AI), please rate the following statements:
The use of AI will allow business to grow, leaving the ones unable to adopt it at a disadvantage.

Analysis of the results:

In this statement and as shown in Figure 8, once again, the positive response is almost unanimous, with 44% of the participants fully agreeing and 42% partially agreeing.

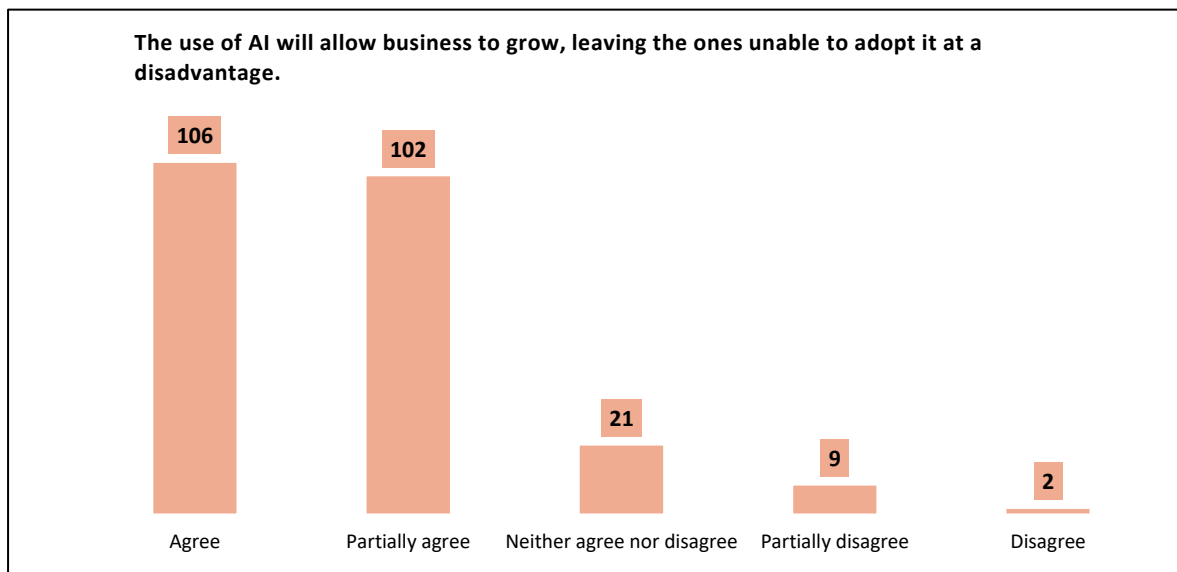


Figure 8 - The use of AI will allow business to grow, leaving the ones unable to adopt it at a disadvantage.

Survey question:

Considering your knowledge of Artificial Intelligence (AI), please rate the following statements:
Artificial Intelligence brings more advantages than disadvantages.

Analysis of the results:

Accordingly, to Figure 9, the participants divide their opinions. Most of them partially agree (35%), but there is a large portion of participants who neither agree nor disagree (28%)

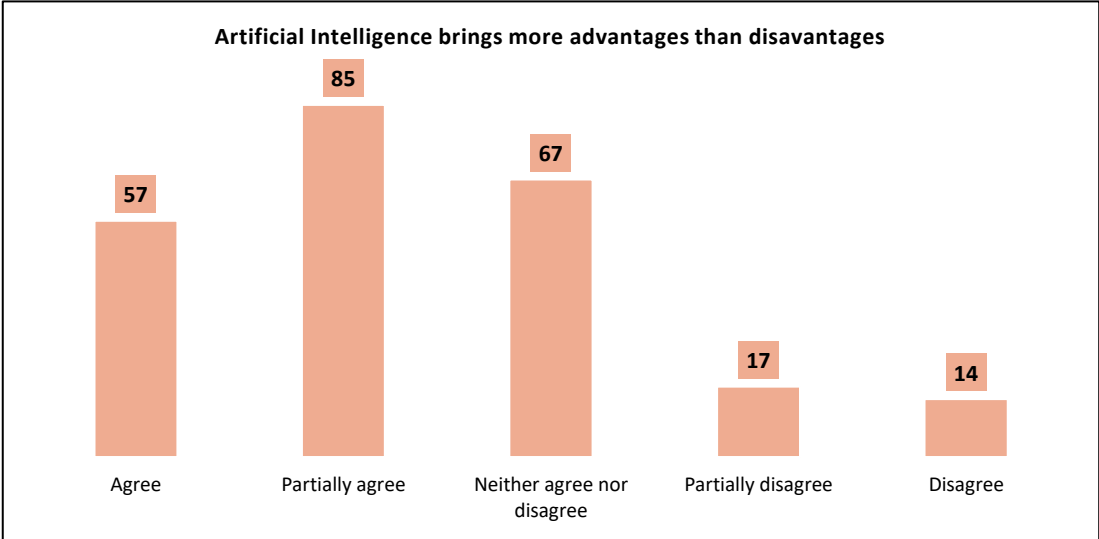


Figure 9 - Artificial Intelligence brings more advantages than disadvantages.

4.4.6. THE REPLACEMENT OF THE ACCOUNTING PROFESSION

Survey question:

According to several studies the accounting profession in 20-30 years will slowly be replaced by Artificial Intelligence. Do you agree with this affirmation?

Analysis of the results:

From Figure 10 it can be concluded that half of the participants believe that Artificial Intelligence will only partially replace the accounting profession, however 39% believe that it will fully be replaced by this technology. On the other hand, 5% doesn't have an opinion and 3% considers that Artificial Intelligence will not replace at all the accounting profession.

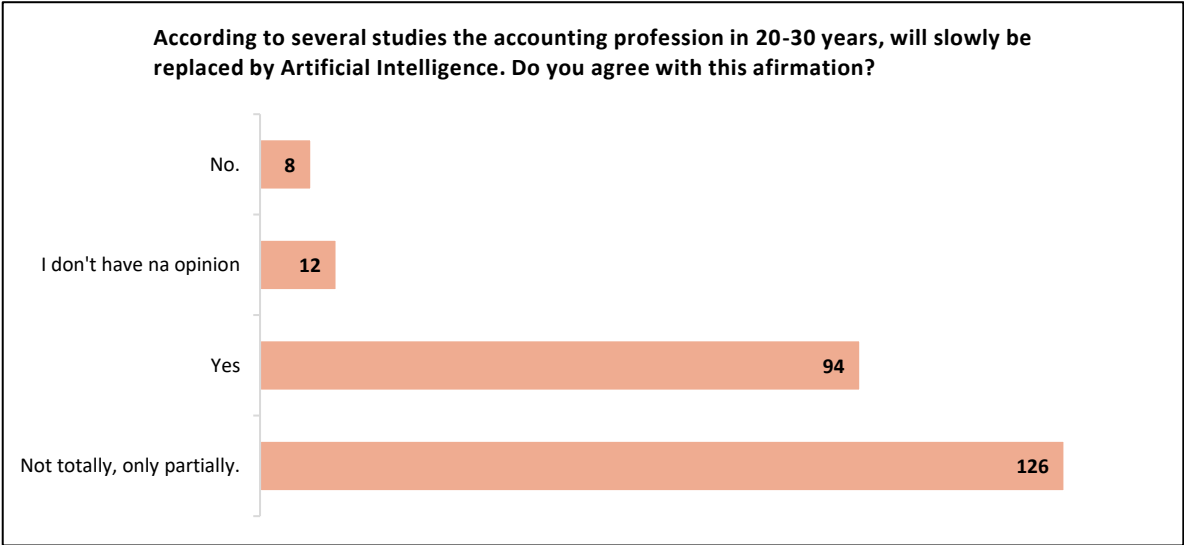


Figure 10 - Will the accounting profession be replaced by AI?

4.4.7. THE RELATIONSHIP BETWEEN ACCOUNTING AND ARTIFICIAL INTELLIGENCE

Survey question:

Do you believe humans and AI can co-exist and complement each other in the work assignments?

Analysis of the results:

The last question was to evaluate the opinion of the participants about the co-existing of AI and humans. This was almost unanimous with 93% responding positively. On the other hand, 2% don't have an opinion and 5% don't believe that both areas can work together. This data is presented in Figure 11.

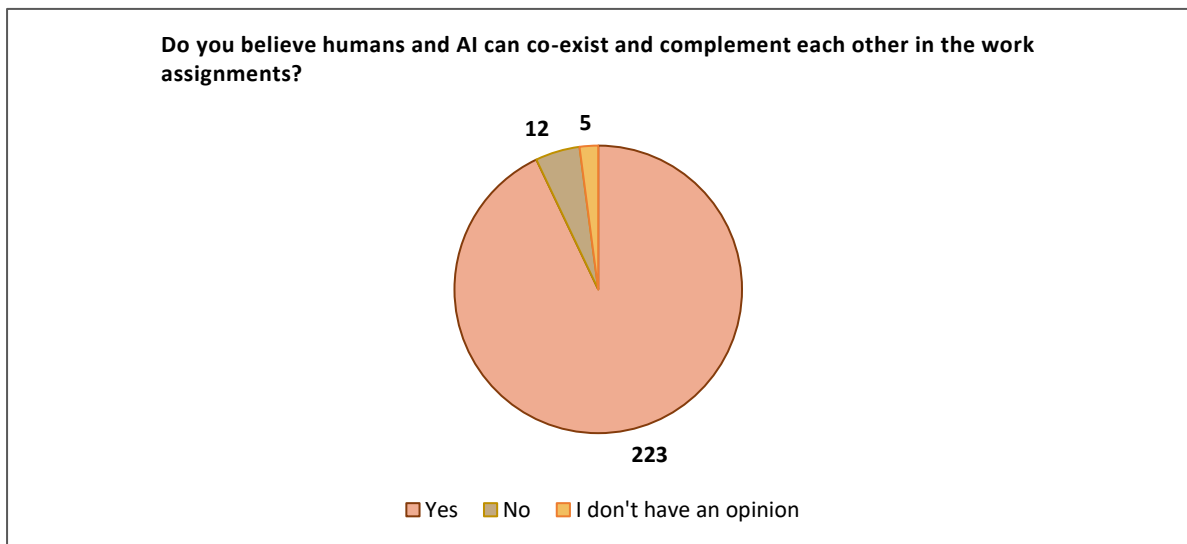


Figure 11 - Humans and AI can co-exist and complement each other in the work assignments?

4.5 COMPARING OTHER VARIABLES FROM THE SURVEY

- a. Comparison between the knowledge of Artificial Intelligence and participants' age

Comparing the knowledge of artificial intelligence with the age of the participants, we can identify that the knowledge of AI's concept is introduced in every generation, however, it's the groups of "18 to 24" and "25 to 33" that are more comfortable with this theme. There are some experts between the participants with a highlight in the group of "34 to 43".

What is your level of Artificial Intelligence?	18 to 24	25 to 33	34 to 43	44 to 53	54 to 55	> 65	Total
I don't know anything about this theme.		5	2				7
I know some concepts.	38	70	22	23	6	1	160
I'm an expert.		2	4	1	1		8
I'm comfortable with this theme.	21	21	10	9	4		65

Table 7 - Distribution of the knowledge of AI by Age of the Participants

4.5.1 COMPARING THE PREVIOUS QUESTION WITH THE PROFESSION OF THE PARTICIPANTS

As demonstrated in Table 8, regardless of the participant's profession, most participants believe that in 10 years' time accountants will only have a supervisory role. The remainder, a smaller sample, of the participants is divided. There are 9 participants that work in business and other services, finance or insurance that believe that AI will take a long time to be completely autonomous, but, on the other hand, 6 participants from this group believe that AI will be able to perform and supervise its activities.

Do you believe that the accounting role will still be necessary in 10 years, with the continuous evolution of AI?	Other	Retired	Student	Unemployed	Work in Finance or Insurance, Business and Other Services	Work in Education	Work in Health or Social Care	Work in Hospitality, Catering or Leisure Services	Work in Transport, Retail or Wholesale	Total
I don't have an opinion.	2				2	3				7
No, as AI will be able to perform the tasks and supervise them.	1		4	1	6	1	2		1	16
No, I believe it will take longer for AI to be completely autonomous.	2	1	4		9	1	1	1	1	20
Yes, it will always be necessary	6		5		12	5	1		1	30
Yes, but more as a supervisor role.	21		35	2	77	18	4	5	5	167

Table 8 - The expectation of the accounting role in 10 years comparing to the participant's profession.

4.5.2 COMPARING THE PREVIOUS QUESTION WITH THE PARTICIPANTS' AGE

We have a different perspective when we compare it with age, as shown in Table 9. In spite of the different age groups from this studies sample, the majority across all of them believes the accountant will always be necessary.

Do you believe that the accounting role will still be necessary in 10 years, with the continuous evolution of AI?	18 to 24	25 to 33	34 to 43	44 to 53	54 to 55	> 65	Total
I don't have an opinion.		3	2		2		7
No, as AI will be able to perform the tasks and supervise them.	4	7	4		1		16
No, I believe it will take longer for AI to be completely autonomous.	4	10	4	1		1	20
Yes, it will always be necessary	4	12	7	6	1		30
Yes, but more as a supervisor role.	47	66	21	26	7		167

Table 9 – The expectation of the accounting role in 10 years comparing to the participant's age.

4.5.3 COMPARING THE PARTICIPANTS' PROFESSION WITH THE BELIEF OF ACCOUNTING BEING REPLACED BY AI.

Every group of participants is divided as we can see in Table 10. The majority believes that only partially will be replaced by AI with a similarly close sample believing that the accountant will be replaced. In the table below it's possible to see this division according to the participant's profession.

Do you believe that the accounting role will still be necessary in 10 years, with the continuous evolution of AI?	Other	Retired	Student	Unemployed	Work in Finance or Insurance, Business and Other Services	Work in Education	Work in Health or Social Care	Work in Hospitality, Catering or Leisure Services	Work in Transport, Retail or Wholesale	Total
I don't have an opinion.	2		2		4	3		1		12
No.			1		5		1		1	8
Not totally, only partially.	18	1	23	1	54	16	4	4	5	126
Yes.	12		22	2	43	9	3	1	2	94

Table 10 – Will accounting be replaced by AI compared to the participant's age profession.

4.5.4 COMPARING THE PARTICIPANTS' AGE WITH THE BELIEF THAT HUMANS AND AI CAN COMPLEMENT EACH OTHER.

As mentioned before, the answer to this question was almost unanimous. Although the great majority believes that humans and AI can co-exist, there is still a small sample in the groups of "18 to 24" and "25 to 33" that either believes humans and AI can't co-exist (10) or don't have an opinion formed (5). We can see this data in Table 11.

Do you believe humans and AI can co-exist and complement each other in work assignments?	18 to 24	25 to 33	34 to 43	44 to 53	54 to 55	> 65	Total
I don't have an opinion.		5					5
No.	5	5	1	1			12
Yes.	54	88	37	32	11	1	223

Table 11 – Will humans and AI co-exist compared to the participant's age.

4.6 CORRELATIONAL ANALYSIS

Correlation measures the scale of association between two variables. This association is crucial in data analysis and methodological research. A substantial increase and decrease between the relation of two variables commonly indicates, respectively, positive and negative values of the correlation coefficients (Chok, 2010).

Although there are several types of measuring correlation, this project will use *Pearson's* correlation.

The correlation's coefficient, usually represented by ρ , only takes values between -1 and 1.

- If there is a positive association, it means that two variables tend to increase or decrease simultaneously.
- If there is a negative correlation, one variable tends to increase when the other decreases.
- In the case that the correlation's result is equal to 0, there is an absence of association between these variables.

To be able to calculate the correlation between all the variables, it was necessary to transform the string variables into integer variables, making them all the same type.

4.6.1 LEVEL OF KNOWLEDGE OF ARTIFICIAL INTELLIGENCE

Table 12 shows the correlation between variable X ("Do you believe that humans and AI can coexist and complement each other in work tasks?") with variables Q, S, T, W and Y.

Therefore, this table shows that there is an increasing pattern between all these variables. They all have a positive correlation which means that when one grows the other has the same tendency.

As shown in Table 12, participants' confidence that Artificial Intelligence and humans will collaborate in the future increments when there is a growth in their general knowledge of these technologies (correlation between Variable X and Variable Q: 0.117).

This sample of participants also believes in the advantages that AI can bring to the labor market and how it can automate tasks and free up workers' time to prioritise other tasks. Besides, they consider as well that AI will be a fundamental part of guaranteeing the competitiveness of

companies in relation to others and that, on a balance of benefits and disadvantages, they consider that AI will bring more earnings than obstacles.

	<i>Variable Q</i>	<i>Variable S</i>	<i>Variable T</i>	<i>Variable W</i>	<i>Variable Y</i>
<i>Variable X</i>	<i>What is your level of knowledge of Artificial Intelligence?</i>	<i>AI positively impacts the labor market.</i>	<i>AI performs more automatic tasks and therefore allows the worker to prioritise different tasks.</i>	<i>The use of AI will allow business to grow, leaving the ones unable to adopt it at a disadvantage.</i>	<i>Artificial Intelligence brings more advantages than disadvantages.</i>
<i>Do you believe humans and AI can co-exist and complement each other in the work assignments?</i>	0.117	0.136	0.175	0.108	0.152

Table 12 - Analysis between the belief of Humans and AI complement each other and other variables.

4.6.2 THE REPLACEMENT OF THE ACCOUNTING PROFESSION

Table 13 illustrates the correlation between variable X, the possibility of Artificial Intelligence replacing the accountant in the future, with variables T, W, Y, Z.

Maintaining the pattern of a positive correlation, as the belief that Artificial Intelligence will slowly completely replace the accountant increases so does the knowledge about artificial intelligence and that it will only replace the accountant in the most analytical tasks (Variable T and Y).

Similarly, in this sense, comparing the Variable X with the Variable Z, it is the participants who have more belief in this replacement who consider that AI is and will be an instrument that will allow organizations to develop and become more competitive.

Additionally, Variable X and Variable W also show a positive correlation, indicating that when the confidence that AI will slowly replace the accountant's profession increases, so do the positive responses that the accountant's role will still be necessary with the continuous growth of AI technologies in this area.

	<i>Variable T</i>	<i>Variable W</i>	<i>Variable Y</i>	<i>Variable Z</i>
<i>Variable X</i>	<i>What is your level of knowledge of Artificial Intelligence?</i>	<i>Do you believe that the accounting role will still be necessary in 10 years, with the continuous evolution of Artificial Intelligence (AI)?</i>	<i>In 10 years, AI will replace the human being in most analytical tasks.</i>	<i>The use of AI will allow business to grow, leaving the ones unable to adopt it at a disadvantage.</i>
<i>According to several studies the accounting profession in 20-30 years, will slowly be replaced by Artificial Intelligence. Do you agree with this affirmation?</i>	0.114	0.092	0.226	0.163

Table 13 - The replacement of the Accounting profession.

4.6.3 THE KNOWLEDGE OF ARTIFICIAL INTELLIGENCE

As shown in Table 14, there is a positive correlation between the X variables and the Y and Z variables.

This result allows us to conclude that the participants who have more knowledge of Artificial Intelligence’s technologies believe that these tools are an asset to the company's growth and it provides more advantages to the organization than disadvantages.

	<i>Variable Y</i>	<i>Variable Z</i>
<i>Variable X</i>	<i>The use of AI will allow business to grow, leaving the ones unable to adopt it at a disadvantage.</i>	<i>Artificial Intelligence brings more advantages than disadvantages.</i>
<i>What is your level of knowledge of Artificial Intelligence?</i>	0.183	0.167

Table 14 - The level of knowledge of Artificial Intelligence

5 DISCUSSION

The survey allowed us to obtain a realistic view of the participants' perspective on the introduction of Artificial Intelligence tools to accounting.

In terms of age distribution, it was possible to achieve a balanced scope of the 240 participants as previously analyzed. The main areas of activity of the participants are mainly finance, insurance or business, education or they are still studying. When asked about their level of Artificial Intelligence, the majority of this cluster answered that they knew some concepts regarding this topic.

Based on the previous analysis, it can be concluded that the level of knowledge of Artificial intelligence is a parameter that greatly influences the remainder of the answers. In addition, age is also an important factor, bearing in mind that Artificial Intelligence tools have had the biggest development in recent years.

In order to achieve the objectives defined in point 1.1, a descriptive and a correlational analysis of the results obtained in the survey were carried out. The main conclusions drawn from both analyzes were as follows:

- Participants with age between 18 to 33 are the group that are more comfortable with AI's concepts. However, it is in the 34 to 43 age group that exist the biggest number of people who consider themselves experts on the matter.
- Most of the participants consider that in 10 years the accountant will have a supervisory role. Of this group that believes in this possibility, most work in the "Finance, Insurance, Business or Other Services" sample.
- Regardless of participants' age, 93% of this cluster recognize that accountants and Artificial Intelligence can complete each other and succeed together.
- The participants that are less certain that AI and accounting can work together in the future are the one who have less knowledge of AI tools and concepts. They are also the ones who don't see the advantages of AI in the labor market and that think it doesn't contribute to the competitiveness of the companies.
- As the knowledge of Artificial Intelligence increases, so does the confidence that that AI will replace the more analytical accounting tasks and that these tools allow companies to be a competitive advantage for organizations.
- It is the participants with the most knowledge of AI who consider that this tool allows for a greater business growth and that those who don't follow these developments

could become stagnant in their growth, as they don't develop their knowledge of the AI tools.

In summary, participants who already have some knowledge of Artificial Intelligence can envision a future for accounting with these tools. They do believe that AI will perform more analytical tasks, but human intelligence will always be needed, transitioning into a supervisory role. In addition, their knowledge of these tools allows them to see it as an advantage in the job market, rather than a liability. On the other hand, the participants who are not so comfortable with the concepts of AI have some insecurities about the future of the profession, not believing in the competitive advantages that these tools provide for organizations.

In spite of the level of knowledge shown across the different age groups, there is something in common to all of them: 93% of participants believe that Artificial Intelligence and human beings will work together.

6 CONCLUSIONS

This chapter aims to summarize the main contributions and conclusions of this study. It will be supported by the results obtained within the survey carried out and the analysis of the same. The limitations of the study will be stated and the main topics to delve into in future investigations. It was decided to divide this chapter into three parts: an overview of the work developed, its limitations and the ideas for future work.

6.1 SYNTHESIS OF THE DEVELOPED WORK

This study was dedicated to investigating the impact of the continued growth of artificial intelligence on the accounting sector, with a particular look to analyze the role of accounting today and in the future. Taking this into account, it was defined the methodology to be used and the research questions of this study:

- RQ1 – How can the accountant role still be important in accounting while the presence of Artificial Intelligence is increasing in this sector?
- RQ2 – How can accountants adapt their skills and techniques to the new era of accounting?

In order to answer the respective questions, firstly, the aim was to introduce some concepts from both areas and then to relate them and understand the current impact of these technological tools in the accounting sector: which are the most used, who are the organizations that use them most, its limitations and benefits. Finally, in a third phase, a survey was drawn up to get a perception of these issues at a social level and how this increase of the Artificial Intelligence presence was seen, particularly, in accounting.

As a result of this survey, we obtained several noteworthy findings, some of which was that the level of knowledge regarding Artificial Intelligence and the age of the respondents directly influences one's entire perspective on AI. This suggests that people with more knowledge of the subject are more confident that it is an advantage not only for organizations but also for the professional carrying out the tasks, in this case the accountant. On the other hand, it is the people who have less knowledge of these definitions who see AI as a limitation and something that will bring more obstacles than benefits. Besides this conclusion, from the cluster of this survey, it's possible to verify that the youngest generations are the ones who have more knowledge of these tools.

Contrary to the belief of many studies that the role of the accountant will be replaced in 20-30 years, it was verified, through our population surveyed, that not the entire sample supports this belief. It was highlighted by the population that works essentially in the areas of Finance, Insurance and Business, that the role of the accountant will continue to exist, however, increasingly as a supervisory role.

In spite of the age of the participants who took part in the survey, 93% of them believe that accounting and artificial intelligence can and will work together, complementing each other.

6.2 LIMITATIONS

During the investigation and development of this study, some limitations were identified, which allowed us to make recommendations for future studies, such as:

- A survey was created which, although it facilitated a reduction in the data collection time, allowing to speed up the processing of the data collected, on the other hand it conditioned the sample by only reaching individuals who have access to the Internet, potentially distorting the results, thus not guaranteeing that it is representative of all the scenarios that could possibly exist.
- The fact that there were several closed questions in the questionnaire led to less open-ended responses and the opportunity to collect additional data may be lost.
- The survey was tested on an academic scenario and that's a limitation as it conditions the population of the sample.
- It was not possible to carry out an association analysis because there was not enough time to do so.

6.3 FUTURE WORK

Taking into consideration the research limitations identified, an association analysis should be performed to allow for other conclusions to be drawn from the data. In order to not constrain the sample and to have a larger diversity of the sample, research should be carried out beyond the academic scenario, allowing results to be obtained from additional environments.

REFERENCES

- Nnenna Chukwuani, V., & Egiyi, M. (2020). Automation of Accounting Processes: Impact of Artificial Intelligence. *International Journal of Research and Innovation in Social Science*. www.rsisinternational.org
- Babington. (2022, May 27). *A Brief History of Accounting: Where Did It Start?*
- Republic of South Africa. (2010). *Basic Accounting Handbook for Government Departments Overview*.
- Chok, N. S. (2010). *Pearson's versus Spearman's and Kendall's Correlation*. University of Pittsburgh.
- Das, P. K. (2021). Impact of Artificial Intelligence on Accounting. *Sumerianz Journal of Economics and Finance*, 4, 17–24.
- J. Quinto II, E. (2022). *How Technology Has Changed the Field of Accounting* [Bridgewater State University].
https://vc.bridgew.edu/cgi/viewcontent.cgi?article=1561&context=honors_proj
- Hasan, A. R. (2022). Artificial Intelligence (AI) in Accounting & Auditing: A Literature Review. *Open Journal of Business and Management*, 10.
- Huang, Z. (2018). Discussion on the Development of Artificial Intelligence in Taxation. *American Journal of Industrial and Business Management*, 8(8).
- Icaew Thought Leadership, I. F. (2018). *Artificial Intelligence and the future of accountancy*.
- Johnson, E., Petersen, M., Sloan, J., & Valencia, A. (2021). *The Interest, Knowledge, and Usage of Artificial Intelligence in Accounting: Evidence from Accounting Professionals*. Florida Gulf Coast University.
- K, M., & S, G. (2014). Research using qualitative, quantitative or mixed methods and choice based on the research. *Sage Journals*, Volume 30, Issue 7.
- Keserer, E. (2022). *The six main subsets of AI: (Machine learning, NLP, and more)*.
<https://www.akkio.com/post/the-five-main-subsets-of-ai-machine-learning-nlp-and-more>
- Kokina, J., & Davenport, T. H. (2017). *The Emergence of Artificial Intelligence: How Automation is Changing Auditing*.
- Mui Kim Chu, & Kevin Ow Yong. (2021). Big Data Analytics for Business Intelligence in Accounting and Audit. *Open Journal of Social Sciences*, Vol.9 No.9.
- Omoteso, K. (2012). *The application of artificial intelligence in auditing: Looking back to the future*.
<https://www.sciencedirect.com/science/article/abs/pii/S095741741200111X?via%3Dihub>
- Schroer, A. (2023). *What Is Artificial Intelligence?* <https://builtin.com/artificial-intelligence>
- Shekhar, C. (2021). *Introduction to Accounting*.
<https://www.ddegjust.ac.in/studymaterial/bba/bba-104.pdf>

- Siau, K. C. (2022). *Supply Chain Management Health Information Systems*.
- Solutions, R. (2022). *What Is an Accountant and What Do They Do?*
<https://www.ramseysolutions.com/taxes/what-is-an-accountant>
- Stancheva-Todorova, E. (2018). How Artificial Intelligence is challenging accounting profession.
Journal of International Scientific Publications, 12.
- Brock, T., & The Investopedia Team. (2022, April 28). *What Are the Origins of Accounting?*
- Reuters, T. (2022, November). *How technology has impacted accounting—from compliance to strategy*. <https://tax.thomsonreuters.com/blog/how-technology-has-impacted-accounting-from-compliance-to-strategy/>
- Ucoglu, D. (2020). Current Machine Learning Applications in Accounting and Auditing.
PressAcademia Procedia, 12, 1–7.
- University, M. (2022, October). *History of Accounting: How It's Evolved Over Time*.
<https://online.maryville.edu/blog/history-of-accounting/>
- Yingying, Z., Feng, X., Yi, X., Xuan, F., & Haifeng, G. (2020). *The Impact of Artificial Intelligence and Blockchain on the Accounting Profession*.
- Yoon, S. (2020). A Study on the Transformation of Accounting Based on New Technologies: Evidence from Korea. In *Economic and Business Aspects of Sustainability*.
- Zemánková, A. (2019). *Artificial Intelligence and Blockchain in Audit and Accounting: Literature Review* . 16.

APPENDIX

Appendix 1 – SURVEY

Welcome to this survey!

As part of the Masters in Information Management, I would like to get your participation in this survey. The theme of my thesis is "Artificial Intelligence: the changing role of the Accountant".

Your participation is completely voluntary and you must be over 18 years old to answer it. All answers will be anonymous and will only be used for this study.

By ticking the box below, you agree to participate in the survey in accordance with the terms above.

I agree to participate with the terms indicated above

Thank you for your participation!

Gender

Female

Male

Prefer not to say

Age

18 to 24

25 to 33

34 to 43

44 to 53

54 to 65

> 65

What is your profession/occupation?

Student

Work in Business and Other Services, Finance or Insurance

Work in Hospitality, Catering or Leisure Services

Work in Health or Social Care

Work in Transport, Retail or Wholesale

Work in Education

Retired

Unemployed

Other

What is your level of knowledge of Artificial Intelligence?

I don't know anything about this theme.

I know some concepts.

I'm comfortable with the theme.

I'm an expert.

Which sectors do you consider most likely to automate their functions?

Finance/Accounting	<input type="checkbox"/>
Education	<input type="checkbox"/>
Health Care	<input type="checkbox"/>
Human Resources	<input type="checkbox"/>
Manufacturing	<input type="checkbox"/>
Retail	<input type="checkbox"/>
Insurance	<input type="checkbox"/>
Science	<input type="checkbox"/>
Other	<input type="checkbox"/>

Rate from most important aspect of Artificial Intelligence to the least one.
Consider 1 as the most important a 5 the least important.

- Imitating human behaviour.
- Solve complex problems.
- Automation of the more routine tasks.
- Analyze data in real time.
- Improvement of decision making and thus growth of efficiency.

From the disadvantages presented below, rate from most to least negative. Consider 1 as the worst disadvantage and 5 the least negative.

- Difficulty in explaining the information acquired.
- Workers' resistance to change and innovation.
- Privacy concerns.
- Shortage of employees with knowledge and skills in the field.
- Unemployment.

Do you believe that the accounting role will still be necessary in 10 years, with the continuous evolution of Artificial Intelligence (AI)?

Yes, it will always be necessary.

Yes but more as a supervisor role.

No, I believe that it will take longer for AI to be completely autonomous.

No as the AI will be able to perform the tasks and supervise them.

I don't have an opinion.

Considering your knowledge of Artificial Intelligence (AI), please rate the following statements:

	Disagree	Partially disagree	Neither agree nor disagree	Partially agree	Agree
AI positively impacts the labour market.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In 10 years, AI will replace the human being in most analytical tasks.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
AI performs more automatic tasks and therefore allows the worker to prioritise different tasks.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The use of AI will allow business to grow, leaving the ones unable to adopt it at a disadvantage.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Artificial Intelligence brings more advantages than disadvantages.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

According to several studies the accounting profession in 20-30 years, will slowly be replaced by Artificial Intelligence. Do you agree with this affirmation?

Yes.

No.

Not totally, only partially.

I don't have an opinion.

Do you believe humans and AI can co-exist and complement each other in the work assignments?

Yes.

No.

I don't have an opinion.

AI