Artificial intelligence in strategic business management: the case of auditing

Leandro Pereira*

Business Research Unit – BRU-IUL,
ISCTE – Instituto Universitário de Lisboa,
WINNING Lab, Lisbon, Portugal
Email: leandro.pereira@iscte-iul.pt
*Corresponding author

Mariana Résio

ISCTE – Instituto Universitário de Lisboa,
Cidade Universitária de Lisboa, Av. das Forças Armadas,
1649-026 Lisboa, Portugal
Email: marianabmj@gmail.com

Renato Lopes da Costa

Business Research Unit – BRU-IUL,
ISCTE – Instituto Universitário de Lisboa,
Lisbon, Portugal
Email: renatojlc@gmail.com

Álvaro Dias

ISCTE – Instituto Universitário de Lisboa,
Universidade Lusófona de Humanidades e Tecnologias,
Lisbon, Portugal
Email: alvaro.dias1@gmail.com

Rui Gonçalves

ISCTE – Instituto Universitário de Lisboa,
Cidade Universitária de Lisboa, Av. das Forças Armadas,
1649-026 Lisboa, Portugal
Email: ruiahgoncalves@gmail.com

Abstract: We live in the era of digital transformation and adopting innovative tools and technologies such as artificial intelligence (AI) seems to be extolling business models and driving optimisation in the processes inherent to their operation. The audit area which is intense in tasks that can be performed by machines, studies emerge showing positive results in the adoption of AI tools. The literature affirms the use of machinery such as AI in business models opens doors to the creation of value in organisations adjacent to this strategy. In order to deepen this contradictory approach between the benefits associated

with the adoption of AI and the low rate of use of it, around 200 employees from mostly Portuguese companies were inquired. The research findings allow to understand what kind of work can be transferred for AI automatisation and present a list of technological issues to solve in this transformation.

Keywords: auditing; innovation; innovation processes; technology adoption; technological change; technological innovation.

JEL Codes: O31, O33, M420.

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Biographical notes: Leandro Pereira holds a PhD in Project Management. He is also the CEO and Founder of WINNING Scientific Management and a Professor at the ISCTE Business School. He is also a former President of Business Case Institute, PMI Portugal Chapter and training specialist of the Court of Auditors. As the CEO, he receives from Best Teams Leaders the award of Best Team Leader and CEO of Portugal in 2017 in Portugal. He is also PMP from PMI and ROI certified. As a researcher, he published more than 50 scientific publications and ten books. As a student, he received the Best Student Award from the University of Minho. He is an international expert in strategic management, project management, benefits realisation management, and problem solving.

Mariana Résio holds a degree in Economics from ISCTE Business School. He took his Master's in Management at the same institution. She is currently an auditor at Ernst & Young. Combined with his professional training, he investigates the impact of artificial intelligence on the strategic management of companies, with special emphasis on the role of auditors.

Renato Lopes da Costa holds a PhD in General Management, Strategy and Business Development by ISCTE (Portugal) and has articles published in several specialised journals in the East, the USA, Canada, Africa, South America and Portugal. He is currently a researcher and member of BRU-UNIDE and Professor at INDEG where he holds the post of Director of the MScBA (Master in Business Administration) and guides students in the development of Masters and PhD theses. He teaches business strategy modules in executive and post-graduate Master degrees. Since 2013, he has also accumulated teaching duties as an Invited Professor at the Military Academy where he teaches the knowledge management.

Álvaro Dias is a Professor of Strategy at the Instituto Superior de Gestão and ISCTE-IUL, both in Lisbon, Portugal. He got his PhD in Management from the Universidad de Extremadura, Spain, after an MBA in International Business. He has over 24 years of teaching experience. He has had several visiting positions in different countries and institutions including Brazil, Angola, Spain, Poland and Finland. He regularly teaches in English, Portuguese, and Spanish at undergraduate, Master and doctorate levels, as well as in executive programs. He has produced extensive research in the field of tourism and management, including books, book chapters, papers in scientific journals and conference proceedings, case studies, and working papers.

Rui Gonçalves holds a PhD in Management from the Instituto Superior de Economia e Gestão, with research in information systems for operational risk management, Master's in Statistics and Information Management from the NOVA Information Management School (NOVA IMS), with research in the area of intelligent agents, and a degree in Business Management from the International University. He is currently a Guest Assistant Professor at NOVA IMS and works as a Manager in the Business Expertise division at SAS Portugal. In recent years, he has coordinated the areas of operational risk, compliance, fraud, audit and money laundering.

1 Introduction

1.1 Contextualisation

In a world of continuous changing, companies need to have a good balance between technology, organisation, and human resources if they want to prevail in the marketplace. There is an increasing need of managing these three key factors in a harmonic and conscient way, achieving increased productivity gains that are reflected in the quality of its products and services and consequently in the satisfaction of its clients, employees, owners, and shareholders. We cannot forget that the culture and internal values of companies built over years are not always flexible enough to conform with a new pattern of short-term thinking and behaviour. Despite this, we shall make a start and prepare companies for the mandatory digital transformation that somehow or other will affect them (Ferraz et al., 2014).

There are lots of technological tools that can add value to the way companies manage projects in a strategic and efficient way. Artificial intelligence (AI) is a new digital frontier that has and will have a deep impact on world, changing the way we live and how we work. The term AI is a segment of computer science that proposes the development of devices that simulate the human capacity to reason, perceive, make decisions, and solve problems – in short, machines with the ability of being intelligent. This approach has been already applied in areas such as driverless cars, medicine, or even investment portfolio management. All of them came up with positive results and improvements in terms of time efficiency and effectiveness, and AI is disclosing a stronger competitive advantage for the one who follow its path. For companies, the use of AI is not a futuristic option, but a reality that can be decisive in terms of competitiveness (Lopes da Costa et al., 2019; Wirtz et al., 2019; Walton, 2018).

For the reasons above mentioned, there is no need for companies to think about losing out among the others by adopting AI systems. However, even if the appearance of AI has decades, its effective usage is a recent phenomenon and organisations are reluctant to take the first step. The problem is that sooner or later all businesses will be affected by emerging technologies, and the sooner they take on it, the better. Companies are already feeling the impacts of AI – this is what indicates the study 'Modernisation of IT: from critical to digital transformation', conducted by Vanson Bourne, a technology research company. According to it, among the most demanded tools is process automation using robots (63%), intelligent automation (61%) and cognitive automation (59%). Increased productivity (85%) and cost savings (62%) are the two main factors that influence

organisations to implement AI. The tricky issue does not passes buy assume it, but to effectually adopt it.

This research aims to mitigate this reluctance, arguing whether companies are prepared or not to go further with AI and how they can take advantage of it. The digital transformation to which the business world has been gradually and inevitably subjected deserves to be studied and approached critically and constructively for those who seek it. Emphasising AI, this analysis aims to frame this tool in the strategic management of a company, more precisely in the way an auditor manages his projects and/or optimises his daily routines performance. The theme in question then seeks to understand whether companies are prepared and motivated for this evolution or not, clarifying how they can benefit from adopting such tool. Thus, the main research questions (RQs) to be explored in this research are the following: are companies adapting their business models to the digital transformation? In the case of auditing, are companies prepared for applying AI?

To accomplish the main goal under study in this investigation, specific objectives were established and three RQs around the problem appeared to be answered. Linked to specific objectives and findings of each topic raised from the literature review introduced further in Section 2, the research objectives (RO) and RQ are the following: *RQ1 – are companies aware and prepared for digital transformation*? RO: acquire a global outlook about digital technologies and its boom across years, debriefing around its usage in companies and all the hope around it to expand business models; *RQ2 – how can and how is AI being applied in business strategy*? RO: point out AI as one of the trendiest technologies and understand its concept, as well as its advantages and implications*; RQ3 – what are the auditing firms' approaches to grab new opportunities resulting from using AI in auditing*? RO: analyse the role of AI in auditing and auditors' job and how it can improve project management efficiency and customers' value creation. Collect empirical data regarding accounting company's knowledge about AI implementation as well as the drawbacks and concerns influencing the acceptance and use of this innovative technology.

This research was developed according to the following structure. First, a brief contextualisation of the research and the problematic it aims to clarify is introduced. After, theoretical review throughout the existing literature is made and concepts and approaches around subjects such as digital transformation, digital technologies and digital business strategy will be presented, as well as AI as one of the trendiest digital tools appear. Its types and usages and the respective advantages and disadvantages will also be addressed. After that, a reflection on accounting firms and auditing in specific will be described, then showing critical points and motivations of positioning AI in auditors' role. Moving on to the methodology section, the RO and associated RQs are exposed and the techniques in charge of data collection and analysis are summarised and the reasons for choice are detailed. Subsequently, it is presented the key findings of the investigation with relevant conclusions arising from the results are indicated. Lastly, general conclusions about the implementation of AI in companies and in auditing firms in specific will be remarked, as well as limitations linked to the study.

2 Literature review

Technological advances lead companies today to find themselves in an era of digital and technological transformation, through the incorporation of AI systems in their daily lives.

Nowadays, a company that does not use an AI system or does not provide it to its collaborator loses competitive advantage before other companies in the same business area that use AI systems. In this sense, and according to what was said in the introduction, the literature review will be based on three main points:

1 first exploring the theme of digital transformation and its connection to the business strategy of companies

2 later relying on the types and uses that can be given to AI, as well as the advantages and limitations that can be inherent to them and, finally

3 presenting the role that can be played by AI in the audit theme.

2.1 Digital transformation: digital technologies and digital business strategy

'Leading in the new digital world is like walking a very thin tightrope' (Eyre, 2017). Eyre, the executive vice president of Fujitsu Americas, has more than 25 years of IT experience and suggests the technological digital world we are living as the main driver of 'human empowerment and engagement across business, society and in every aspect of our lives'. The digital revolution has triggered off the position that companies must have to prevail in the marketplace, almost forcing companies to adapt their strategies in such a way where technologies act like major players to achieve results. Technology is the steppingstone for the future (Karthikeyan and Soni, 2020).

Innovation appears when combining technological resources that consist of computing, communication, interaction, and information technologies. New products and services can be created towards new trends, nowadays mastered by the digital era we live. The disruptive dimension of digital technologies opens doors to digital business strategies. According to Grover and Kohli (2013) and Bharadwaj et al. (2018) the term 'digital business strategy' refers to an organisational strategy that raises distinctive business value by the use of digital technologies, based on the merging of business and information systems strategies that are both inspired by technology and centred on business value.

The implementation of new digital technologies in companies' business models supports the opportunity they're already giving to radically change their strategy and try not to misfit market trends. Therefore, society is overall facing a radical change as well, due to this development and their extensive implementation of all markets. All this process is almost mandatory. Moreover, we have to forward that to add to the expanded interest from clients, organisations are facing even harder competition because of globalisation and putting strain to go digital before others do, looking to survive and accomplish competitive benefits (Ziyadin et al., 2019). As mentioned, describe digital in organisations implies them to debrief around three basic pillars that will necessarily be influenced. First, within the company, since business objectives, leadership and organisational structure will need changes to fit the current environment. Second, from the perspective of the value added to clients, given that outside the company the experience will be improved. Last and combining this to its important to recognise that, in general, all business will be impacted as well as its opportunities, leading to absolutely new business models (Sebaa et al., 2019).

So far, we have defined the main concepts around digital transformation and its implications on organisations business strategy. Although there are several advantages in

implement technological tools in business, discussed and argued further on, professionals are still reluctant to take that step. Ziyadin et al. (2019), concluded that "this is upheld by the fact that digital transformation is viewed as one of the real difficulties in all industries lately, without exception, and even in spite of the fact that organisations perceive its fundamental significance, they still confront numerous obstacles that repress them from starting, not to mention profiting by, digital transformation". His vision states that this happens mainly because of the lack that exists about the range of accessible choices and components that directors need to consider in their transformation approach, as studied by Hess et al. (2016). Notwithstanding the natural fear of a human being to assume the need of change and start doing it, studies prove that companies are not well clarified about how to implement technology in their business as well as about the advantages they can take advantage from Basu (2015).

2.2 Artificial intelligence

Amongst the range of technologies available in the market it appears AI as one of the trendiest. Studies concerning AI have started many years ago, by Alan Turing, who developed his first theories about machine intelligence in the mid 50s. This notion was invented by John McCarthy whose conference in Dartmouth in 1956 brought the key researcher on this approach, Minsky. In 1956, this academic came up with conclusions underlining 'basic features of AI programs that still form the basis of artificial problem solving today' (Jelonek et al., 2019) from Minsky (1961).

There are lots of definitions for this approach – and this can be explained by the complexity of this advance and difficulty in finding an expression that covers all its features. To define AI, we are almost forced to first understand what a robot is. According to Ribeiro (2004) and Jahantigh et al. (2019), a robot is an automatic device with high processing power which is reprogrammable and so can make decisions based on information collected from its periphery through sensors. In accordance with the previous concept and for the purpose of this research, we can briefly suggest AI as a computer system that shows off human attitudes made of concepts, methodologies and techniques that lead the corpus to act resembling intelligent behaviour (Dubitzky, 2004). Putting it simpler we can look at AI as a branch of computation that builds up structures with power to simulate the human ability to reason, perceive, make decisions and solve problems (McCarthy, 1959; Syam and Rao, 2020).

2.2.1 Types and usages of AI

The European Agency for Safety and Health at Work reports two types of AI: weak and strong. Poor AI refers to technology that solves problems in a limited field of application (text and image recognition, expert systems, and chess computers). In contrast, strong AI refers to hypothetical equipment that exhibits behaviour like a human being but thinking relentlessly and relentlessly (Kaivo, 2015). According to Souza (2016) and Shatnawi (2018), AI can help finding non-documented lacks and even testing systems without errors, using is capacity to think and solving problems to manage them under security.

In the space, defence, or nuclear industry sectors, but also in logistics, maintenance and inspection, autonomous robots are particularly useful for replacing human workers who perform dirty, repetitive or unsafe tasks, thus avoiding worker exposure to hazardous conditions and reducing physical, biomechanical and psychosocial risks. Robots are

already used, for example, in repetitive and monotonous tasks, in the treatment of radioactive material or in explosive atmospheres. In the future, many other highly repetitive, risky and/or unpleasant tasks will be performed by robots in a lot of sectors, such as agriculture, construction, transportation, health, firefighting or cleaning services (Kaivo, 2015; Mashingaidze and Backhouse, 2017).

The constant growing of AI points out that companies will inevitably use it as a recurrent tool – the boom of equipment with high sophisticated mental skills will cross over the most different departments. As a result and whatever the field, the usage of AI will add value to the products and services delivered, always reflected in customer service improvement (Holtel, 2016).

We have to debrief that, as conclude in Veiga and Pires (2018) in Denkena et al. (2003) we are in times where "intelligent equipment will overwhelm the power of the human brain, decisively influencing the future of our planet, as well as pose an existential risk to humanity".

2.2.2 Advantages and major limitations of AI

AI machinery is made of neural networks that use genetic algorithms with optimisation purposes, where problem solving appears every minute better and faster and the outcomes show coherent and reasonable associations in the data analysed (Munakata, 2008; Neves and Bernardino, 2017). Moreover, when of its best characteristics points to the ability of retaining learning processes, supporting the link between AI components and the respective benefits to business management. According to Jelonek et al. (2019), the mix of AI neural networks, machine learning, big data, data mining and business intelligence thus improves decision processes and organisation functionality, as well as it automates tasks that have the conditions to do so.

Going more deeply, and in accordance with studies conducted by Szajt (2014) regarding strengths and threats of applying AI in an enterprise, we can underline creation and deployment of intuitive interfaces, reduction of business analyses time, optimisation support in company's strategy creation and creative thinking support and the biggest positive issue about it. However, there are consequently some disadvantages about the topic, referred to by the respondents of the study by reduction of employees needed and consequently increased dismissals, the possibility of error occurrence, the lack of experience, creativity and empathy of real humans and even the probability that information technology security is always being appealed. The author concludes that the key topic here is to change managers mind and give them reliable evidence about the high weight of AI application benefits in strategic business management, thus clarifying there reluctance on going one step further (Brock and Khan, 2017).

Summing up, based on Shukla et al. (2017) ideas, AI findings allow for value creation with process improvement in a company, also improving workers' productivity by recreating a relationship between humans and machinery where the workaday tasks are replaced by the tool.

2.3 Auditing and auditors' role

The importance and relevance of auditing appeared around 18th century as a result of industrial revolution. Audit, in Latin *audire*, means 'to hear'. Initially companies used to have specific persons in charge of going to specialised judges, known as 'auditors', to

issue their opinion about the entity's accounting health. Searching for someone outside the company to check and evaluate its accounts costs time and money – and so, given the size of the businesses, the amount of capital and the petty number of transactions of companies before industrial revolution it was advantageous to look at it by themselves. As a result of that event, production in large scale as started and auditing started to grow (Kumar and Sharma, 2001).

Auditing companies' accounts aims to promote confidence and trust on revenue outputs, validating its financial statements. The main objective is to enhance and bolster financial specialist certainty, overseeing regulatory duties and supporting a sustainable economic growth in the long-term (Dennis, 2015). Apart from accounting rules, an audit must follow some fundamental principles, such as (Kumar and Sharma, 2001):

- Principle of independence: obligations or interests of the auditing entity must be sufficiently exempt from the interests of the audited company to allow services to be provided objectively. The auditor must be independent of the client company, so that the audit opinion is not influenced by any relationship between them.
- Principle of objectivity: auditors need to be liberated from inclination, feelings and impulses while reviewing. It requests checks of the exchanges and the utilisation of sensible ability and determination.
- Principle of full disclosure: mutual sharing of evidence and findings must occur. It is agreed between the auditor and the client that all information and explanations required must not be hidden from both.
- Principle of materiality: more consideration must be paid to those things which are physically significant, and in the regions where the danger of blunder or potentially extortion is generally more. The reality of materiality must be resolved as per the circumstance.

Among many others, auditors must follow these principles as a basis for the effective achievement of the auditing objectives. According to Kumar and Sharma (2001) auditing emerges as a validation of accounts to verify that accuracy and transparency – affirming assurance for potential readers of financial statements. Auditing requires checking the exactness of organisations' accounts with the assistance of narrative proof and through techniques as confirmation and valuation, covering the entire of accounting records of the business on one specific fiscal year, introducing thus a review report submitted to investors that is settled by a certificated accountant. Nowadays it is to ascertain whether the balance sheet – a statement of assets, liabilities and capital of a business in a specific period of time – and the profit and loss or revenue accounts exhibit a true and fair view of financial health of a business. Business' complexity is increasing over years and its transactions are following its path (Dias et al., 2021), increasing audits' potential to add value. The role that auditors play in this field is crucial to deliver high quality reports, which is directly related with a greater assurance of high financial reporting quality. As studies like DeFond and Zhang 2014) explain, the value of an audit arises from the expectation that the market has that if errors occur in the client's accounting, the auditor will detect them and report publicly.

Auditors must be neutral in the position they assume while auditing companies' accounts. This means they have to own not only professional features to do their job but also personal qualities that make them capable to deal with clients and all the

bureaucracies audit involves – both in negotiation and execution parts (McCraken, 2008). Professionally, to perform his duties an auditor must be framed on the business in which he operates and know the respective organisation and have knowledge not only in accounting interpretation but also in principles and practices of business laws (Kumar and Sharma, 2001).

This means being in constant learning about systems of accounting in use while relating facts recorded in accounts with the past, present and future of the business under inspection. It is mandatory that the auditor, working both as an analyst and a reporter, keeps in touch with clients' methods and operations and has intimate knowledge about the entity he is serving. Auditing is different from accountancy and involves more than arithmetical checks – it is related with critical judgements about revenue and costs of a specific period and its relationship with past and future expectations for business strategy.

Moreover, the individual must be gifted with personal qualities providing a good connection with clients, crucial in the way they obtain information and get transparency from the other side. An auditor must be "a man of integrity and moral courage capable of solving intricate problems patiently (…). He must try to be absolutely impartial, unbiased and independent" – a problem solver with the capacity of putting apart his own interests, analysing its issues without being influenced by others, specifically clients. While doing so, his position may lead to a cordial atmosphere and he can never assume a position of superiority towards clients' staff, developing a spirit of mutual trust between parties and never criticising their position. When understanding its explanations, auditors must be honest and transmit the feeling of confidentiality to make others comfortable when explaining why occurring in more or less costs in a specific rubric, for example. It is a profession that underlines special care about sincerity, following the professional ethics, customs and regulations. It is fundamental to be in a constant interrogative mindset until getting a reasonable explanation for what they're looking for, being patient with those who know the technical matters that an auditor is trying to understand (Kumar and Sharma, 2001).

2.4 Application of AI in auditing

The sharp growing of internet-related technologies that is disrupting the global economy is also affecting accounting and the role accountants play in a company. Moll and Yigitbasioglu (2019) analysed how technologies like cloud, big data, blockchain and AI are influencing accountant's job, more specifically in management accounting, financial accounting and audit, considering researchers, policy makers and practitioners as main groups of interest in this profession (as illustrated in Table 1). Though AI is our focus within this research, all the mentioned machineries are drivers of financial discernibility improvement and permit to reduce time dispended. However, there are some interrogations around this topic.

Table 1 Topics covered in Moll and Yigitbasioglu (2019) literature review

Internet-related technologies	*Accounting areas*	*Accounting profession interest groups*
Cloud	Management accounting	Researchers
Big data	Financial accounting	Policy makers
Blockchain	Audit	Practitioners
Artificial intelligence		Practitioners

Decision-making with technologies' support improvements connected to auditors' force to be more efficient on decision making gives space to deep concerning about the topic. Giving a special look over AI and its application on auditing, Omoteso (2012) starts his thoughts by dividing decision-making process in three parts: intelligence, design, and choice. In this split, we can allocate that intelligence opens doors to data collection and validation, define objectives and diagnose/structure problems, design means manipulating data, quantify its goals and create/add value to alternatives and choice generates statistics on alternatives by simulating its results while explain one alternative among others and clarifying their selection. This is where AI appears as a decision aid that is being developed and introduced in auditor's role of making judgements among decisions – and its notorious the sustained effort that there has been to come up with complex systems to do so. The author also infers that its position is not to substitute humans by machines but rather to optimise decision making process in such a way that errors that appear in a purely manual approach do not happen. As he concluded in Dalal (1999), operating audit procedures will be gradually conditioned by software and inevitably helped by AI and other expert systems, not only because of the dimension of complexity transactions but also due to unbelievable levels of people world is achieving.

However, some studies do believe that auditors are responsible for the final judgement and that given its sensibility and versatility they're giving much effort and reliance to machinery (Gloover, 1996; Swinney, 1999). The auditor is responsible to ensure the relevance, reliability, and effectiveness of such tools for their purpose (Omoteso, 2012).

Krumwiede (2017) inquired 161 senior finance professionals to notice their concern about skills and knowledge they will need to acquire to thrive in technology workspace. He concluded that about 5% of the respondents are extremely worried about the fact of having machines doing their jobs, 42% are slightly worried about the topic and the remnants 58% are not scared about the idea. The main apprehension of this workforce is related to the fact that they would feel irrelevant in their position.

Despite this, accounting and auditing are effectively changing given the advances in data analytics and AI. In 2015, (Forum, 2015) interrogated 816 executives from information technology and communication areas and about 75% of the respondents settled that audits performed by AI machinery will have an inflexion of 30% in 2025. In fact, the approach of conducting an audit with recurrence to machine learning is not latest, but its effective implementation is more believable now given the advances in this field over years (Keenoy, 1958).

Kokina and Davenport (2017) presented an article where they analyse how automation and the emergence of AI is changing auditors' job. To support their position, they do believe that both supply and demand sides following AI expansion are influencing the way companies adopt that tool:

- On the demand side, they consider that companies are waiting for a boost in productivity with cognitive technologies – in sophisticated economies the average annual growth only reached about 1.3% from 2007 to 2015 and in the first semester of 2016 it has decreased. Moreover, and not only in professions related to accounting, there are many situations where humans need to quickly analyse and make conclusions about a heavy data base, what becomes unworkable. A good example that fits this problem is the detailed examination auditors need to do in all company transactions.

- On the supply side, there are nowadays sophisticated hardware and software to execute cognitive tasks with great data and processing power to embrace this challenge. Nowadays versions of neural networks, that exist since 1950s, are prepared to learn on massive amounts of data and have computing potential with willingness to problem solving. Graphics processing units (GPU's), a recent type of processor is an example of a tool with enough power to process data with cognitive means.

As the authors concluded, to issue a financial opinion the treatment of the immensity of necessary data is one of the biggest audit challenges, which makes us looking for this area as particularly suitable for data analysis and AI applications (Kokina and Davenport, 2017). This idea gets even stronger when we know that auditors perform various repetitive tasks that can thus, be automated. We can look at the cases of accounting *big* four firms as evidence of investments are linked to innovation technology. KPMG, for example, as already a teamplay with IBM to develop AI tools (Melendez, 2016). Pricewaterhousecoopers (PwC) created a system that 'serves as a pipeline to AI and augmented reality products' (Presswire, 2016), Deloitte has generated the software Argus for AI and Optrix for data analytics (Kokina and Davenport, 2017) and Ernst & Young (EY) estimates that its usual recruitment of new hires that are supposed perform repetitive tasks – that will be done by machinery – falls by half (Agnew, 2016).

Table 2 Aggregate task structure

		Task structure		
Audit phase	*No. of tasks*	*Structured*	*Semi-structured*	*Unstructured*
Orientation	45	7(16%)	14(31%)	24(53%)
Control structure	75	10(13%)	58(77%)	7(10%)
Substantive tests	171	114(67%)	54(32%)	3(1%)
Forming an opinion and financial statement reporting	41	0(0%)	9(22%)	32(78%)
Total	332	131(39%)	135(41%)	66(20%)

Source: Abdolmohammadi (1999)

It is predictable and accessible to reason that the AI effects will first be pronounced in tasks already being helped by technology that were traditionally performed manually. By doing so, the main objective of introducing AI competencies in auditing is to automate labour intensive tasks (Rapoport, 2016).

Although the structure of an audit has little changes over years, its dimension is not enough to disregard Table 2, proposed by Abdolmohammadi (1999). To better understand which areas of auditing are most apt to be influenced by AI, the author came up with a series of tasks that make up and audit and identified that the most structured ones are in substantive tests phase. Therefore, that phase and all tasks related were considered as the most minded for decision-aid development.

All structured automated tasks presented in its approach let us agree that automation is related with 'verification, recomputation, footing, and vouching' (Abdolmohammadi, 1999). Among the list of tasks performed in substantive tests phase suggested in the analysis, we can give as an example the footing of cash receipts journal and cash

disbursement journal and tracing to general ledger postings and bank statements (task no. 10).

AI is an open topic and not all its types are applicable for accounting, but most of them are possible to be used in this area. Davenport (2016) suggested a list of types of cognitive technology and their intelligence level that was used to better understand its relevance on auditing and accounting. The principal domain of a robot is to accomplish physical tasks – at a first glance it may not seem relevant for audit, but it can be used in inventory counts. Moreover, traditionally auditors used algebraic analysis as the basis of their work but with all technological improvements over years they're using business intelligence help. Effectively, the core of their job is to *analyse numbers* and much of this analysis is done on a daily repetitive basis. Some companies are already working with auditing platforms that already help specific tasks of the process but only in the initial stages of the process (Schneider et al., 2015).To follow the path of AI improvements and to take advantage of its capabilities – such as time saving, productivity, etc. – companies must hurry up their suiting with this reality.

One of the most repetitive tasks that an auditor is used to perform – especially new hires that are contracted in bulk to execute it – is the analysis of contracts and other financial relevant documents. Translating those documents into digital information is done on a large scale and transforms its relevant information in meaningful text it is a limitation that machines are somewhat able to do. This task category, called by the author as 'digesting words, images', is already being used for "accounting-oriented tasks such as creating 'suspicious activity reports' for anti-money-laundering processes in financial services" (Davenport, 2016).

Finally, accessing online processes as making changes in entries and records, defining the task category of *performing digital tasks*, has increasingly been adopting by accounting firms and improved productivity in audits' management. There is no evidence of real application of AI in this field but given its benefits (Lacity, 2016) concludes that "The next level of capability for this task, 'robotic process automation', automates structured tasks and draws from multiple information systems sources".

Concluding this research of Kokina and Davenport (2017), there are many advantages when comparing specific types of tasks and its associated level of intelligence to perform it. If we think about these skills in a machine, performing in an audit, that are already some of them being implemented and none of them prejudicated goals – rather on the contrary. It is important to note that in Table 3 that are no cognitive technologies able of self-aware intelligence, but that level of AI is estimated to appear in a near future, and companies must be prepared to adopt it (Bostrom, 2014).

3 Methodology

The methodology of investigation is a discipline derived from logic and has as object the study of the scientific method. It can thus be deduced that the scientific method or process is a set of practices used and ratified by the scientific community as valid for the exposure and confirmation of a given theory. This section thus has the purpose of presenting the specific objectives and the RQs that are inherent to them, the research design, data on the survey applied within the research, as well as the characterisation of the sample that had been worked on for the presentation of the results obtained.

3.1 Specific RO and key RQs

To accomplish the main goal under study in this investigation, specific objectives were established and three RQs around the problem appeared to be answered. In Table 3, these questions are presented, linked at the same to specific objectives and findings of each topic raised from the literature review introduced in Section 2.

Table 3 RO and RQs

Research objectives	*Research questions*	*Literature review*
Acquire a global outlook about digital technologies and its boom across years, debriefing around its usage in companies and all the hope around it to expand business models.	RQ1 – Are companies aware and prepared for digital transformation?	Eyre (2017), Grover and Kohli (2013), Bharadwaj et al (2018), Hess et al. (2016) and Basu (2015)
Point out AI as one of the trendiest technologies and understand its concept, as well as its advantages and implications.	RQ2 – How can and how is AI being applied in business strategy?	Jelonek et al. (2019), Dubitzky (2004), Kaivo (2015), Holtel (2016), Szajt (2014) and Omoteso (2012)
Analyse the role of AI in auditing and auditors' job and how it can improve project management efficiency and customers' value creation. Collect empirical data regarding accounting company's knowledge about AI implementation as well as the drawbacks and concerns influencing the acceptance and use of this innovative technology.	RQ3 – What are the auditing firms' approaches to grab new opportunities resulting from using AI in auditing?	Omoteso (2012), Krumwiede (2017), Kokina and Davenport (2017), Melendez (2016), Rapoport (2016), Schneider et al. (2015), Davenport (2016), Bostrom (2014), Abdolmohammadi (1999), Presswire (2016) and Keenoy (1958)

Source: Self-constructed

3.2 Research design

This research combines two types of research methodologies, exploratory and explanatory research strategies. To better achieve complete findings and results it is crucial to use both and understand that they are not mutually exclusive rather fitting better together.

Exploratory research was conducted by collecting data – named secondary data – from previous investigations and studies about the implementation of AI in companies' strategies, as presented in Section 2. By doing so, the research problem and objectives were highlighted and questions about the theme appeared as a problematic that need to be studied. To investigate it, explanatory research was guided by primary data acquired from an online survey posted on Google forms. This survey implied both qualitative and quantitative data, explained further on Section 3.3. The online survey is presented on Attachment A.

There exists a wide spread of research techniques when considering primary data collection. Among many others like interviews, case studies and focus groups it appears surveys as an instrument to inquire a specific target population in a large scale. According to Hox and Boeije (2005), "a survey is carried out when researchers are interested in collecting data on the observations, attitudes, feelings, experiences, or

opinions of a population", fully integrated with the research objective under study. Moreover, we must think that online surveys are practical, have no costs and let us get results more quickly on compared to others. Respondents can express themselves anonymously and without pressure, maybe improving their honesty.

After getting a suitable number of responses, the survey was closed, and a database was downloaded directly from Google forms platform in Microsoft Excel format. This data was processed in Statistical Package for Social Science (SPSS) program, version 25, whose license is provided annually by the IT services of ISCTE Business School. Its findings and results are presented in Section 4.

3.3 Online survey

An online survey was shared in Google forms platform between 27th of September 2020 and 11th of October 2020 to get the largest sample possible and find the results for this investigation. Before the official publication of the survey, pre-tests were made, and none identified difficulty or failure when filling out the questionary. This survey was divided in four parts to facilitate the connection to the RO and better meet the connection of its answers to the purpose of each analysis, as shown in Table 4.

Two control variables were assumed before part 1, in order to exclude from our investigation all respondents who are not familiarised with AI meaning and/or do not belong to a company where is possible to use digital tools. The idea is to differentiate our sample and create statistical correlations that better achieve out matter of study, considering opinions about relevant profiles.

Table 4 Online survey structure

Part 1	*Part 2*	*Part 3*	*Part 4*
Sample characterisation	Digital transformation companies' consciousness.	Companies' awareness and usage of AI.	Accounting firms position about AI.

Source: Self-constructed

The first part of the online survey was entirely conceptualised in view of obtaining information about the respondents' professional career, namely their occupation, the nationality of the company where they work, their rank inside the firm and the market where it operates. The purpose of this data is to understand of kind of companies are we considering for our investigation and if the rank of the respondents influences their position about the adoption of AI in the company. Going more deeply, we are also segregating our sample according to the market where it operates.

The second part intends to bring up the concept of digital transformation importance to better understand how respondents look at its boom. More specifically, this section of the online survey aims to clarify if digital transformation is understood as a greater weight inside or outside the company and in which extent it adds value to the business.

The third part of the questionary points out AI as the selected digital tool in this investigation and tries to resume respondents' judgements about the adoption of AI tools in their job. After asked to select both two advantages and disadvantages of implementing it, they were presented with an open answer question with the purpose of detecting what are the main reasons companies are not using that innovative tool. Turning the spotlight on the respondents and their role as a worker, it was asked if they feel comfortable with the idea of applying such machinery in some tasks and if they do not, why. Moreover, on

a percentage scale from 0% to 100%, they were confronted about the usage of AI tools in their job.

The fourth and last part of the online survey was developed to a specific target audience: auditors. To better understand how the adoption of AI tools is perceived in accounting firms, this section differentiates respondents according to the company where they work. In a scale of 1 to 4, being 1 'totally disagree' and 4 'totally agree', it was investigated auditors' position about their performance improvement by using AI and how replaceable and repetitive are their tasks. Also, according to Kumar and Sharma (2001) proposal of some fundamental principles of auditing, presented in Section 2.3, auditors were asked about the possibility of not violating them in the presence of AI. Additionally, this section seeks to understand who do they think that benefits the most by replace Human Intelligence by AI in some parts of the job and what is spot towards digital transformation of the accounting firm where they work.

It is important to notice that notwithstanding the last part was directed to audit employees; all other individuals from different areas had the chance to name their job and to propose in which extent it is possible to implement AI on their tasks.

3.4 Sample characterisation

This research was conducted aiming a target population over 18 years old, both male and female with different education levels and backgrounds. Respondents were both from audit areas or not in order to enrich and fulfil the research around not only the application of AI in auditors' role but also employees' awareness of digital transformation in strategic business management across other industries. In the case of auditing, the survey was applied in accounting firms such as Deloitte, EY, KPMG and PWC. The survey was held in Portuguese as all workers addressed are Portuguese and work mainly in Portuguese companies.

Table 5 Prototype of sample characterisation

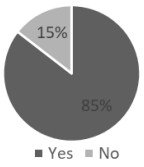
Research objective	*Question*	*Variables*
Sample characterisation	Respondent's occupational status	Employed; self-employed; student/employed
	What is the nationality of the company where you work?	Portuguese; other
	Where is your hierarchical level in the company?	Top management; management; team management; operational
	In which market does the company operates?	Public administration; asset management; banking and financial services; energy; engineering and construction; healthcare; hotel and tourism; logistics and transport; oil and gas; industrial production; real estate; retail and consumption; insurance; services; smart cities; telecommunications; other.

Source: Self-constructed

Overall, the sample is composed by 200 individuals, from which 85.5% (n = 171) reveal to be familiar with the concept of AI. All other 29 respondents who are not aware about

this concept were automatically excluded from our study. This is presented in Figure 1 and you can conclude that almost all participants have some relation with the digital tool under study.

Figure 1 'Are you familiar with the term AI?'



Source: SPSS Statistics

From those 171 individuals familiarised with AI, 78.9% (n = 135) work and/or are owners of a company where it is possible to use digital tools. The remaining 21.1% (n = 36) who are aware of AI but do not belong to a company where it is possible to use digital tools were automatically excluded from the investigation. This is presented in Table 6 – 'are you a worker/owner of a company where it is possible to use digital tools?'

Table 6 'Do you work/are you owner of a company where it is possible to use digital tools?'

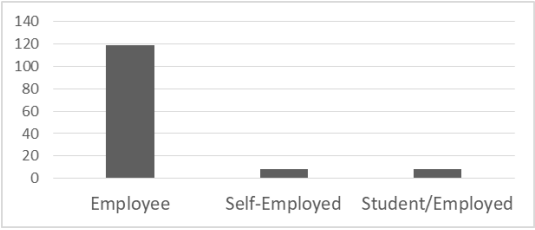
	Frequency	*Valid percent*
Yes	135	78.9%
No	36	21.1%
Total	*171*	*100%*
Missing	29	-
Grand total	200	-

Source: SPSS Statistics

By reducing our sample for these 135 respondents we are ensuring that our test is relevant for our investigation, making sure that individuals are not only comfortable with AI meaning and fit in a company where it is possible to use digital tools.

In terms of occupational status of the respondents, who are all employed, we can conclude from the analysis of Figure 2 that this survey gathered answers from 88.1% working for others (n = 119), 5.9% (n = 8) self-employed and 5.9% (n = 8) students /employed.

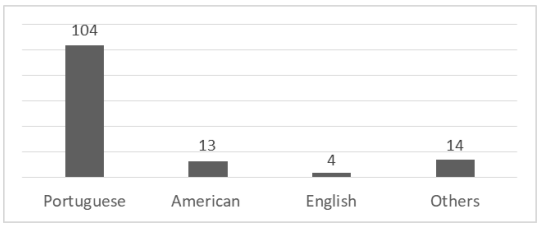
Figure 2 Occupational status



Source: SPSS Statistics

In the sample (n = 135), it was confirmed that the most represented nationality (77%) of the company in which they operate is Portuguese. This is presented in Figure 3.

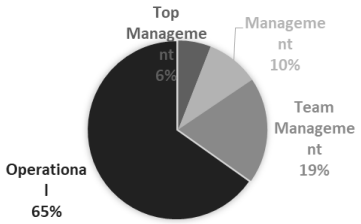
Figure 3 Nationality of the company where respondent works



Source: SPSS Statistics

Regarding the position of the respondent in the company he/she belongs, we can verify in Figure 4 that the hierarchical level that is most present is the operational level with a valid percent of 65.2% (n = 88). It should also be noted that about 19.3% possess team management ranks (n = 26) and about 9.6% are from management positions (n = 13), meaning that only 5.9% (n = 8) of the respondents are from top management role.

Figure 4 Respondent's role in the company



Source: SPSS Statistics

Lastly, considering the market where the company where the respondent works/his owner, it is found that services providers companies represent most of our sample, with a valid percent of 33% (n = 44), followed by healthcare industry who represents 21% (n = 28) in this investigation.

4 Results

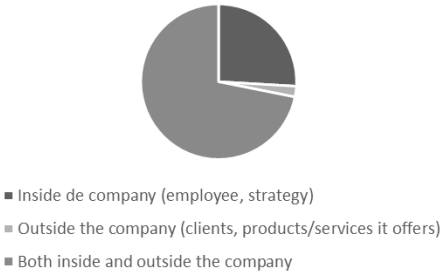
4.1 Descriptive analysis

As presented in the previous sections, the online survey is conceptualised in conformity with the three specific RO under analysis in this investigation. The answers showed results like the literature review as well as some discordant outcomes, making it possible to collect different insights and strengthen certain points of view regarding the aims of this research. Descriptive analysis of respondents' inputs was organised in accordance to the online survey structure and is portrayed in the following sections.

4.1.1 Digital transformation companies' consciousness

The first question of the survey was theorised to catch respondents' opinion about digital transformation influence in a company's environment. Of the 135 individuals of the sample, about 72% (n = 97) admitted that they do believe about digital transformation influence both inside and outside the company. Even if they represent the majority, there are 35 individuals who consider that its influence is more considerable inside the company and only three people think it weighs more on clients and products and services offered. This is presented in Figure 5.

Figure 5 Where does digital transformation have the greatest influence?



Source: SPSS Statistics

Forwardly, among seven principal potential victims within a company when talking about digital transformation, process optimisation appears to be the saturated variable with 86 responses within a sample of 135 individuals. The aim of this question was to understand in which extent the usage of digital tools adds value to a company and the majority looks at process improvement as the chosen. About 17% (n = 23) think that development and growth of a company are the most influenced indicator, followed by differentiation, profit, products and services offered, customer and employee satisfaction who were pointed out from only 30% of the sample – Table 7.

Table 7 Value creation of digital tools usage in a company

	Frequency	*Valid percent*
Development and growth of the company	23	17%
Differentiation by following a trend	8	6%
Profit	1	1%
Process optimisation inside the company	86	64%
Products/services offered	5	4%
Customer satisfaction	7	5%
Employee satisfaction	5	4%
Total	*135*	*100%*
Missing	65	
Grand total	200	

Source: SPSS Statistics

Even considering that this outcome as not a precise indicator and excluding all technological investment needed, this analysis follows the reasoning of Ziyadin et al. (2019) since the answers are rather standardised. Applying digital in organisations means to examinate around three pillars which will inevitably be impacted. As presented in the literature review, the authors debrief around the influence inside a company, outside a company, and give special strength to the combination of those two as a third and complete pillar. Is deeply consensual that digital transformation as power both inside – employees and/or strategies defined – and outside – clients, products and services it offers – a company, being process optimisation the indicator which the utilisation of digital tools most adds value on the organisation.

4.1.2 Companies' awareness and usage of AI

On the third section of the online survey, individuals were firstly asked about the two principal advantages of using AI in specific tasks. Among:

1 decision-making support, efficiency

2 doing well

3 doing fast

4 the allowance of release people to develop new skills (Duque et al., 2020)

5 the allowance of release people to develop skills already acquired

6 data protection, doing fast and doing well were the most answered couple with a valid percent of 27% (n = 36).

Right after, from 135 individuals about 21% (n = 28) consider that efficiency (doing fast) and the allowance of release people to develop new skills are two greater advantages when applying AI in specific tasks, followed by the pair 'decision-making support; allowance of release people to develop new skills' with 18 respondents (roundly 13% of the sample). These results are presented in Table 8.

When asked about their opinion about the two biggest disadvantages of using AI in specific tasks of their work, respondents had the opportunity to choose among the options:

1 unemployment

2 high costs of system construction and maintenance

3 inhibition of knowledge/development of professional judgment of human workers

4 longer decision-making process because more alternatives are explored

5 the risk of tools being transferred to the competition.

Around 35% (n = 47) consider unemployment and high costs of system construction and maintenance as the two principal disadvantages of using AI to perform some parts of their job, followed by 20% respondents (n = 27) who consider unemployment and longer decision-making process because more alternatives are explored. These results are presented in Table 9.

Table 8 Two principal advantages of using AI in specific tasks

	Frequency	*Valid percent*
Decision-making support; doing fast	13	10%
Decision-making support; doing well	4	3%
Decision-making support; allowance of release people to develop new skills	18	13%
Decision-making support; allowance of release people to develop acquired skills	3	2%
Doing well; doing fast	36	27%
Doing well; allowance of release people to develop new skills	12	9%
Doing well; allowance of release people to develop acquired skills	2	1%
Doing well; data protection	1	1%
Doing fast; allowance of release people to develop new skills	28	21%
Doing fast; allowance of release people to develop acquired skills	6	4%
Doing fast; data protection	3	2%
Allowance of release people to develop new skills; allowance of release people to develop acquired skills	8	6%
Allowance of release people to develop new skills; data protection	1	1%
Total	*135*	*100%*
Missing	65	-
Grand total	200	-

Source: SPSS Statistics

Summing up, this means respondents believe that decision-making support and efficiency are the major benefits of using AI to perform specific tasks of their work and point out unemployment, high costs of construction and maintenance and longer decision-making process because more alternatives are explored as the biggest problems around the topic.

Our sample thus considers better and quicker results when using AI machinery, leading to decision processes improvements, following the arguments of Munakata (2008), Jelonek et al. (2019) and Szajt (2014). Moreover, this study meets our findings about unemployment as a likely concern around this topic, pointed out as problem number one in Szajt (2014) studies. Nonetheless, it is a consensual on our sample that replacing human intelligence by AI will bring up longer periods for decision making process, linked with the authors' uneasiness about machinery lack of experience and error occurrence – with many alternatives available, AI machinery will take longer to decide whether and why to use one or another.

There seems to be a scarcity of investigation around AI implementation and maintenance costs, which may be an important focus for future researches and investigation. After the advantage and disadvantages of using AI, the online survey asked respondent's opinion with an open answer question regarding the reason that is hinder companies to adopt AI, and more than a half of the sample (around 56%) pointed out high costs as the cause. In a total of 135 individuals, nearby 26% (n = 35) assume the lack of knowledge about the tool as the bigger obstacle and about 18% (n = 25) refer to the fear of technological change.

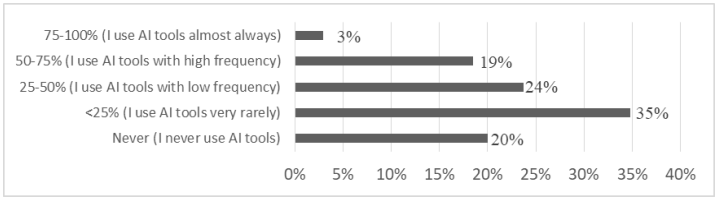
Table 9 Two principal disadvantages of using AI in specific tasks

	Frequency	*Valid percent*
Unemployment; high costs of system construction and maintenance.	47	35%
Unemployment; inhibition of knowledge/development of professional judgment of human workers.	21	16%
Unemployment; risk of tools being transferred to the competition	4	3%
Unemployment; longer decision-making process because more alternatives are explored.	4	3%
High costs of system construction and maintenance; inhibition of knowledge/development of professional judgment of human workers.	24	18%
High costs of system construction and maintenance; longer decision-making process because more alternatives are explored.	27	20%
Inhibition of knowledge/development of professional judgment of human workers; longer decision-making process because more alternatives are explored.	5	4%
Inhibition of knowledge/development of professional judgment of human workers; risk of tools being transferred to the competition.	2	1%
Longer decision-making process because more alternatives are explored; risk of tools being transferred to the competition.	1	1%
Total	135	100%
Missing	65	-
Grand total	200	-

Source: SPSS Statistics

Then, individuals were asked if they feel comfortable and prepared for the idea of replacing their tasks by machinery such as AI, and 104 of 135 respondents consider themselves ready for this transformation – this represents 77% of our sample. Within the remaining inquired (n = 31), it was asked with and open answer question why they do not feel comfortable with the idea and around 48% (n = 15) pointed the fear of losing the job as major factor, followed by 32% (n = 10) of the respondents who do not feel confident on AI. This reveals again ignorance about the tool, not only regarding costs but also usages benefits, or implications.

Figure 6 'What percentage of AI tools are used in your work?'



Source: SPSS Statistics

Lastly on this section about companies' awareness and usage of AI, to collect data about effective usage of such machinery, individuals were asked about the percentage of use of

AI tools in their work. The answers to this question indicated that is significant important to improve general knowledge about AI not only on companies' leadership who decides to take the step but also on employees who will directly deal with the machine. As presented in Figure 6, about 35% of the considered respondents (n = 47/135) use AI tools very rarely, 24% (n = 32/135) use AI tools with low frequency and 20% (n = 27/135) never use Ai tools in their job. Right after, about 18.5% (n = 25) of the respondents say they use AI tools with high frequency, meaning that only 3% (n = 4) of our sample uses AI tools almost always.

4.1.3 Accounting firms position about AI

The last part of this survey was conceptualised in a logical structure, in view of collecting information and results regarding AI adoption and use in the specific case of accounting firms. Individuals were firstly asked about their current job, in order to separate auditors from others. Trying to take advantage of this split, even the ones who do not belong to auditing side were asked about their profession and in which extend the tasks performed were replaceable by AI tools.

Within the 135 individuals considered, 36% (n = 49) are auditors and 64% (n = 86) work in other different job. The group of non-auditors is majorly composed by nurses, that represent 23.3% (n = 20) of that 86 individuals and consultants, who represent 18.6% (n = 16) of that group. From all respondents who do not work for accounting services, data analysis, share content and data insertion were the top three tasks that respondents pointed out as the relevant ones to apply AI.

Analysing our focus of study, auditors, it is possible to conclude that our sample belongs to the *big four* accounting firms EY, Deloitte, KPMG and PwC, represented mainly by EY with a weight of 63.3% (n = 31/49).

Next, individuals were asked to classify in a scale from 1 – 'totally disagree' to 4 – 'totally agree' how their performance would improve with the substitution of some tasks by AI. Among the 49 individuals, 59.2% (n = 29) agrees with this statement and about 32.7% (n = 16) totally agree with the idea. This means only four individuals disagree and no one totally disagrees about performance improvement when using AI. This is presented in Table 10.

Table 10 'My performance would improve with the replacement of some tasks by AI'

	Frequency	*Valid percent*
Totally disagree	0	0.0%
Disagree	4	8.2%
Agree	29	59.2%
Totally agree	16	32.7%
Total	49	100%

Source: SPSS Statistics

Nevertheless, when asked to classify in a scale from 1 – 'totally disagree' to 4 – 'totally agree' the sentence 'My tasks are easily replaceable by AI', our sample is divided. From the 49 auditors, 44.9% (n = 22) disagree with this assumption and 40.8% (n = 20) agree. This means that when talking directly about replacing human intelligence by AI auditors are afraid. After that, the online survey inquired individuals to categorised, also in a scale

from 1 – 'totally disagree' to 4 – 'totally agree', the repeatability of some tasks in specific phases of the auditory. The majority agrees or totally agrees with this statement, with a percentage of 40.8% (n = 20) and 49% (n = 24), respectively. Only five respondents disagree or totally disagree with the idea, with a percentage of 6.1% (n = 3) and 4.1% (n = 2), respectively. These results are shown in Tables 11 and 12.

Some studies like Gloover (1996) and Swinney (1999) are concluding that of the problems around the topic under study in this research is related to the effort that it is being given to machinery when applying AI in auditors' job. So, looking at the split of our sample, it is not a consensus that auditors' tasks are easily replaceable by AI, which gives space to think about a deeper investigation to understand where does it makes sense to put power on machinery. The outputs of our sample are a great support to Rapoport (2016) thoughts about the introduction of AI machinery in auditing – he manifested results showing that first steps will be assumed in tasks that were already being helped by technology, with the idea of automating labour intensive repetitive tasks.

Table 11 'My tasks are easily replaceable by AI'

	Frequency	*Valid percent*
Totally disagree	1	2.0%
Disagree	22	44.9%
Agree	20	40.8%
Totally agree	6	12.2%
Total	49	100%

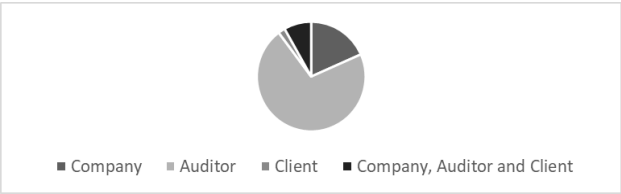
Source: SPSS Statistics

Table 12 'I perform repeatable tasks in some phases of my job'

	Frequency	*Valid percent*
Totally disagree	2	4.1%
Disagree	3	6.1%
Agree	20	40.8%
Totally agree	24	49.0%
Total	49	100%

Source: SPSS Statistics

Figure 7 'When using AI tools, who benefits the most?'



Source: SPSS Statistics

When using digital tools such as AI, it is the auditor the one who most benefits, in the opinion of the respondents from the online survey. Asked to choose between the

company, the auditor, the client or the combination of those three, 71.4% (n = 35) of the 49 individuals consider that the auditor is the individual that gets better by doing so. This is illustrated in Figure 7. The results are relatively in line with (Kokina and Davenport, 2017) speculations about automation and the emergence of AI influence on auditors' job – companies demand a boost in productivity by responding positively to the supply competent hardware and software now available in the market.

Following the arguments of Kumar and Sharma (2001) and the principles of audit presented by the authors – principle of materiality, principle of independence, principle of objectivity and principle of full disclosure – respondents were asked to classify in a scale from 1 – totally possible to 5 – totally impossible, being 3 – indifferent.

- Regarding the *principle of full disclosure*, auditors under study find it somehow possible to respect: 40.8% (n = 20) respondents consider it totally possible and 55.1% (n = 27) partially possible. It is important to underline that no one believes in the impossibility of accomplishment of this principle by using AI in auditing, meaning that the remaining three respondents answer option 3 – indifferent.
- Looking at respondents' opinion about the fulfilment of the *principle of independence*, 51% (n = 25) reveal total possibility concordance and 42.9% (n = 21) think it is partially possible to respect. Only one individual thinks it is partially impossible and two of them assume an indifferent position about the topic.
- A valid percent of 51% (n = 25) answered option 1 – totally possible and 46.9% (n = 23) option 2 – partially possible when staring at the *principle of materiality*. This concept is related with being able to filter which topics are significant and which are not relevant to analyse, and no one from our sample thinks it is impossible with AI tools.
- Finally, the respect for the *principle of objectivity* in the presence of AI was questioned and about 57.1% (n = 28) consider it partially possible, while 38.8% (n = 19) assume that it is totally possible. Only two respondents show impossibility around this theme and no one assumed an indifferent position.

Concluding, when looking at the four main principles of auditing identified and argued by Kumar and Sharma (2001), all variables have a saturation level that allows us to assume the agreement of our sample with the possibility of respecting them when using AI in some tasks of the audit process. These results are summarised in the table (Table 13 – 'How possible is it to respect audit principles with AI usage'). It is thus predictable that by consciously applying machinery in previously thought tasks that meet the conditions for human intelligence to be replaced do not threaten the four principles presented in Section 2.3.

Intending to understand accounting firms position and next steps on adopting AI machinery to perform certain tasks of auditing process and auditors' general position of that pace, the online survey was finalised with four yes or no questions focused on the topic. 77.6% of the population (n = 38) answered affirmatively in its consideration about the preparation of the company in which he/she works for the digital transformation we are living, while only 22.4% (n = 11) positions its place of work unprepared. The outcomes are the same when we asked auditors about the threat of his position as an auditor due to the growing use of AI. This is presented in Figure 8. The alarm presented in our investigation by auditors regarding their position does not meet the studies

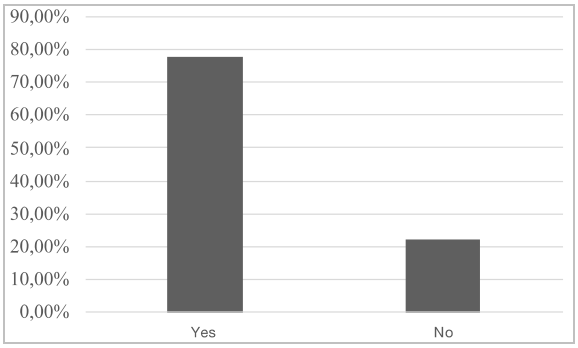
conducted by DeFond and Zhang (2014) who defined audit quality and the importance of their role to deliver high quality reports. The replacement of human judgements is supposed to be done in appropriate tasks that do not call excellence as an issue, demanding for shorten time waist in responsibilities that do not require critical intelligence to be done properly (Dalal, 1999).

Table 13 'How possible is it to respect audit principles with AI usage'

	1 – Totally possible	*2 – Partially possible*	*3 – Indifferent*	*4 – Partially impossible*	*5 – Totally possible*	*Total*
Principle of full disclosure	20	27	2	0	0	49
Principle of independence	25	21	2	1	0	49
Principle of materiality	25	23	1	0	0	49
Principle of objectivity	19	28	0	2	0	49

Source: SPSS Statistics

Figure 8 'Do you think that the company you work for is prepared for the digital transformation that we live in?'/'Do you feel your position as an auditor is threatened by the growing use of AI in the profession?'



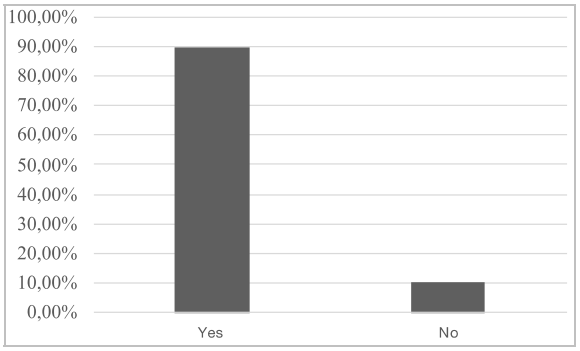
Source: SPSS Statistics

Our research shows that, regardless of the workers' motivations, companies will choose/increase the use of AI in certain tasks. Almost all the respondents' – about 89.8%, representing 44 of the 49 individuals – have a favourably about this concern, as presented in Figure 9. Meeting (Keenoy, 1958) conclusions in the area, it is predictable that given the improvements in this field over years the intention of conducting an audit with recurrence to machine learning will be faced as almost obligatory and usual in the market. Also, these results are in accordance with a study conducted by Forum (2015) which concluded about a change-over around 30% in the increase of audits performed by AI machinery.

The last issue aims to understand whether auditors think that recruitment would decrease or not with the increase of AI tools usage, even for those who did not point out unemployment as one of the two biggest disadvantages of such machinery asked in the

previous section of the survey. The question 'Do you think that if the company increased the use of AI the recruitment would decrease?' reveals fundamentally that, in the sample (n = 49), both 25 (51%) of the participants considered that the recruitment would not decrease as well as 24 (49%) consider that it would happen. It is possible to verify a division in the responses of the participants. As aforementioned before around 63% of our respondents work in EY and so it is interesting to link the results to Agnew (2016) who concluded that the company (EY) predicts a decrease of an half on its usual recruitment, mainly composed by staffs hired to perform repetitive tasks easily replaceable.

Figure 9 'Do you think that, regardless of the workers' motivations, your company will choose/increase the use of AI in certain tasks?'



4.2 Statistical correlation analysis

4.2.1 Research question

The investigation pretends to understand if the control variables have an influence on the dependent variable ('My performance improves with the replacement of some of my tasks by AI'), looking for a correlation between them. In other words, it is intended to confirm in a linear model (*model 1*) if the variable 'My performance would improve with the replacement of some tasks by AI' depends on the independent variables of our study:

- 'Are you familiar with the term AI'.
- 'Do you work and/or are you a business owner where you can use digital tools?'
- 'Advantage in the use of AI: support in decision making'.
- 'Advantage in the use of AI: effectiveness (doing well)'.
- 'Advantage in the use of AI: it allows to free people to develop new skills/challenges'.
- 'Advantage in the use of AI: it allows freeing people to improve the skills already acquired'.
- 'Advantage in the use of AI: data protection'.
- 'Disadvantage in the use of AI: unemployment'.

- 'Disadvantage in the use of AI: high cost of construction and maintenance of the system'.
- 'Disadvantage in the use of AI: inhibition of knowledge/development of professional judgment of human workers'.
- 'Disadvantage in the use of AI: decision process takes longer because more alternatives are explored'.
- 'Disadvantage in the use of AI: risk of the tools being transferred to the competition'.
- 'Do you feel comfortable and prepared for the idea of replacing your tasks with technologies like AI?'
- 'What is your professional activity?'
- 'My tasks are easily replaced by AI'
- 'I perform repetitive tasks in some phases of my work'
- 'Principle of full disclosure'
- 'Principle of independence'
- 'Principle of materiality'
- 'Principle of objectivity'
- 'He considers that the company he works for is prepared for the digital transformation that we live in'
- 'Do you feel your position as an auditor is threatened by the growing use of AI in the profession?'
- 'Do you consider that, regardless of the workers' will, your company will choose/increase the use of AI in certain tasks?'
- 'Do you think that, if your company increased the use of AI, would the recruitment decrease?'.

4.2.2 Model quality measures

In the analysis of the quality of the statistical model, R, R^2 and adjusted R^2 are used.

R is the multiple correlation coefficients. In model 1 (R = 0.861) the multiple correlation coefficient reveals a strong correlation between the observed values and the estimated values. Adjusted R^2 is the adjusted multiple determination coefficient that reveals the model's quality. In model 1, it is confirmed that 53.5% (adjusted R^2 = 0.535) of the dependent variable: 'My performance improves with the replacement of some of my tasks by AI' is explained by the linear model, that is, it is explained by the variables independent. R^2 is a multiple determination coefficient that reveals the amount of variation of the dependent variable (My performance improves with the replacement of some of my tasks by AI) which is explained by the model, that is, by the independent variables. In model 1, it is observed that 74.2% (R^2 = 0.742) of the variation of the dependent variable is explained by the independent variables.

Table 14 Model quality measures

Model	*R*	*R square*	*Adjusted R square*	*Std. error of the estimate*	*Change Statistics*					*Durbin-Watson*
					R square change	*F change*	*df1*	*df2*	*Sig. F change*	
1	.861a	0.742	0.535	0.404	0.742	3.59	20	25	0.002	2.015

Notes: a Predictors: (Constant), Do you think that if your company increased the use of AI, recruitment would decrease? Principle of independence, My tasks are easily replaceable by AI], Disadvantage in the use of AI? Risk of tools being transferred to the competition, Advantage in using AI in certain tasks? Data protection, Disadvantage in the use of AI in certain tasks? Longer decision process because more alternatives are explored, Do you think that, regardless of the will of the workers, your company will choose/ increase the use of AI in certain tasks? Effectiveness (doing it well), Do you feel your position as an auditor threatened by the increasing use of AI in the profession?, Do you feel comfortable and prepared for the idea of replacing your tasks with technologies like AI?, Advantage in the use of AI in certain tasks? Support in decision making, Principle of objectivity, Disadvantage in the use of AI in certain tasks? Inhibition of knowledge/development of professional judgment of human workers, Principle of materiality, I perform repetitive tasks in some phases of my work, Advantage in the use of AI in certain tasks? Does it free people to improve already acquired skills, Disadvantage in the use of AI in certain tasks? High cost of construction and maintenance of the system, Do you think the company you work for is prepared for the digital transformation we live?, Principle of full disclosure, Advantage in the use of AI in certain tasks? Allows people to free themselves to develop new skills/challenges.

Source: SPSS Statistics

4.2.3 Model 1 and interpretation of non-standardised regression coefficients

In order to disclose the behaviour between the dependent variable 'My performance would improve with the replacement of some tasks by AI' and the independent variables of this investigation, listed in Section 4.2.1, a model were designed to find a relationship between the dependent variable and the others. Using the SPSS Statistics software, the following outputs were obtained:

Therefore, we can elaborate the respective model:

$$\begin{aligned}\hat{Y} = {} & 1,452 + 0.285x_1 - 0.100x_2 - 0.259x_3 + 0.069x_4 + 0.2905x_5 + 0.254x_6 \\ & + 0.386x_7 + 0.343x_8 + 0.023x_9 - 0.468x_{10} - 0.022x_{11} + 0.310x_{12} - 0.332x_{13} \\ & + 0.255x_{14} - 0.046x_{15} - 0.215x_{16} + 0.899x_{17} - 0.052x_{18} - 0.131x_{19} + 0.121x_{20}\end{aligned}$$

where

x_1 decision making support

x_2 effectiveness – doing well

x_3 allowance of release people to develop new skills

x_4 allowance of release people to develop acquired skills

x_5 data protection

x_6 high system construction and maintenance cost

x_7 inhibition of knowledge/development of professional judgement of human workers

x_8 decision-making process takes longer because more alternatives are explored

x_9 risk of tools being transferred to competitors

x_{10} feels comfortable/ready to replace tasks with AI technology

x_{11} my tasks are easily replaceable by AI

x_{12} I perform repetitive tasks in some phases of my work

x_{13} respect for the principle of full disclosure

x_{14} respect for the principle of independence

x_{15} respect for the principle of materiality

x_{16} respect for the principle of objectivity

x_{17} company prepared for digital transformation

x_{18} feel your position as an auditor threatened when using AI

x_{19} company will choose/increase the use of AI

x_{20} company increases AI utilisation, recruitment would decrease.

β(*Advantage of using IA: decision-making support*) = 0.285

Dichotomous variable (1 = Yes; 2 = No)

It is estimated that the level of agreement (1 = 'strongly disagree'; 2 = 'disagree'; 3 = 'agree'; 4 = 'strongly agree') of the variable: 'My performance improves with the replacement of some of my tasks by AI' may be bigger at 0.285 in the participants who do not consider the use of AI to support decision making. That is, the estimated difference between those who consider that the use of AI supports decision making and those who do not consider that the AI supports decision making, regarding the consistency of its performance improvement with the replacement of some of their tasks by AI, is 0.285.

β(*Advantage in the use of AI: effectiveness – doing well*) = 0.100

Dichotomous variable (1 = Yes; 2 = No)

It is estimated that the level of agreement (1 = 'strongly disagree'; 2 = 'disagree'; 3 = 'agree'; 4 = 'strongly agree') of the variable: 'My performance improves with the replacement of some of my tasks by AI' is higher in 0.1 of the participants who do not consider the use of AI effective. That is, the estimated difference between those who consider that the use of IA is effective and those who do not believe in the idea, concerning performance improvement, is 0.1.

β(*Advantage in the use of AI: it allows freeing people to develop new skills*) =–0.259

Dichotomous variable (1 = Yes; 2 = No)

Table 15 Multiple linear regression model

Model	Coefficients					
	Unstandardised coefficients		*Standardised coefficients*	*t*	*Sig.*	
	B	*Std. error*	*Beta*			
1 (Constant)	–1.452	2.163		–0.671	0.508	
Advantage in using AI in certain tasks? Support in decision making	0.285	0.25	0.192	1.136	0.267	
Advantage in using AI in certain tasks? Effectiveness (doing it well)	0.1	0.208	0.085	0.482	0.634	
Advantage in using AI in certain tasks? Allows people to free themselves to develop new skills/challenges	–0.259	0.251	–0.213	–1.034	0.311	
Advantage in using AI in certain tasks? Allows people to be free to improve skills already acquired	0.069	0.29	0.039	0.237	0.815	
Advantage in using AI in certain tasks? Data protection	0.905	0.528	0.225	1.714	0.099	
Disadvantage in using AI in certain tasks? High cost of system construction and maintenance	0.254	0.228	0.179	1.112	0.277	
Disadvantage in using AI in certain tasks? Inhibition of knowledge/development of professional judgment of human workers	0.386	0.181	0.321	2.133	0.043	
Disadvantage in using AI in certain tasks? Longer decision process because more alternatives are explored	0.343	0.209	0.21	1.644	0.113	
Disadvantage in using AI in certain tasks? Risk of the tools being transferred to the competition	0.023	0.284	0.011	0.079	0.937	
Are you comfortable and prepared for the idea of replacing your tasks with technologies like AI?	–0.468	0.282	–0.287	–1.661	0.109	
My tasks are easily replaceable with AI	–0.022	0.14	–0.027	–0.158	0.875	
I perform repetitive tasks in some phases of my work	0.31	0.125	0.413	2.488	0.02	
Principle of full disclosure	–0.332	0.196	–0.317	–1.689	0.104	
Principle of independence	0.255	0.168	0.282	1.521	0.141	
Principle of materiality	–0.046	0.201	–0.043	–0.231	0.819	
Principle of objectivity	–0.215	0.17	–0.217	–1.261	0.219	
Do you think the company you work for is prepared for the digital transformation we are experiencing?	0.899	0.241	0.632	3.722	0.001	
Do you feel your position as an auditor threatened by the increasing use of AI in the profession?	–0.052	0.186	–0.038	–0.28	0.782	
Do you think that, regardless of the will of the workers, your company will choose/ increase the use of AI in certain tasks?	–0.131	0.297	–0.07	–0.441	0.663	
Do you think that if your company increased the use of AI, recruitment would decrease?	0.121	0.156	0.103	0.776	0.445	

Note: a Dependent variable: my performance would improve with the replacement of some of my tasks with AI.

Source: SPSS Statistics

Comment [a1]: Author: Please indicate where should 'a' be inserted inside the table.

Table 15 Multiple linear regression model (continued)

Coefficients							
		Correlations			*Collinearity statistics*		
		Zero-order	*Partial*	*Part*	*Tolerance*	*VIF*	
1	(Constant)						
	Advantage in using AI in certain tasks? Support in decision making	–0.097	0.222	0.115	0.36	2.778	
	Advantage in using AI in certain tasks? Effectiveness (doing it well)	0.026	0.096	0.049	0.334	2.994	
	Advantage in using AI in certain tasks? Allows people to free themselves to develop new skills/challenges	–0.023	–0.202	–0.105	0.243	4.121	
	Advantage in using AI in certain tasks? Allows people to be free to improve skills already acquired	–0.077	0.047	0.024	0.372	2.686	
	Advantage in using AI in certain tasks? Data protection	0.309	0.324	0.174	0.599	1.67	
	Disadvantage in using AI in certain tasks? High cost of system construction and maintenance	–0.195	0.217	0.113	0.401	2.496	
	Disadvantage in using AI in certain tasks? Inhibition of knowledge/development of professional judgment of human workers	0.221	0.392	0.217	0.455	2.199	
	Disadvantage in using AI in certain tasks? Longer decision process because more alternatives are explored	0.157	0.312	0.167	0.633	1.579	
	Disadvantage in using AI in certain tasks? Risk of the tools being transferred to the competition	0.114	0.016	0.008	0.555	1.802	
	Are you comfortable and prepared for the idea of replacing your tasks with technologies like AI?	0.153	–0.315	–0.169	0.347	2.886	
	My tasks are easily replaceable with AI	0.373	–0.032	–0.016	0.358	2.794	
	I perform repetitive tasks in some phases of my work	0.509	0.445	0.253	0.375	2.67	
	Principle of full disclosure	–0.365	–0.32	–0.172	0.294	3.404	
	Principle of independence	–0.037	0.291	0.155	0.3	3.331	
	Principle of materiality	–0.015	–0.046	–0.023	0.302	3.316	
	Principle of objectivity	–0.109	–0.245	–0.128	0.35	2.856	
	Do you think the company you work for is prepared for the digital transformation we are experiencing?	0.524	0.597	0.378	0.359	2.789	
	Do you feel your position as an auditor threatened by the increasing use of AI in the profession?	0.034	–0.056	–0.028	0.564	1.772	
	Do you think that, regardless of the will of the workers, your company will choose/ increase the use of AI in certain tasks?	–0.01	–0.088	–0.045	0.416	2.406	
	Do you think that if your company increased the use of AI, recruitment would decrease?	0	0.153	0.079	0.584	1.711	

Note: a Dependent variable: my performance would improve with the replacement of some of my tasks with AI.

Source: SPSS Statistics

Comment [a2]: Author: Please indicate where should 'a' be inserted inside the table.

It is estimated that the level of agreement (1 = 'strongly disagree'; 2 = 'disagree'; 3 = 'agree'; 4 = 'strongly agree') of the variable: 'My performance improves with the replacement of some of my tasks by AI' is lower in 0.259 of the participants who do not consider that the use of AI allows workers to develop new skills. In other words, the estimated difference between those who consider that the use of AI allows people to be freed to develop new skills and those who do not regarding performance improvement with the replacement of some tasks by is 0.1.

β (*Advantage in the use of AI: allowance to release people to improve skills already acquired*) = 0.069

Dichotomous variable (1 = Yes; 2 = No)

It is estimated that the level of agreement (1 = 'strongly disagree'; 2 = 'disagree'; 3 = 'agree'; 4 = 'strongly agree') of 'My performance improves with the replacement of some of my tasks by AI' is higher at 0.069 of the respondents who do not consider that the use of AI allows people to have more time to improve acquired skills. That is, the estimated difference between those who that agree with the idea and those who do not, in relation to performance improvement with the replacement of some of its tasks by AI is 0.069.

β (*Advantage in using AI: data protection*) = 0.905

Dichotomous variable (1 = Yes; 2 = No)

It is estimated that the level of agreement (1 = 'strongly disagree'; 2 = 'disagree'; 3 = 'agree'; 4 = 'strongly agree') of the variable: 'My performance would improve with the replacement of some tasks by AI' is 0.905 higher in the participants who do not consider that the use of AI contributes to data protection. That is, the estimated difference between those who consider that the use of AI contributes to data protection and those who do not consider that AI contributes to data protection in terms of the agreement of its performance improvement with the replacement of some tasks by AI is 0.905.

β (*Drawbacks of using IA: high cost of construction and maintenance of the system*) = 0.254

Dichotomous variable (1 = Yes; 2 = No)

It is estimated that the level of agreement (1 = 'strongly disagree'; 2 = 'disagree'; 3 = 'agree'; 4 = 'strongly agree') on the question 'My performance improves with the replacement of some of my tasks by AI' is 0.254 higher in the participants who do not consider that the use of AI has high costs of implementation and maintenance. That is, the estimated difference between those who consider that the use of AI has a high cost of building and maintenance and those who are against this issue, in relation to the agreement of its performance improvement with the replacement of tasks by AI is 0.254.

β (*Disadvantage of using IA: inhibition of knowledge/development of professional judgment of human workers*) = 0.386

Dichotomous variable (1 = Yes; 2 = No)

It is estimated that the level of agreement (1 = 'strongly disagree'; 2 = 'disagree'; 3 = 'agree'; 4 = 'strongly agree') of the subject: 'My performance would improve with the replacement of some of my tasks by AI' is higher at 0.386 in participants who did not

consider that the use of AI has the disadvantage of impeding human workers to develop professional judgements and retract their knowledge. That is, the estimated difference between those who believe in that inhibition and those who not in relation to the consistency of its performance enhancement with the application of AI is 0.386.

β (*Disadvantage in the use of AI: longer decision-making process because more alternatives are explored*) = 0.343

Dichotomous variable (1 = Yes; 2 = No)

It is estimated that the level of agreement (1 = 'strongly disagree'; 2 = 'disagree'; 3 = 'agree'; 4 = 'strongly agree') of the variable: 'My performance improves with the replacement of some of my tasks by AI' is 0.343 higher in the participants who do not consider that the use of AI has this disadvantage. In other words, the estimated difference between those who consider that the use of AI leads to longer decision-making process because more alternative are explored and those who do not consider that AI has this disadvantage, when thinking about performance improvement by the replacement of some tasks by AI, is 0.343.

β (*Disadvantage in the use of AI: Risk of tools being transferred to the competition*) = 0.023

Dichotomous variable (1 = Yes; 2 = No)

It is estimated that the level of agreement (1 = 'strongly disagree'; 2 = 'disagree'; 3 = 'agree'; 4 = 'strongly agree') of the variable: 'My performance improves with the replacement of some of my tasks by AI' is higher at 0.023 in the participants who do not consider that the use of AI presents the risk of the tools being transferred to the competition. That is, the estimated difference between those who consider that the use of AI has the risk transferring the tool to competitors and those who do not, regarding performance improvement, is 0.023.

β (*Do you feel comfortable and prepared for the idea of replacing your tasks with technologies like AI?*) = –0.468

Dichotomous variable (1 = Yes; 2 = No)

It is estimated that the level of agreement (1 = 'strongly disagree'; 2 = 'disagree'; 3 = 'agree'; 4 = 'strongly agree') of the variable: 'My performance improves with the replacement of some of my tasks by AI' is lower at 0.468 in the participants who do not feel comfortable and prepared for the idea of replacing their tasks with technologies such as AI. That is, the estimated difference between those who feel comfortable and those who do not relatively to the concordance of their performance advances with the replacement of some of their tasks by AI is 0.468.

β (*My tasks are easily replaceable by IA*) = –0.022

Quantitative variable (1 = strongly disagree to 4 = strongly agree)

If nothing else changes, for each increase of a unit in the opinion about the substitutability auditors' daily tasks, a decrease in the confidence of their performance is assessed with the replacement of some of their tasks by AI.

β (*Possible to respect the principle of full disclosure*) = 0.310

Quantitative variable (1 = totally possible to 4 = totally impossible)

If nothing else changes, for each increase of a unit in the opinion in view of the possibility of respecting the Principle of total disclosure with the replacement of some tasks in the auditing process, an increase in the confidence of employees' performance improvement is expected to arise.

β (*Possible to respect the principle of independence*) = 0.255

Quantitative variable (1 = totally possible to 4 = totally impossible)

If nothing else changes, for each increase of a unit in the opinion in view of the possibility of respecting the Principle of independence, an increase in the confidence of auditors' performance is expected to improve with the replacement of some of its tasks by AI.

β (*Possible to respect the materiality principle*) = –0.046

Quantitative variable (1 = totally possible to 4 = totally impossible)

If nothing else changes, for each increase of one unit on the opinion given the opportunity to comply with the materiality principle it is estimated a decrease in the confidence of workers' performance improvement with the replacement of some of their tasks by IA.

β (*Possible to respect the objectivity principle*) = –0.215

Quantitative variable (1 = totally possible to 4 = totally impossible)

If nothing else changes, for each increase of one unit on the opinion given the possibility to comply with the principle of objectivity when replacing some tasks of the auditing process by AI, it is estimated that the confidence of employees' performance upgrading decreases.

β (*Do you think that the company you work for is prepared for the digital transformation that we live in?*) = 0.899

Dichotomous variable (1 = Yes; 2 = No)

It is estimated that the level of agreement (1 = 'strongly disagree'; 2 = 'disagree'; 3 = 'agree'; 4 = 'strongly agree') of the dependent variable: 'My performance improves with the replacement of some of my tasks by AI' is higher at 0.899 in the participants who do not consider that the company they work for is prepared for the digital transformation we live in. In other words, the estimated difference between those who consider that the company they work for is prepared for digital transformation and those who do not, in terms of their agreement in performance improvement with the replacement of some tasks by AI is 0.899.

β (*Do you feel your position as an auditor is threatened by the growing use of AI in the profession?*) = –0.052

Dichotomous variable (1 = Yes; 2 = No)

It is estimated that the level of agreement (1 = 'strongly disagree'; 2 = 'disagree'; 3 = 'agree'; 4 = 'strongly agree') of 'My performance would improve with the replacement of some of my tasks by AI' is lower at 0.052 in participants who do not feel their auditor position threatened by the increasing use of AI in the profession. In other

words, the estimated difference between those who feel afraid of losing their positions' importance and those who not when thinking about their performance improvement by AI usage in soe tasks of the audit process is 0.052.

β (*Do you think that, regardless of the workers' will, your company will choose/increase the use of AI in certain tasks?*) = –0.131

Dichotomous variable (1 = Yes; 2 = No)

It is estimated that the level of agreement (1 = 'strongly disagree'; 2 = 'disagree'; 3 = 'agree'; 4 = 'strongly agree') of the variable: 'My performance improves with the replacement of some of my tasks by AI' is lower in 0.131 among participants who do not consider that, regardless of the workers', their company will choose/increase the use of AI in certain tasks. That is, the estimated difference between those who consider that, regardless workers opinion, 'their company will use AI sooner or later in certain tasks and those who do not is 0.131.

β (*Do you think that if the company increased the use of AI the recruitment would decrease*) = 0.121

Dichotomous variable (1 = Yes; 2 = No)

It is estimated that the level of agreement (1 = 'strongly disagree'; 2 = 'disagree'; 3 = 'agree'; 4 = 'strongly agree') of the variable: 'My performance improves with the replacement of some of my tasks by AI' is 0.121 higher in participants who do not consider that if their company increases the use of AI, recruitment would decrease. That is, the estimated difference between those who consider recruitment decrease as a consequence of AI usage increase and those who not is 0.121.

Constant

$\beta 0 = –1.452$

If all explanatory variables have a value of zero, the estimated value of agreement on performance improvement with the replacement of some tasks by AI is 1.452, that is, disagreement.

4.2.4 F-test for model suitability

Test hypotheses:

H0 the linear model is not suitable.

Ha the linear model is suitable.

Test results:

Model 1

F (20, 25) = 3.590, p = 0.002 (or p < 0.001).

Decision: p < 0.05, then H0 is rejected.

The outputs from SPPS Statistics are presented in Table 16.

Interpretation of test results and adjusted R^2:

The linear model is statistically significant [F (20, 25) = 3.590, p < 0.001)].

Model 1 explains 53.5% of the variation in the variable: 'My performance improves with the replacement of some of my tasks by AI' (adjusted $R^2 = 0.535$).

Table 16 Model suitability

ANOVA						
Model		*Sum of squares*	*df*	*Mean Square*	*F*	*Sig.*
1	Regression	11.739	20	0.587	3.59	.002b
	Residual	4.087	25	0.163		
	Total	15.826	45			

Notes: a Dependent variable: considering the scale below, mark (X) from 1 to 4 your opinion regarding the following statements: (My performance would improve with the replacement of some of my tasks with IA).
b Predictors: (constant), do you think that if your company increased the use of AI, recruitment would decrease?, Considering the audit principles presented below, please indicate (x) how possible it is to respect them in the presence of AI when performing tasks: (Principle of independence), Considering the scale below, please tick (X) from 1 to 4 your opinion regarding the following statements: (My tasks are easily replaceable by AI), What are the two main DISADVANTAGES in using AI in certain tasks? Risk of tools being transferred to the competition, What are the two main ADVANTAGES in the use of AI in certain tasks? Data protection, What are the two main ADVANTAGES in the use of AI in certain tasks? Longer decision-making process because more alternatives are explored, Do you think that, regardless of the will of the workers, your company will choose/ increase the use of AI in certain tasks? What are the two main ADVANTAGES in the use of AI in certain tasks? Effectiveness (doing it well), Do you feel your position as an auditor threatened by the increasing use of AI in the profession?, Do you feel comfortable and prepared for the idea of replacing your tasks with technologies like AI?, What are the two main ADVANTAGES in the use of AI in certain tasks? Support in decision making, Considering the audit principles presented below, please indicate (x) how possible it is to respect them in the presence of AI in the execution of tasks: What are the two main ADVANTAGES in the use of AI in certain tasks? Inhibition of knowledge/development of professional judgment of human workers, Considering the audit principles presented below, check (x) how possible it is to respect them in the presence of AI in the execution of tasks: (Principle of materiality), Considering the scale below, mark (X) from 1 to 4 your opinion regarding the following statements: (I perform repetitive tasks in some phases of my work), What are the two main ADVANTAGES in using AI in certain tasks? It frees up people to improve skills already acquired, What are the two main ADVANTAGES in the use of AI in certain tasks? High cost of system construction and maintenance, Do you think the company you work for is prepared for the digital transformation we live in?, Considering the audit principles presented below, please indicate (x) how possible it is to respect them in the presence of AI in the execution of tasks: What are the two main ADVANTAGES in the use of AI in certain tasks? Allows to free people to develop new skills/challenges.

Source: SPSS Statistics

Comment [a3]: Author: Please indicate where should 'a' be inserted inside the table.

4.2.5 Correlation analysis

In the analysis of the correlation between the variables of the statistical model, the Pearson correlation coefficient is used. This measure of association is used to measure the

intensity of linear correlation between quantitative variables and results range from –1 to 1 – the closer the results to these values, the greater the relationship between the variables. Pearson correlation coefficient, namely *r* in this investigation, has the following meanings:

- *r* = 1: means a perfect positive correlation between the two variables.
- *r* = –1: means a perfect negative correlation between the two variables – that is, if one increases, the other always decreases.
- *r* = 0: means that the two variables do not depend linearly on each other. However, there may be a nonlinear dependency. Thus, the result r = 0 must be investigated by other means.

Hypotheses:

H0 the Pearson correlation coefficient is equal to zero, that is, there is no linear relationship between the variables (R Pearson = 0).

HA the Pearson correlation coefficient is different from zero, that is, there is a linear relationship to the dimensions under analysis (R Pearson ≠ 0).

Decision rule:

Do not reject H0 if sig> α = 0.05.

Reject H0 and accept Ha if sig ≤ α = 0.05.

4.2.5.1 Results and conclusions (attachment B)

It was observed that there is a moderate and positive linear correlation between 'My performance improves with the replacement of some of my tasks by AI' and the quantitative variable: 'My tasks are easily replaceable by AI' (*r* = 0.373, p-value = 0.005) ≤ 0.05 (accepts the alternative hypothesis, that there is a linear correlation), that is, when, on average, the agreement with 'My performance improves with the replacement of some of my tasks by AI' increases the agreement with 'My tasks are easily replaced by AI'. Moreover, we can conclude that there is a moderate and positive linear correlation between 'My performance improves with the replacement of some of my tasks by AI' and the quantitative variable: 'I perform repetitive tasks in some phases of my work' (*r* = 0.59, p-value = 0.001) ≤ 0.05 (accepts the alternative hypothesis, that there is a linear correlation), that is, when, on average, the agreement with 'My performance improves with the replacement of some of my tasks by AI' increases the agreement with 'I perform repetitive tasks in some phases of my work'. Also, there is a moderate and negative linear correlation between 'My performance improves with the replacement of some of my tasks by AI' and the quantitative variable: 'Principle of total disclosure' (*r* = –0.365, p-value = 0.006) ≤ 0.05 (accepts the alternative hypothesis, that there is a linear correlation), that is, when, on average, the agreement with 'My performance improves with the replacement of some of my tasks by AI' reduces the possibility of respecting the 'principle' of full disclosure. There is a moderate and negative linear correlation between 'My performance improves with the replacement of some of my tasks by AI' and the quantitative variable: 'principle of total disclosure' (*r* = –0.365, p-value = 0.006) ≤ 0.05 (accepts the alternative hypothesis, that there is a linear correlation), that is, when, on

average, the agreement with 'My performance improves with the replacement of some of my tasks by AI' reduces the impossibility of respecting the 'principle' of total disclosure (1 = totally possible to 4 = totally impossible). It was observed that there is no linear correlation between 'My performance improves with the replacement of some of my tasks by AI' and the quantitative variable: 'principle of independence' (r = –0.037, p-value = 0.403) > 0.05 (does not reject the null hypothesis, that there is no linear correlation). We can see that there is no linear correlation between 'My performance improves with the replacement of some of my tasks by AI' and the quantitative variable: 'principle of materiality' (r = –0.015, p-value = 0.461) > 0.05 (does not reject the null hypothesis, that there is no linear correlation). Finally, from the SPSS output we can assume that there is no linear correlation between 'My performance improves with the replacement of some of my tasks by AI' and the quantitative variable: 'principle of objectivity' (r = –0.109, p-value = 0.236) > 0.05 (does not reject the null hypothesis, that there is no linear correlation).

5 Conclusions and discussion

This section aims to summarise the findings and results based on the data collected and analysed in the sections above mentioned, validating the achievement of the proposed objectives and goals. It starts by presenting a general overview of what the investigation brings to the table, and then shows a quick debrief for each RQ. Furthermore, the limitations concerning this research will be introduced and synthesised, providing, moreover, individual recommendations and guidelines for future investigations.

5.1 General conclusions and findings

Majorly considering operational ranks of Portuguese service provider companies, this research concluded that this like a mixed feelings approach regarding the implementation of AI in strategic business management. When looking merely to accounting firms, auditors' opinion about the issue also reveals reluctance of acceptance to this technology, even agreeing with performance improvement by replacing some tasks by AI. In general, the main drivers of this standing back with the tool are related with the lack of knowledge about its benefits, the costs associated with implementation and the aversion to technological change and, finally, the fear that unemployment increases.

RQ1 Are companies aware and prepared for digital transformation?

The first RQ intended to acquire a global outlook about digital technologies and its boom across years, debriefing around its usage in companies and all the hope around it to expand business models. In this regard, both the literature review and the online survey highlighted that there is clearly a room for improving digital transformation companies' consciousness and approval.

With this investigation we find that it is a consensus that digital transformation has a huge impact both inside and outside the company, with a special emphasis when talking about process improvement and development and growth of the business. This said, company's awareness of the impact of AI is recognised and converges in terms of operational progresses, influencing not the employees and the strategy defined but also client satisfaction with the products/services offered.

RQ2 How can and how is AI being applied in business strategy?

The second research question aimed to point out AI as one of the trendiest technologies and understand its concept, as well as its advantages and implications.

Efficiency in both doing fast and well sides are pointed as the two principal advantages of AI usage, followed by the allowance of release people to develop new skills and decision-making support. This shows that employees are aware of the value creation generated by machinery in their daily well-being at work, not only in terms of productivity but also in new challenges acceptance, crucial for professional grow.

Measure and predict AI acceptance is a sizeable task, not only because of the intrinsic subjectivity involved but also because each person has specific thoughts and formulates different opinions, making the topic rather complex. Despite this, our study brings relevant data to understand the conditioners influencing employee's mind-set towards AI machinery.

Concluding, our findings about companies' awareness and usage of AI present disinformation and/or misinformation about AI implementation and opportunities. Giving the sensivity and reluctance about change, specifically technological change, in business models that work without it for years, it is important to improve the communication about AI and its benefits.

RQ3 What are the auditing firms' approaches to grab new opportunities resulting from using AI in auditing?

The last RQ of this investigation looked for an analysis of the role of AI in auditing and auditors' job and how it can improve project management efficiency and customers' value creation. Moreover, it searched for empirical data collection regarding accounting company's knowledge about AI implementation as well as the drawbacks and concerns influencing the acceptance and use of this innovative technology.

Precisely looking for auditing, our study found that auditors perform repeatable tasks in some phases of the job which can be replaceable by AI machinery. This opens doors to an entire revolution in the auditing process, improving auditor's performance by given that it is not necessary to perform the least challenging and routine tasks, thus closer to audit reports quality improvements. We found with our investigation that auditors do believe in their performance improvement with the replacement of some tasks by AI.

5.2 Discussion

Innovating business models with the implementation of digital tools is nowadays a successful decision for companies that choose this route. Facing an increasingly digital business strategy has been one of the main factors for creating value in an organisation and optimising its processes. Grover and Kohli (2013) are just one of many examples of researchers who have been evaluating for a few years the positive impact that digital transformation is having on the results of organisations that have transformed their business models and that attend the era we live in. It is important to note that, in competitive means, (Ziyadin et al., 2019) mentioned that this must be a step to be taken and that it will have an influence both inside (business strategy) and outside (customers) of a company – allowing it to stand out and survive in the marketplace. However, as we can see from the findings of this investigation, unlocking human potential through digital processes is still not seen as an essential and inevitable phenomenon. Talking about

digital transformation today still seems redundant and, if we look at tools like AI in particular, the obstacles that companies face for their adoption surpass the relevance they can associate with it (Ziyadin et al., 2019). This leads us to question how the idea of replacing human intelligence with AI is reaching companies and how its implementation is sold, since there are few real cases in the Portuguese industry of business models adapted to this trend – there seems to be a scarcity of investigation around AI machinery and its effective application in a company. If we consider the different sectors in which the use of this type of machinery points to a promising future, as proposed by Kaivo (2015), and the effective AI usage rate, doubts are further deepened.

The awareness about AI advances seems to be solid and employees, in general, do feel comfortable about the idea of replacing specific tasks by automatic machinery, but real cases of companies that implement it are almost null. Fear is associated to costs implementation and maintenance, lack of knowledge about the tool and aversion technological change (mainly related with unemployment) – and this is shameful when living a peak era of digital world that will not decrease anymore. In order to predict and improve a truthfully acceptance of a technology by an individual, we have to transmit a deep understanding about that technology when selling the idea to the employee and also meet the individual in terms of stimulus's, attitudes and prospects. A disruptive technology is more likely to substantially change an entire market, breaking routines, which involves switching costs that sometimes and for some individuals, can be more relevant, than the actual beneficial added value of that technology. The more informed the employee is about the replacement of human intelligence by AI in specific tasks, the more likely he is to accept and have a well-structured opinion and position towards its approval and usage, making it less volatile.

AI usage in business in general and in auditing in specific is raising at a dizzying speed (Moll and Yigitbasioglu, 2019). However, there are still several tasks which require human intervention, namely those involving critical judgements and/or approvals impossible – until now – to achieve with machinery. By now, this technology is majorly used in tasks that AI can learn by doing and that do not require psychological evaluations. However, convincing auditors that their job position does not become less relevant with machinery support – on the contrary it promises to significantly improve its importance in riskier approaches – keeps to be a challenge and there seems to be confusion about which phases of the audit should AI be applied and which tasks are replaceable or not. Again, the problem appears to be related with the way this idea is bid, revealing poor case studies of real implementation.

5.3. Limitations

Along the elaboration of this investigation some limitations have to be underlined and will be detailed below.

First of all, it is important to notice that unclear definitions were identified in the literature review, given the subjectivity of the topic and the meanings underlying. The issue under study is a concept considerably broad, leading to many different interpretations. Most of the studies around digital transformation and the usage of AI are even inconclusive and transmit contradictory ideas that cannot find an equilibrium between the advantages and disadvantages of human intelligence replacement. Also, there are still no reasoned disclosures concerning where to apply AI – the only consensus is that in a company it must start in tasks that were firstly performed manually and are

now already executed by digital tools. Going more deeply, it is a fact that the concept of AI application in auditing is a developing and emerging concept and there are still few practical cases embracing the idea.

Moreover, we must consider limitations in the sample from the online survey. From the 200 initial respondents only 135 were eligible for our study, meaning that it turned out to be little diversified in terms of target population. The investigation was conducted mainly in the Portuguese market and thus it is not applauded to extrapolate the data to a global analysis and conclusions. Another limitation arises from respondents' job, given the representativity of service providers and health care market members – a bigger and more diversified sample would let us have a more general view of AI usage globally. The last focus of our RO concerning auditors' position towards AI application and digital transformation has not been also achieved in the best way, given not only the reduced sample of accounting firms' employees but also the presence in weight of the company *EY* in that niche.

Finally, it is crucial to point out that all subjects in this research arise from the service provider's side and, therefore, the service receiver's side was not explored, which can hide an important and decisive element for the adoption of digital tools such AI in a company.

5.4 Contributions to management and recommendations for future research

This investigation is a good resource for management in general and as also good contributions for the technology industry. It underlines the importance of employees' point of view when pondering the impact and comfortability of introducing a specific digital tool in a company, namely AI in this study. Transforming business models and adopt a digital business strategy passes not only to think about results in terms of market achievements but also in stands of an adequate management strategy to do so in a sustainable way for the entire organisation. The effective implementation of this machinery in Portuguese companies is still poorly explored and changing business practices will for sure take place in the short term. To do so there is an urgent need to adapt to this new paradigm and so technology developers can use this investigation as a guide to stab the market.

To surpass the limitations above mentioned it must be important to, at a first glance, extend this study to a significant sample from each sector of potential markets. By doing so and given the complexity and reluctance of implementing machinery in companies, it will be important to first define which market to sell the idea first.

Deeply development and clearing of the existing literature can also support the vague knowledge of future AI users about the tool and its benefits, focusing more on real and concrete cases of success which already took the step. Even the authors argue about the complexity of the topic given the absence of coherence about the effective implementation of machinery instead of human beings in specific tasks – mainly how, where, and why to use it. Employees' fear of using AI stays around implementation and maintenance costs, as well as mistrust about being replaced by robots.

Summing up and going more deeply, it would be critical to make a richer approach about the effects of implementing AI in specific tasks of jobs who can take advantage of it. Considering auditing companies, there is a unanimity around the benefits of applying such machinery in the audit process, the shortage of information appears again when thinking about how to go through it and in which phases of the audit to apply. The key

point of investigation needs to impact organisations' mind-set towards the implementation of AI in strategic business management.

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