



**AUDITORS' PERCEPTIONS OF ARTIFICIAL  
INTELLIGENCE: EVIDENCE FROM GLOBAL AUDIT  
COMPANIES**

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Thesis for the Master's Program in Financial Economics

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## ETHICAL DECLARATION

I hereby declare that I am the sole author of this thesis and that I have conducted my work in accordance with academic rules and ethical behaviour at every stage from the planning of the thesis to its defence. I confirm that I have cited all ideas, information and findings that are not specific to my study, as required by the code of ethical behaviour, and that all statements not cited are my own.



Name, Surname:

Date:

Signature:

# ABSTRACT

## AUDITORS' PERCEPTIONS OF ARTIFICIAL INTELLIGENCE: EVIDENCE FROM GLOBAL AUDIT COMPANIES

Şen, Yağmur

Master's Program in Financial Economics

Advisor: Prof. Dr. Cumhuri Coşkun Küçüközmen

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Recent technological advancements have made it clear that the audit industry must change and transform its processes by establishing a technology-based foundation for its operations. This dissertation uses a survey of the auditors working for the top four audit firms to examine the current state of artificial intelligence applications in Turkey's audit industry and the attitudes of the auditors toward this topic. Descriptive statistics were used to analyze survey responses from auditors, and chi-square analysis was used to look at how the questions and variables related. As a result, it was discovered that global audit companies in Turkey use artificial intelligence platforms in their processes and that auditors generally view these systems favorably. The attitudes of the auditors who participate in artificial intelligence-assisted audits in Turkey are revealed in this study for the first time.

Keywords: Artificial Intelligence, Machine Learning, Audit, Auditor, Fraud.

# ÖZET

## DENETÇİLERİN YAPAY ZEKÂYA İLİŞKİN ALGILARI: KÜRESEL DENETİM ŞİRKETLERİNDEN BULGULAR

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Son dönemde yaşanan teknolojik gelişmeler, denetim sektörünün faaliyetlerini teknoloji tabanlı temeller üzerine oturtarak süreçlerini değiştirme ve dönüştürme gerekliliğini ortaya çıkarmıştır. Bu tez, Türkiye'de denetim sektöründeki yapay zekâ uygulamalarının mevcut durumunu ve denetçilerin bu konudaki tutumlarını dört büyük denetim şirketlerinde faaliyet gösteren denetçilere anket uygulayarak ortaya koymayı amaçlamaktadır. Denetçilerin anket cevapları betimsel istatistiklerle, sorular ile değişkenler arasındaki ilişki ki-kare analizi ile incelenmiştir. Sonuç olarak, yapay zekâ platformlarının Türkiye'deki küresel denetim şirketlerinin süreçlerine dahil edildiği ve denetçilerin genel olarak yapay zekâ platformlarına olumlu baktığı gözlemlenmiştir. Türkiye'de yapay zekâ destekli denetimlere katılan denetçilerin tutumları ilk kez bu çalışmada ortaya konulmuştur.

Anahtar Kelimeler: Yapay Zekâ, Makine Öğrenmesi, Denetim, Denetçi, Hile.

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## **LIST OF ABBREVIATIONS**

ACFE: Association of Certified Fraud Examiners  
AICPA: American Institute of Certified Public Accountants  
CEDA: Critical Event Detection Analysis  
CEO: Chief Executive Officer  
CFO: Chief Financial Officer  
CPS: Cyber-Physical Systems  
ERP: Enterprise Resource Planning  
EY: Ernst&Young  
GAAP: Generally Accepted Accounting Principles  
GAAS: Generally Accepted Auditing Standards  
GDP: Gross Domestic Product  
GPS: Global Positioning System  
GSE: Ghana Stock Exchange  
GSM: Global System for Mobile Communications  
IBM: International Business Machines  
IoS: Internet of Services  
IP Code: International Protection Code  
IT: Information Technology  
KPMG: Klynveld Peat Marwick Goerdeler  
PLS-SEM: Partial Least Squares Structural Equation Modeling  
PwC: PricewaterhouseCoopers  
RFID: Radio Frequency Identification  
SAIs: Supreme Audit Institutions  
SEC: Securities and Exchange Commission  
TOPSIS: The Technique for Order of Preference by Similarity to Ideal Solution  
USA: United States of America  
UTAUT: Unified Theory of Acceptance and Use of Technology

## **CHAPTER 1: INTRODUCTION**

With the expansion of sectors and the increase in activities in the business world, economic developments continue to increase day by day. Every business wants to build its own systems on solid foundations and maintain their existence forever. At this point, the existence of strong accounting systems and internal control systems within a business would provide a positive differentiation from other companies in terms of maintaining its competitiveness. For the accounting systems and internal control systems of enterprises to work flawlessly, a quality audit system must exist. At this point, the importance of auditing and auditors becomes clear.

In order for the audit process to proceed successfully, it is necessary to take advantage of the power of existing technological equipment. Technological developments lead to changes in the audit sector as well as in many other sectors. In parallel with technological developments, the adaptation of artificial intelligence (AI) platforms to the processes in the audit sector has also been a major topic. Deloitte, KPMG, PwC, and Ernst & Young, which are named as The Big Four international audit companies, have been more successful than small-scale audit companies in adapting artificial intelligence to their processes.

The Big Four auditors, who used artificial intelligence platforms in their operations, made up the research population at this point. Within the context of the research questions "What is the current status of the use of artificial intelligence in audits in Turkey?" and "Why is artificial intelligence used in audits?" questionnaire questions were put to the auditors in this study by fostering a discussion environment.

"In many countries, surveys have been conducted to evaluate the attitudes of the auditors toward computer-assisted audit tools and techniques (CAATTs) and the adaptation of artificial intelligence to the audit process," is the passage from the literature that will fill the gap and set this study apart from the others. Additionally, studies about digitalization and Industry 4.0 applications are being conducted in Turkey with the participation of auditors and accountants. There is, however, no study

in Turkey that asks survey questions of the big four auditors who use AI platforms in their operations. In this sense, the study is novel.

The literature also contains studies on fraud detection. Artificial intelligence algorithms have been used to create fraud detection models, and fraud prevention research has been done. However, no study has been conducted in Turkey that asks survey questions of the auditors about using artificial intelligence to spot and stop fraud during the audit process. This study enhances the audit industry while also adding to the body of literature.

This thesis develops a conceptual framework for the foundations, goal, and ethics of auditing in Chapter 3. Additionally, the chapter discusses fraud and provides information on accounting scandals. The third chapter also covers applications of artificial intelligence (AI) in the big four audit corporations.

In Chapter 4, first the purpose and importance of the research are mentioned, then the research question and research model are formed, and finally the general method and scope of the research are mentioned.

In Chapter 5, the answers given by the auditors to the survey questions were analyzed with descriptive statistics, and the relationship between the questions and the variables was examined by chi-square analysis.

The comparison of the analysis and the studies in the literature, as well as the similarities and differences between the two, were covered in Chapter 6. The results of this study were also disclosed, even though they weren't in the literature. The views of the Turkish auditors actively engaged in audits utilizing artificial intelligence on this matter are crucial for the sector and audit firms. This study adds to the body of knowledge and the audit industry in Turkey in this context. The results might show that businesses need to work on improving their processes by acting in accordance with the auditing process.

The issues that needed to be changed and transformed within the sector and audit firms were evaluated and recommendations were made in Chapter 7 in accordance with the study's findings.



## CHAPTER 2: LITERATURE REVIEW

In this section, the use of artificial intelligence in audit processes, which forms the basis of the research question, is discussed, and the studies in this field in the literature are briefly evaluated. Computer-Assisted Audit Tools and Techniques (CAATTs) have become an important part of the accounting and auditing industry with the support of artificial intelligence.

With the aim of increasing the effectiveness and efficiency of inspections with the support of CAATTs and AI, the studies in the literature are as follows:

Awuah, Onumah, and Duho (2021) created a conceptual model called TOE for the adoption of computer-assisted audit tools and techniques (CAATTs) in internal audit units. TOE stands for technology, organization, and environment. Internal audit units from large Ghanaian companies on the GSE and the Ghana Club 100 were used as a sample. A total of 75 companies were analyzed. PLS-SEM was applied as a method. The findings are that while companies in Ghana have adopted the tools and techniques, the use of certain resources is still limited, but the adoption rate of CAATTs is above average. The low actual use of CAATTs in risk assessment, fraud detection, the performance of analytical procedures, and substantive testing are key findings of this study. In addition, as a result of the study, it was stated that the innovation of the head of the internal audit unit did not have a significant effect on the adoption of CAATTs.

Bierstaker, Janvrin, and Lowe (2014) investigated the factors affecting auditors' use of CAATTs. They modified a model called the UTAUT to fit the financial audit concept. They analyzed data from 181 auditors working at the Big Four and other audit firms. They determined nine CAATT usage areas and asked the participants to choose an audit for a client with highly computerized financial reporting systems. Participants stated whether these 9 CAATTs were used under the supervision of the company they chose. As a result of the evaluation of the options from 1 to 7, the average answer was determined to be 5.3. According to the authors, CAATTs allow them to test 100% of the population. They also mentioned that the latest auditing standards led them to adopt CAATTs to increase the effectiveness and efficiency of audits. Four hypotheses have been developed: performance expectation, effort expectancy, social influence, and



facilitating conditions would all positively affect the use of CAATTs. However, according to their conclusion, auditors couldn't use CAATTs systematically and frequently. One of the findings shows that training programs should be developed to increase the use of CAATTs. Another study shows that auditors working in the "big four" were significantly more likely to provide higher ratings for performance expectations and facilitating conditions than auditors working in small audit firms.

Mansour (2016) investigated which factors would affect the adoption and acceptance of CAATTs by surveying external auditors operating in Jordan. The research question was "which factors will affect the attitudes of external auditors operating in Jordan to adopt and use CAATTs in the audit process?" Multiple regression analysis was used to test the research hypotheses. The analysis concludes that the intention of Jordanian external auditors to use CAATTs stems from both the auditor's performance expectations and the firm's facilitating conditions issues.

Shihab et al. (2017) aimed to explore the adoption of CAATTs in public accounting firms. The research model was adapted from the Technology Acceptance Model (TAM). A total of 141 samples of data were collected from various companies, and 11 factors were tested. The data was gathered using a questionnaire, which the auditors were given. Statistical analysis was performed with the PLS-SEM technique. The results provide empirical evidence for the adoption of CAATTs in public accounting firms. In this research, it is seen that behavioral intention, perceived usefulness, and perceived ease of use directly affect In addition, technological complexity and computer self-efficacy affected perceived ease of use. As a result, this situation showed that both perceived ease of use and perceived usefulness affect behavioral intention at the same time. As a result of the research, the authors recommended that for the adoption of CAATTs in the audit industry, auditors should have sufficient knowledge and training to increase their skills.

Siew, Rosli, and Yeow (2020) investigated whether to explain the adoption of CAATTs in Malaysia based on the technology, organization, and environment frameworks. Since it was known that the use of CAATTs was more common in developed countries, they wanted to contribute to the literature in this way by working

in an underdeveloped country such as Malaysia. Questionnaires were distributed to audit firms operating in Malaysia, and responses were received from 158 firms. Analysis was done with the PLS-SEM technique. The results showed that the complexity of information systems and the perceived level of support of accounting organizations were influential in the adoption of CAATTs. In addition, it was found that the IT competence of the employees, the commitment of the senior management, and the size of the firm were effective in the adoption of CAATTs. Conversely, the complexity of CAATTs didn't significantly affect their adoption. In addition, this study concluded that, unlike other studies, competitive pressure was not important in the adoption of CAATTs.

In their study, Braun and Davis (2003) aimed to gather information about their experience with Generalized Audit Software (GAS) tools, a type of CAATT. While there were two types of GAS tools used by the participants, these were Audit Command Language (ACL) and Interactive Data Extraction and Analysis (IDEA). Since ACL was seen as the leader in this market, the survey study was about collecting information about the audit conducted by ACL from 90 auditors operating in the state. The surveyed groups thought that ACL increases efficiency and productivity but that all the advantages the software offers were not realized. In addition, the auditors using this application think that improvements should be made in the documentation applications. Although the auditors generally thought that this system was comfortable, they stated that they had trust problems in designing complex commands and defining input files. In addition to all these, although few auditors saw themselves as well educated, they stated that they thought the training they received was valuable and that additional training would be more beneficial.

Ahmi and Kent (2013) conducted a study on the use of Generalized Audit Software (GAS) in audits by external auditors in the UK. Unlike other studies, they chose small and medium-sized audit firms instead of the Big Four auditors. They developed a framework for the GAS application and collected the responses from 205 auditors operating in the UK through the questionnaire. Looking at the results of the research, it was revealed that the use of GAS among audit firms operating in the UK was very low. The most important finding of the study was that approximately 73 percent of the

sample of auditors preferred traditional manual audit methods instead of using GAS, as auditors thought that the benefit of using GAS in audits was limited.

Thottoli and Ahmed (2022) aimed to develop and test four hypotheses to test the relationship between technology adoption, technological challenges, perceived usefulness, and ease of use with audit practices. A questionnaire was applied to 321 auditors operating in India. Analysis was performed with the PLS-SEM technique. The findings showed that there was a significant and positive relationship between audit practice and technology adoption, technological challenges, and ease of use. It was concluded that there was a negative relationship between audit practice and perceived usefulness.

Purnamasari, Amran, and Hartanto (2022) investigated the tendency of auditors operating in the Indonesian public sector to use CAATTs in their audit processes. Hypotheses have been developed regarding performance expectancy, social impact, and effort expectancy's intention to use CAATTs. Survey questions were directed to 225 public auditors in West Java, East Java, and Central Java. Analysis was performed with the PLS-SEM technique. According to the findings, performance expectations and facilitating conditions encourage auditors to use CAATTs in the audit process. It is intended to contribute to the literature, as an inference about emerging markets will be obtained for government auditors' intentions to use CAATTs. It is also important that the use of CAATTs in the public sector receive a positive attitude from auditors, as it signals strong support from the government.

Pedrosa, Costa, and Aparicio (2019) developed a model for the adoption of CAATTs. Quantitative research was conducted, and survey questions were asked of the auditors. The findings of the study were that the facilitating conditions, effort expectancy, perceived usefulness, and the number of auditors of CAATTs were the main drivers of use and adoption of CAATTs in the audit industry. The most important aim of this study was to contribute to the literature by revealing the factors affecting the adoption and use of CAATTs and the possible connection between the use of CAATTs and their individual benefits.

Issa, Sun, and Vasarhelyi (2016) divided the audit into seven processes and prepared the possible contributions of artificial intelligence in these processes as a suggestion. Due to the increase in artificial intelligence technologies, the importance of applying deep learning technologies such as visual recognition, natural language processing, audio processing, and text analysis to auditing is mentioned. It is mentioned that the video recognition technique will facilitate the detection of fraud and inventory controls. An example of this is inventory footage taken by drones. It is also mentioned that this technique can be used for the analysis of the company's revenues and the number of customers. With the natural language processing method, a model will be developed, and the classification will be made by dividing the companies into two groups: fraudulent and non-fraudulent. As a result, firms identified as fraudulent will be subject to effective scrutiny by auditors skilled in identifying problematic accounts. In addition, with this model, auditors will analyze posts and comments on Facebook and Twitter to obtain audit evidence. With the sound processing model, auditors will be able to reach a judgment and present audit evidence with the voices recorded from the phone and interview opinions. This study is a recommendation and does not provide concrete data on the contribution of artificial intelligence to auditing.

Khan, Adi, and Hussain (2020) aimed to develop an artificial intelligence (AI) auditing tool. In the first stage, five organizations were handled, and manual audits of these organizations were carried out, and degrees were given to these organizations under the name "conformity score." At the same time, scores were assigned for the audit of the same organizations by the AI audit tool. In order to determine the effectiveness and efficiency of the artificial intelligence audit tool, the results of the artificial intelligence and human auditors were compared. It has been concluded that the AI audit tool is 95% effective compared to a human auditor, while at the same time its efficiency is increased by 92%.

Tiron-Tudor and Deliu (2021) used a qualitative analysis of the academic literature and professional reports of the big four and internationally recognized organizations. As a research question, which audit tasks were more suitable for algorithms than humans, and the strengths and weaknesses of algorithms compared to humans, were discussed. The results discuss the dichotomy between algorithms and human-based

actions, highlighting the emergence of artificial intelligence in auditing and giving real-life examples of their use in auditing. For future research, it is suggested to experimentally test how artificial intelligence technologies will affect audit activities and the audit profession.

According to Abbasi et al. (2012), the aim of this study was to develop a framework for detecting financial fraud using publicly available information about firms. In the study, a new meta-learning framework, MetaFraud, was developed for advanced financial fraud detection. In this context, an experiment was conducted involving thousands of fraudulent and legal firms. The results concluded that they contributed significantly to the overall effectiveness of the framework. Experiments concluded that the meta-learning framework was effective in detecting financial fraud.

Wyrobek (2020) aimed to prepare a model for financial irregularities in companies. This model has been developed based on financial statements. The results of the research showed that artificial intelligence and machine learning algorithms can recognize and detect such fraud patterns. In this study, the most important accounting scandals that occurred in the 20th century were examined within the scope of 54 companies registered on Wikipedia. The financial statements of these 54 companies were examined. They matched these companies with a group of 58 honest companies of similar size and operating in a similar industry. The results obtained were differentiated based on gross margin and net profit. It has been concluded that unfair companies have high gross profit margins, low net profits, and these companies pay less tax than honest companies.

Wongpinunwatana, Ferguson, and Bowen (2000) developed a model by investigating the relationship between task technology compliance of audits performed with artificial intelligence systems and user performance. In doing so, four questionnaires, two problem-solving programs, and four artificial intelligence control systems were developed. An experiment was conducted with 292 undergraduate students in the audit department. There are two-level task types and two-level artificial intelligence techniques in the experimental design. Artificial intelligence techniques are rule-based reasoning (RBR) and case-based reasoning (CBR). According to the results of the

research, task technology compatibility affects the performance of novices in problem-solving.

Tarek et al. (2017) aimed to investigate the effect of IT applications on the audit profession in Egypt by surveying 112 auditors working in three of the big four audit firms. In this context, they developed four hypotheses and tested them. The hypotheses are whether the use of technology in auditing and the importance of IT in auditing will vary according to the type of audit firm and the level of technology adoption by the client. Hypotheses were tested with the Mann-Whitney test. One of the findings was that the use of new audit practices was significantly affected by the IT expertise of the auditors. Another was that the auditors' perception of the client's IT was not affected by control risk.

Hooda, Bawa, and Rana (2020) conducted a case study on public companies for their study. They created a framework by collecting annual data from 777 companies from 14 different sectors. The performance of this group was compared with the preliminary group, and the model with the higher TOPSIS score was recorded. At the end of "n" iterations, the last community with the highest performance score was the winning community. The performance of the generated ensemble is tested using the K-fold cross-validation technique. This group is used in a Fake Firm Prediction Web Application to predict high-risk firms. The purpose of the research is to assist auditors by constructing a classification model that can predict fraudulent firms based on risk factors.

Hooda, Bawa, and Rana (2018) conducted a case study at an external audit firm to explore the usefulness of machine learning. They were interested in the data of 777 companies from 14 different sectors. Annual data of these companies were collected. Some risk factors were listed by comparing different classification models. These factors were categorized and a phenomenon called Audit Risk Score (ARS) emerged. As a result of the evaluation, the company with a high ARS score was called a fraudulent company, and the company with a low ARS score was called an honest company. As a result of the study, it was mentioned that with the growth of financial fraud cases, machine learning was important in improving the quality of future audits.

Farrokhi et al. (2020) examined the role of artificial intelligence in detecting crises in a firm. The model developed to detect critical events is the CEDA model. The model was tested with 150 people, mostly Enron's senior executives, from 1999 to the 2001 crisis. Since e-mail was known to be the most widely used tool, the model helped companies calculate the number of e-mails sent and e-mails received in the last three years before Enron's bankruptcy. As a result of the research, they revealed the possibility of detecting important events related to business activities from information obtained from a company's daily data communications (such as e-mail communications).

Cheng, Kao, and Lin (2021) used a data mining method to create a financial fraud model in their study. They tried to create financial fraud rules and used options such as multivariate logistic regression, support vector machines, and Bayesian networks for these rules. According to the authors, such options were useful in detecting financial fraud. They tried to find an optimal fraud model. For this, they used four rule-based methods. As a result, the financial fraud rule was established. They mentioned that the results of this study could be presented as a reference to practitioners, investors, and audit personnel.

Leonov et al. (2020) used the financial statements of private economic institutions in the Russian Federation in their studies. The study aimed to apply analytical audit procedures. These procedures were applied to assess participation in suspicious transactions along with distortions in the financial statements. Some of the methods used in the study were as follows: analysis of cash flow data and comparative analysis; coefficient analysis according to the Beneish and Roxas model. In the study, it was mentioned that an effective internal control system should be established to identify fraudulent activities and that the environment in the company should be monitored. Fraud detection statistics showed that the primary method of explaining fraud in financial statements was to identify analytical symptoms of events that were beyond normal.

In his master's thesis, Köylü (2020) aimed to determine the level of financial risk and the factors affecting the level of companies operating in the manufacturing industry. In the research, data published by 177 companies in the manufacturing industry sector of Borsa Istanbul between 2009 and 2018 was used. These data were analyzed with artificial intelligence methods, which was an objective analysis method. In this thesis, unlike other studies, risk analysis has been carried out for the first time in the manufacturing industry. As a result of the analysis, nine financial risk profiles with different characteristics were created. It has been determined that there is a statistically significant relationship between financial risk and some financial ratios.

Arslan (2021) examined robotic process automation (RPA) in his master's thesis. Robotic process automation, which will automate repetitive tasks, is expected to reorganize the auditor role by emphasizing higher-order thinking skills that will lead to audit quality. This paper uses a PwC case study to demonstrate the potential of RPA to improve audit quality. As a result of the study, it is mentioned that the most important benefit of RPA is that it shortens the time spent on monotonous work. Compared to humans, robots perform their control tasks without error. As a result, higher-quality data and better reports are possible. It is also said that controlling a robot is easier than controlling a human. More and more human-like tasks will be performed by software robots as RPA vendors develop their software with artificial intelligence and enhanced cognitive capabilities.

Nadas (2021), on the other hand, discussed the concept of artificial intelligence in general terms in his master's thesis and examined only the artificial intelligence applications in the Big Four audit companies. It was clear that it was a thesis study that had been put together for discussion without any research.

When the studies are considered again, it is very clear that the studies on artificial intelligence applications in the audit sector in Turkey are insufficient. In the next parts of the thesis, the title "conceptual framework" is talked about, and the research method and method of gathering data are looked at in depth.



## **CHAPTER 3: CONCEPTUAL FRAMEWORK**

The main purposes of a company are to make profit and survive. Companies may want to learn about their financial situation in a short time. In this case, there is a need for a set of financial statements that can show the general financial situation, limits, errors, and deficiencies of the companies and reveal their data. As a result of the economic activities of the companies, as seen in Figure 1, in addition to basic financial statements such as the balance sheet and income statement, additional financial statements such as the fund flow statement, cash flow statement, statement of cost of goods sold, statement of profit allocation, and statement of changes in equity emerge.

Li, Qi, and Zhang defined these statements as the result of the interaction of feasible accounting and auditing standards, management's practices, their interpretation, and auditor practice (Li, Qi, and Zhang, 2021). These tables provide the opportunity to comment on the past, current situation, and future of the firm. It helps to turn the situation against the company in their favor. The data in the financial statements is interpreted, the most appropriate solution is sought for the business by taking the necessary precautions in advance to prevent a possible negative situation, and the necessary financial moves are made to overcome this difficulty.

The balance sheet balances a company's assets against debt or equity financing by presenting a snapshot of the company's financial situation at a given point in time (Gitman and Zutter, 2015). The balance sheet is a chart showing the assets, liabilities, and equity of the business, as well as revealing the capital structure of the company. Balance sheets prepared by businesses are the answer to the questions of both investors and shareholders. Businesses create financial ratios by analyzing the balance sheet items within themselves and also by using the items in the income statement. These ratios allow both banks and investors to observe the company's situation and make more comments in a short period of time.

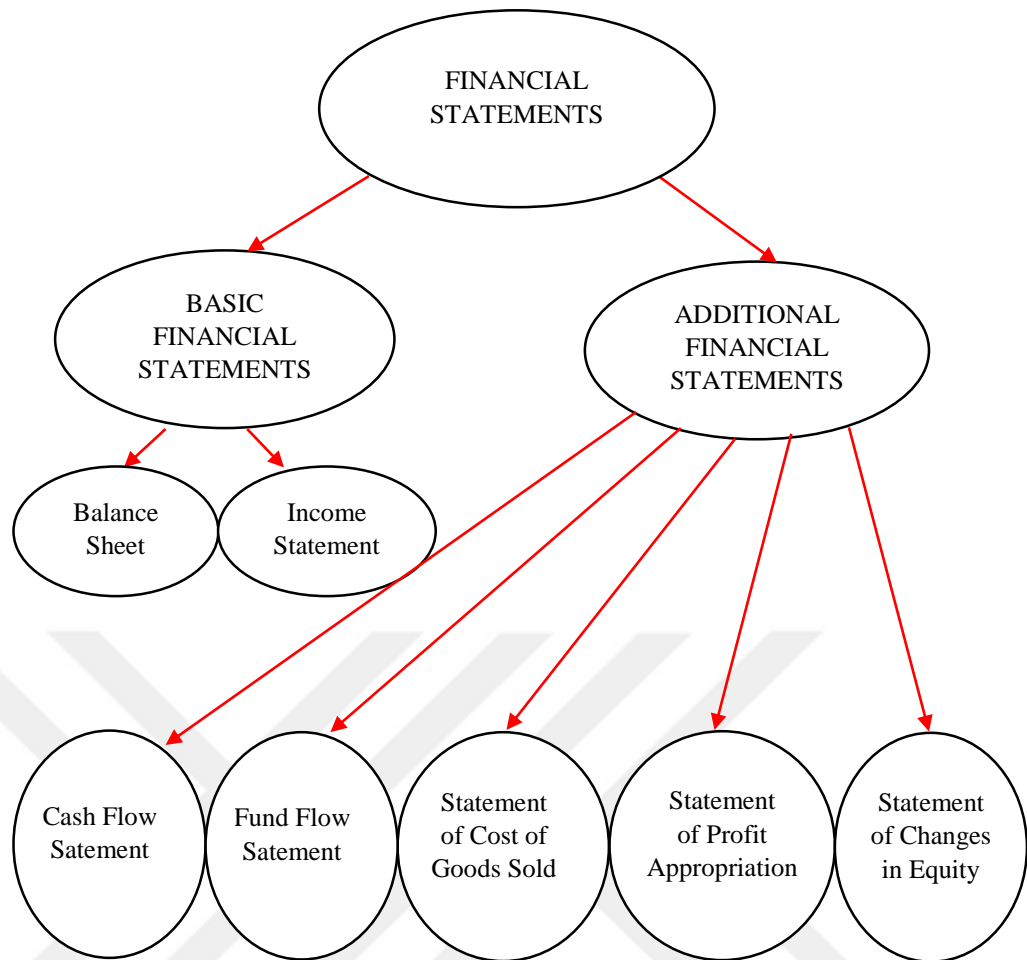


Figure 1. Types of Financial Statements (Source: Compiled by author)

The income statement is expressed as the summary of the firm's financial results at a specific time. The most common income statement is the one that covers 1 year period, usually on December 31 the calendar day (Gitman and Zutter, 2015). By looking at the income statement of a company, it is possible to obtain detailed information about the current status of its financial activities in a certain period and to see the profit/loss status. By comparing the company's income statement with the income statements of other companies in the sector, they can discover areas where they are lacking or superior to other companies. Whether the company is profitable or not, its debt situation, and its situation in the sector can be analyzed and interpreted by looking at the income statement.

The most frequently used financial statements by businesses are income statements and balance sheets, which we call basic financial statements. Apart from these, other additional financial statements that will contribute to expressing an idea about the financial structure of the enterprise are Cash Flow Statement, Fund Flow Statement, Statement of Cost of Goods Sold, Statement of Profit Appropriation and, Statement of Changes in Equity.

A statement that provides detailed information about the operating, financing, and investment cash flows of the firm and is considered a summary of the cash flows is the cash flow statement (Gitman and Zutter, 2015). This table is a table shows the cash flows for a certain period in terms of the sources and places of use of this cash. What is referred to as cash flow is the inflow and outflow of cash and cash equivalents.

The fund flow statement is the table that shows the resources provided by the company to continue its activities and finance its investments in a certain period and in which areas these resources are used. It consists of two parts, fund sources and fund uses. The resources section of the fund flows statement shows from which sources the business activities and investments come. The fund uses section shows where the fund resources are used and gives information about the suitability of the places of use of the funds.

The statement of Cost of Goods Sold is a supplementary statement to the income statement that facilitates the preparation of the income statement. The cost in the Statement of Cost of Goods Sold is transferred directly to the income statement as the cost of sales. Cost of sales, in short, is all the accumulated cost incurred to produce a product sold. The cost of sales table is generally used by manufacturing companies, but it also measures the ability of companies to produce.

Statement of Profit Appropriation is the financial statement showing where and in what amounts the profit for the period is distributed, starting from the profit before tax. Statement of Profit Appropriation is also an extension of the balance sheet and income statement and completes these tables. The purpose of preparing this table is to calculate the company's earnings per share and dividends per share.

The Statement of Changes in Equity is a table that shows the increase and decrease in own resources over time. This table shows the additional investments made by the owners and partners. In other words, changes in the capital increase, reserve, fund, and profit items are transferred to financial statement users with the help of this table.

Based on the definition of all these financial statements, if we think of businesses as a book, financial statements form the summary of this book. In other words, we can see, analyze, and interpret the financial situation of the business with the help of these tables. However, the necessity of these comments by experts highlights the need for auditing and auditors. Analyzing and reporting the financial structure of the company by an expert audit team will be possible as a result of a successful audit process. According to the final opinion in the audit report, auditors increase the efficiency of the process and its contribution to the business by giving feedback and informing the management. Then, they tell business managers to check with each other to see if company policies are right.

In order to conduct a successful audit, the company must have a solid internal control system in place. The internal control system is a system created to ensure that the targets set by management are achieved. Having a regular internal control system in audits means a more efficient audit process that takes less time and costs less money. However, it is a fact that audit activities will be more challenging in businesses where there is no or an insufficient internal control system. It complicates the audits, as it will require more overtime and more work.

Before establishing an internal control system, business management should understand the types and degree of materiality of existing risks. After the management has accepted that these risks can't be avoided, this system should be set up to limit the amount of money that could be lost because of the risks.

As can be seen from the literature review, the importance of auditing the institutions that give life to the economy is an indisputable fact. The smoother the company's audit systems are, the faster and more regular the information flow between subordinates within the organization will be. The more professional the system, the higher the

quality of the audit, so improving the system should be the main task of auditing companies. Audit firms also need to differentiate themselves technologically from other firms to maintain their competitiveness. At this point, the need for artificial intelligence comes to the fore.

In this part of the thesis, the historical development of auditing in the world and Turkey, the concept and types of auditing, the concept and types of auditors, the audit process, the concept and types of fraud, accounting scandals, the concept of artificial intelligence, the relationship between artificial intelligence and auditing, the advantages and risks of artificial intelligence, firms adopting artificial intelligence and artificial intelligence applications in big four companies will be examined.

### ***3.1 Concept of Audit***

The accounting process and the preparation of financial statements become more complex as businesses grow and technology advances, and the probability of making mistakes in financial statements increases. The information revealed by accounting is especially important for investors, creditors, the government, and society. In the absence of information, these groups will have to make decisions in a situation of great uncertainty. Information users cannot interpret these tables themselves in cases where the organizers of the financial statements and the information users are in different places, the information users cannot constantly receive information from the company management, or there are legal barriers to performing the audit work in the company themselves, and it is not advantageous in terms of time and cost to carry out the audit work by the company itself. For these reasons, the need for audits by independent and expert people arises.

Auditing can be defined as the comparison of the planned situation with the results obtained by setting some standards to obtain results according to the plans, and taking certain measures to make corrections where differences are detected (Sanal, 2002). The audit concept is the job of collecting sufficient audit evidence to provide reasonable assurance that the financial information resulting from the economic

activities of an enterprise complies with predetermined criteria, GAAP, and its accuracy.

An accounting audit consists of a process. During the audit, a certain period is selected, and studies are carried out for this period. The audit is carried out in various stages, and all activities that take place from start to finish proceed in a planned manner. The reports prepared on the economic activities of the enterprise are claims for the enterprise, and these reports are prepared by the enterprise and presented to the interested groups. The audit activity, on the other hand, investigates the truthfulness and reliability of these asserted claims. The auditor compares the financial statements, which are the claims of the business, according to several predetermined criteria and decides on their accuracy and reliability. The aforementioned criteria are laws, generally accepted accounting standards, or goals set by management. The criteria to be used in the audit should be appropriate, complete, reliable, impartial, and understandable. Auditors try to gather financial or non-financial evidence about the business in order to investigate whether the claims made by businesses are true. Following that, the auditor writes a report that explains the audit to management or related groups. In the audit, all the activities of the enterprise are handled as a whole, the accounting and internal control systems of the enterprise are examined, the malfunctions and deficiencies are determined, and the situation is intervened in.

Auditing is one of the most important stages of the management process. It is to take all precautions against every possible event by connecting a report on whether an institution acts in line with its objectives, where the disruptions and deficiencies are, and how they will be eliminated.

The main purpose of the audit is to ensure that the auditor reaches an opinion on whether the financial statements and operating results of the enterprises are presented in a true and accurate manner in line with the financial reporting standards. The primary purpose of the audit is to instill confidence in the business and to guide business management in making sound financial decisions.

The main reasons for auditing are things like when company managers and people who use financial information have different goals, when internal control and accounting systems aren't good enough, when business volume goes up, when the accounting system gets more complicated, and when that makes fraud more likely.

The biggest benefit of the audit to the audited company is that it increases the reliability of the financial statements. At the same time, it not only reduces the possibility of a tax audit that can be done by the government but also helps to expand credit opportunities with the financial statements that have passed the independent audit.

### ***3.1.1 History of Audit***

The origins of audits date back to ancient times. With people beginning to live in society, the audit has emerged as a necessary phenomenon. The economic life revived with the industrial revolution, and the involvement of the public authority in this life caused the public's decisions and actions to add a different dimension to the audit (Bozkurt, 2013).

#### ***3.1.1.1 Historical Development of Audit in the World***

It was mentioned that the audit dates back to 3000 BC in history (Sharkansky, 1991). The data obtained from the archaeological findings showed that the kings who ruled in ancient Mesopotamia authorized their scribes to count the royal granaries and control the officials there. These findings formed the origin of the audit of public property accounts and state-run activities (Khan, 1995). In addition, Khan stated in his study that there were written sources showing that the understanding of public audit emerged between the VII and XII centuries when the Islamic Civilization developed and that accounting and auditing units were created by the Islamic caliphs without making any distinction between private and public situations (Khan, 1995).

Auditing practices in Mesopotamia continued with the establishment of city-states in ancient Greece. Officials in public units were required to account to citizens by establishing an organized audit system in city-states. Despite evidence that public accounts were controlled in the Egyptian and Roman civilizations, cross-account control and financial audit systems were developed. It was also said that during the

Zhou Dynasty in 1100 BC, auditing practices were carried out in China (China Audit Society, 1991).

In 1880, five accounting societies merged to form the British Institute of Professional Accountants. Later, a law was enacted in 1900, and with this law, an audit obligation was imposed on limited liability companies. Thus, the professions of public accounting and chartered accounting first emerged in England. Along with audit services, they started to deal with tax consultancy, financial consultancy, and management consultancy. With the legalization of this profession in the USA in 1896, state regulations had a significant impact on the development of this profession (arkçolu, 1995).

After the legal practices related to the accounting profession in the USA emerged in New York in 1896, the first financial statement was published in 1901, and the origin of independent auditing began in the 1930s. Regulations regarding auditing have been in place in the USA since 1940 (Karahana, 2017).

### ***3.1.1.2 Historical Development of Audit in Turkey***

The accounting system in Turkey was not developed at the same level as developments elsewhere in the world. State accounting developed during the Ottoman period, as opposed to the private accounting system used today. For this reason, it was seen that criteria for the audit of government accounting were developed in the Ottoman Empire (Güçlü, 2000). In addition, the activity of developing expertise in accounting in the Ottoman Empire was a practice that has continued from the foundation years of the Ottomans to this day. During the preceding years, the audit dimension in the accounting profession began with expertise activities in courts. However, actual auditing started to be carried out between 1926 and 1934 when tax laws gave the authority to conduct tax audits to some professionals who were known for their honesty in the accounting profession (Bezirci and Karasioğlu, 2011).

In Turkey, the need for an independent auditing profession, which is a profession that can meet the expectations formed upon the demands of banks and financial institutions, has emerged. Since the 1960s, banks and foreign institutions have started



to have independent audits of their financial statements. These studies, which were initially carried out by independent audit companies operating abroad, have started to be carried out by member companies of international independent audit companies located in Turkey since the 1970s (Independent Auditing Association, 2009).

The obligation to carry out independent external audits in Turkey was introduced for the first time in 1987 with the audit of banks. However, the auditing principles and rules became legal with the communique published by the Capital Markets Board for the first time in 1988 (Kutuk1z and Öncü, 2009).

A law numbered 3568 was published in Turkey in 1989. The name of this law is the Law on Independent Accounting, Certified Public Accountant, and Sworn-in Certified Public Accountant. In this law, auditing standards regarding the working procedures and principles of the members of the profession mentioned are included.

One of the most important events affecting the audit profession and its development in the world and in Turkey is the Sarbanes Oxley Act, which was enacted in 2002 in order to protect the investors whose confidence in the capital market was shaken after the Enron Scandal in the USA and the parties whose reputation was damaged. This law is aimed at bringing new order and discipline to the audit of public companies (Lutkevich, 2020). The said law brought new responsibilities for boards of directors and supervisory boards, new reporting obligations for publicly traded companies, and more severe sanctions on corruption and irregularities (Kutuk1z and Öncü, 2009). This law deeply affected the auditing industry all over the world, as well as in Turkey. After the Sarbanes-Oxley law was enacted, the SEC took action in Turkey, issued a communiqué, and tried to prevent fraud by making the rules a little more stringent.

When the development of the auditing profession is examined from the past to the present, it is seen that auditing is shaped according to the economic conditions and situations both in the world and in Turkey. Therefore, considering today's technological developments, it is inevitable that artificial intelligence and computer-assisted audit tools will enter the audit sector.

### 3.2 Types of Audit

Audit types can be classified under certain criteria according to who performs the audit and according to the purpose of the audit. As indicated in Figure 2, audit types are divided into internal audit, public audit, and independent (external) audit according to the status of auditors. The purpose of the audit is divided into four categories: financial statements audit, compliance audit, operational audit, and special purpose audit (Doğan and Hilal, 2019).

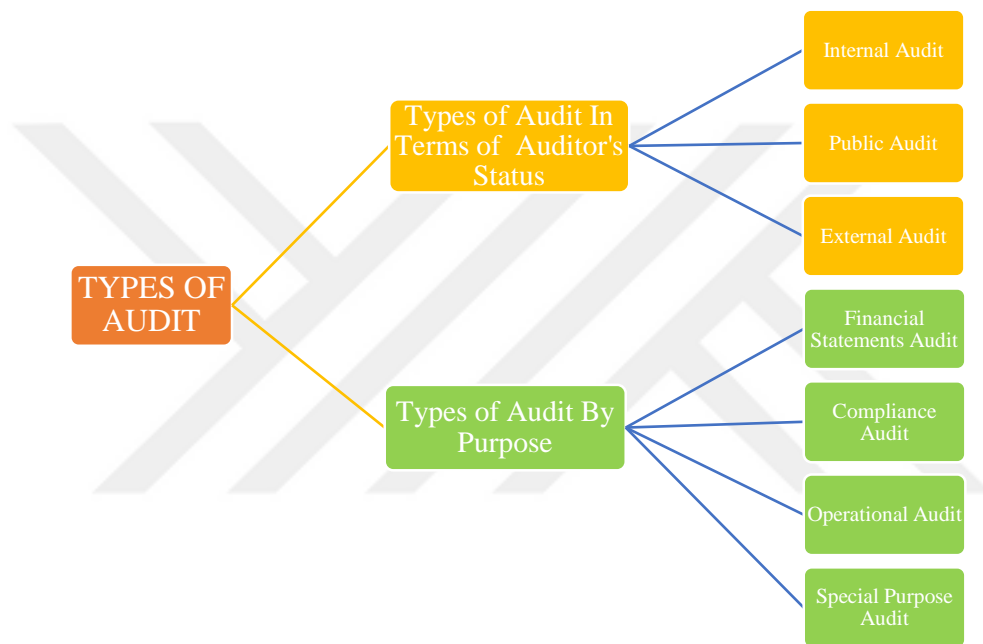


Figure 2. Types of Audit (Source: Compiled by author)

#### 3.2.1 Types of Audit in Terms of Auditor's Status

##### 3.2.1.1 Internal Audit

Internal auditing is an auditing process carried out within the business to examine and evaluate the activities of the business. The internal audit is aimed at serving the business. The scope of the internal audit includes both financial transactions and non-financial transactions. Internal audit activities include financial auditing, compliance auditing, and operational auditing. The most important purpose of internal auditing is to prevent mistakes and corruption that can be made by the employees of the enterprise

and to identify the ones that have been made. The compliance and effectiveness of the work done by the employees of the internal audit organization and the reliability of all kinds of information produced are researched and examined by the internal auditors in terms of legislation and laws and reported to the senior management.

Internal auditing ensures that the risks that are unpredictable within the business and that may have devastating results are determined beforehand. It monitors whether the events are carried out in an effective and beneficial manner, in line with the procedures and policies of the enterprise. It ensures the prevention of losses caused by mistakes and fraud in the business. It provides assurance, and thus the need to provide reliable information is met. And ultimately, it helps with the establishment of a strong internal control system by ensuring that the internal controls of the enterprise are maintained in a healthy way.

The most critical task of internal auditing is to provide assurance that an organization's risk management and internal control processes are progressing effectively and efficiently. In order for the internal audit process to work effectively and efficiently, there is a need for skilled, qualified, and experienced auditors who can work in accordance with ethical rules and determined standards.

Internal auditors may engage in the activities detailed below (Chartered IIA, 2021):

- Evaluation of risk management
- Assisting management to improve internal controls
- Activities of internal audit
- Assessing controls
- Advising managers
- Risk assessment
- Seeking transactions
- Reviewing information

### ***3.2.1.2 Public Audit***

A public audit is carried out by people or institutions that derive their duties and powers from the law on behalf of the public and that conduct audits within the framework of the needs of the public. Public audit institutions are organized within various government agencies. The public audit examines whether an organization's activities are in accordance with the law and the public interest. Public audit organizations report to the public units they are affiliated with about the organizations they audit.

The public audit is done to ensure accountable, transparent, and robust auditing of public expenditures. At this point, SAIs come into play as external public auditors. SAIs conduct independent investigations. These investigations are about the effective, economic, and efficient use of public resources and the compliance of public expenditures and collections with certain rules. Public auditing contributes to the management of policies, public administration, and state finances by supporting the parliamentary audit of governments with objective and realistic audit reports. As a result, societies build citizens' trust in their control mechanisms. And properly functioning democracies are further developed (Public Audit in the European Union, 2021).

### ***3.2.1.3 Independent (External) Audit***

Independent auditing refers to the auditing of the financial statements of businesses by auditors working on their own behalf as self-employed or under the supervision of an audit firm. Independent auditing provides professional audit services to its customers. Upon the request of the business, the audit process begins when the business and the audit firm mutually agree and sign an audit contract. In an independent audit, there is no employee-employer relationship between the company and the auditors; the auditors come from outside independently. The most important objective of the independent audit is to determine whether the financial reports of the enterprises are appropriate within the framework of GAAP (Kepekçi, 2004).

The audit determines whether the information reviewed properly reflects financial and business transactions. The tool used to measure whether this information is accurately recorded is GAAP. Therefore, auditors must have knowledge of these principles.

GAAP refers to the rules that must be followed when preparing financial reports (Gitman and Zutter, 2015). GAAS are rules that say who will do the audit, how it will be done, where it will be done, and how the results will be reported. Auditing standards assist the auditor in fulfilling his or her professional responsibilities and shed light on audit activity processes. The auditor uses GAAS as a guideline. Auditors must collect sufficient and reliable information about the business in order to reach their audit opinion. This information serves as evidence. Each auditor determines the path to be followed and the audit to be chosen by using his own judgment.

GAAS were first published by the AICPA in 1947 and have been adopted by many countries. Figure 3 shows that these generally accepted auditing standards are split into three groups: general standards, fieldwork standards, and reporting standards (Arens and Loebbecke, 1976).

Within the scope of general standards, issues such as vocational training and competence, acting independently, and showing the attention and care required by the profession are discussed. Situations such as audit planning and monitoring, obtaining information about the internal control system, and collecting sufficient and reliable evidence in the business areas where the audit is carried out are discussed, as are fieldwork standards. The content of the reporting standards includes the compliance of the reporting with GAAP, its continuity, the criteria for expressing opinions of the auditors, and the adequacy of explaining the financial statements (Şen, 2003).

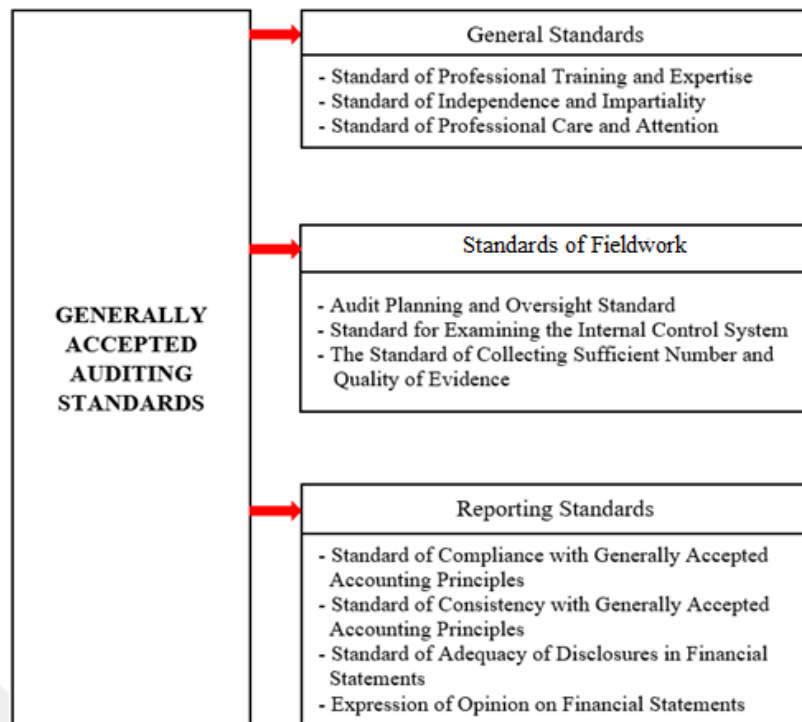


Figure 3. Types of Generally Accepted Auditing Standards (Source: Arens and Loebbecke, 1976)

Conflicts arise between providers of financial information and users of this information. In order to avoid these conflicts, the reliability of the financial information of the enterprise should be approved by independent and competent third parties, i.e., independent auditing should be done.

The fact that a company goes through the independent audit process creates an advantage for businesses. In the study of Aygün (2016), the benefits of independent auditing to the audited business are summarized as follows (Aygün, 2016).

Independent audit;

It enables the company's management to access the information flow quickly.

In a company that has been audited independently, the rights of all partners are better protected.

Independent audits contribute significantly to cost reduction in businesses.

In companies subject to independent audits, fraud is prevented by business management and employees.

It determines whether the financial statements reflect the truth.

- Investigates the compliance of business records and documents with legislation and makes necessary corrections in the event of inconvenience.

It reduces the possibility of a tax inspection by the state.

Audited financial statements shape the decisions of the management of the enterprise. Business managers convey the economic situation of the business to the competent authorities with the analyses they make in the financial statements and reports. This increases the credibility of the business.

It increases the effectiveness of these activities by helping the business management and the activities of the employees.

It enables the internal control system to work more effectively.

In short, the independent audit will make sure that the company and its partners go through a process to get the most out of the data they have, taking into account the personal interests of the company. It will also give feedback on the future of the company by looking at data from the past.

### ***3.2.2 Types of Audits by Purpose***

#### ***3.2.2.1 Financial Statements Audit***

In the audit of financial statements, the balance sheet and income statement are mentioned as financial statements. Financial statements can be audited by independent auditors and public auditors. The purpose of this type of audit is to report on whether the financial statements are presented in accordance with GAAP. The information in the financial statements is compared with the accounting principles accepted by everyone, and the compatibility or incompatibility is checked. The auditor reaches an opinion as to whether the financial statements are reliable, complete, and accurate.

#### ***3.2.2.2 Compliance Audit***

Compliance auditing is the examination of the compliance of the activities and financial transactions in the enterprise with the rules determined by the authorized institutions, inside or outside the enterprise. Examples of rules are laws, communiqués, acts, master contracts, and business policies. An example of a compliance audit is

examining whether the transactions in the company comply with the procedures determined by the top management, or, when the company is examined from a tax point of view, whether the tax laws are complied with.

#### ***3.2.2.3 Operational Audit***

Operational auditing is the process of examining the application of methods related to these activities to evaluate and audit the efficiency and effectiveness of an enterprise's operations. It is a broader audit than internal auditing. In the operational audit, the results of the activities are compared with the productivity standards and it is measured whether the enterprise has reached the targets set beforehand for that activity. Operational auditing is usually done by internal auditors or public auditors.

#### ***3.2.2.4 Special Purpose Audit***

A special purpose audit is an audit conducted by the individuals or groups requesting the audit for a specific purpose. The subject of the audit is determined by the requester. It is a useful audit in that those who request it can decide on a subject more easily, and this audit can be guided. Examples of special purpose audits are investigations of fraud, investigations before becoming a partner in a business, examinations in acquisitions, and business combinations.

### ***3.3 Audit Process***

When the audit is considered as a whole, it aims to provide reasonable assurance that the financial data and statements of the companies as a result of their activities do not contain material misstatements that may mislead the auditor's opinion. Reasonable assurance (KGK, 2019) is the process of gathering audit evidence so that it can be said that the financial statements don't have any important lies in them.



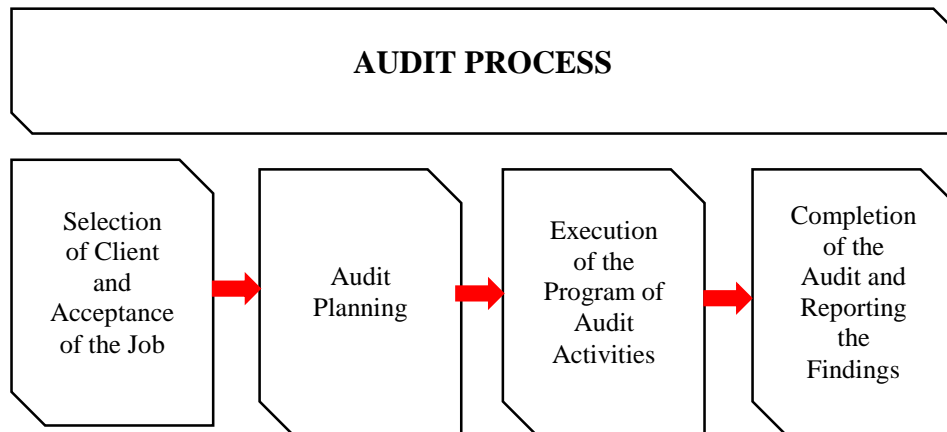


Figure 4. Audit Process (Source: Compiled by author)

The stages of the audit process are indicated in Figure 4, and the audit process begins with the selection of the client and the acceptance of the work, as in any other job. At this stage, the auditor conducts preliminary research on the bidder before deciding to accept the work. The auditor meets with the previous auditor. Considering the current workload, it is evaluating whether the firm can handle it. The auditor evaluates the information obtained and decides whether to take the job. If the auditor wishes to take the job, an audit contract is signed between the client and the audit firm.

If the auditor and the client company reach an agreement, the audit planning phase is initiated. At this stage, the auditor determines and coordinates the work to be done. It collects information about the client and segments the audit work in order to initiate a more efficient audit process. The client determines the level of materiality and audit risk by obtaining information about the internal control system of the enterprise. The auditor determines the duration of the audit, writes a draft of the program, and assigns teammates to take part in the audit. When necessary, it makes stock counts and works to detect inaccuracies in the financial statements, which we call analytical review procedures.

The next stage is the execution of the program of audit activities. At this stage, the internal control system is examined, tested, and evaluated. A strong internal control system is aimed at detecting and preventing errors and frauds. The auditor performs control tests to measure the functioning of the internal control system. In order to test

account balances and test transactions, the auditor tries to gather evidence by performing substantive tests. It values and interprets the evidence collected and moves on to the final stage of the audit process.

The audit is completed and the findings are reported in the final stage. At this stage, the auditor evaluates whether the studies carried out are sufficient, evaluates the data and tables he/she has examined, taking into account the supporting evidence, and reaches an opinion (positive, negative, conditionally positive, or refraining from expressing an opinion). And it concludes the audit process by presenting this opinion in its report.

The auditor's professional judgment is required in matters such as the assessment of the risk of material misstatement arising from fraud or error in the financial statements and the procedures selected and performed to obtain audit evidence. (Denetim, 2021) Based on this interpretation, the need for experienced and skilled auditors with professional judgment skills arises for an audit process to proceed successfully. Having a strong internal control system alone does not make the audit completely successful; therefore, skilled auditors are also needed.

#### ***3.4 Concept of Auditor and Basic Ethical Behaviors That Auditor Must Follow***

The title "auditor" as a professional title was used for the first time in England in 1289, and the first organization related to the profession of the auditor was established in Venice in 1581 (Gürkan, 2009).

Auditors are experts who have professional knowledge and experience, have high moral qualities, and can act independently while carrying out audit activities (Kardeş, 1996). As can be seen from the definition of the auditor, there are some characteristics that auditors must have. Auditors should be able to do their jobs on their own, have enough professional experience and knowledge, be friendly and honest, and work hard.

The auditor's adoption of these characteristics by following some ethical rules in the independent audit activity will help to increase the audit quality. The ethical rules in ethical standards are integrity, impartiality, confidentiality, professional competence and due diligence, and professional behavior for the profession (KGK, 2019). These features are also shown in Figure 5, and if the auditor has all of these features, it is inevitable that he will be a truly successful auditor.

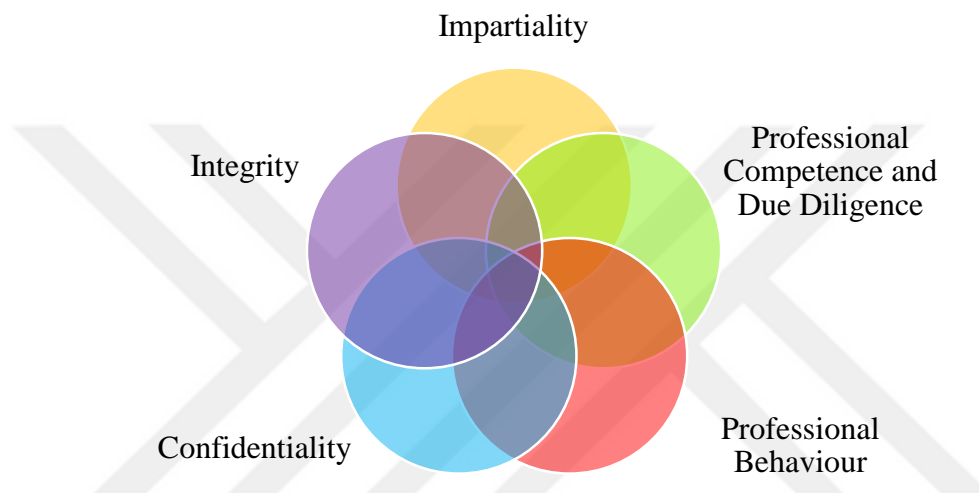


Figure 5. Ethical Conduct of the Auditor (Source: Compiled by author)

Integrity is the first principle of the audit ethics element. An auditor should have basic moral values at first. In this case, an auditor's expected behaviors are honesty and transparency (Alkan, 2018).

Impartiality is the fact that the auditor has a completely impartial view, regardless of what happens when the audit service is carried out independently against the customers. The audited firm's purposes should not be served, situations that would harm independence should be avoided, and the boundary between the client and the auditor should be maintained. Even if the relationship between the auditor and the client goes bad during the audit process, it is necessary to act in accordance with the framework of ethical rules and avoid situations that will harm independence and impartiality (Demirçalı, 2020).

Professional competence and due diligence enable auditors to obtain more realistic results if they apply the professional knowledge they have acquired to the work they are responsible for on time and in place. All stages of the audit should be completed with the same care and meticulousness. In the event that the auditor is faced with situations that exceed his knowledge, he should seek help from an auditor whose knowledge and experience are more competent. The auditor should always improve himself by following the current situations that affect his professional knowledge (Demirçalı, 2020).

Confidentiality is related to the auditor's access to the financial data of the company he/she supervises and his/her not sharing some information with third parties for the sake of personal gain. According to this principle, the auditor should not pass on information to first-degree relatives. In addition, the auditor should not share information after completing his audit (Demirçalı, 2020).

In the ethical rules standard published by The Public Oversight, Accounting, and Auditing Standards Authority, it is stated that, according to the principle of professional behavior, restrictions can be made so that the auditor's compliance with the ethical rules will not discredit the auditor (KGK, 2019). The auditor should act according to his profession by avoiding any situation that may cast a shadow on him and the audit firm while performing his profession.

### ***3.5 Types of Auditor***

The variety of audits to be performed in various institutions or businesses has resulted in a variety of auditors. The auditor will be selected according to the type of audit to be conducted, and the audit process will begin. For example, if the firm needs a financial statement audit, it should work with an independent auditor instead of a public auditor. On the contrary, only the public auditor can meet the need for an audit for a public reason.

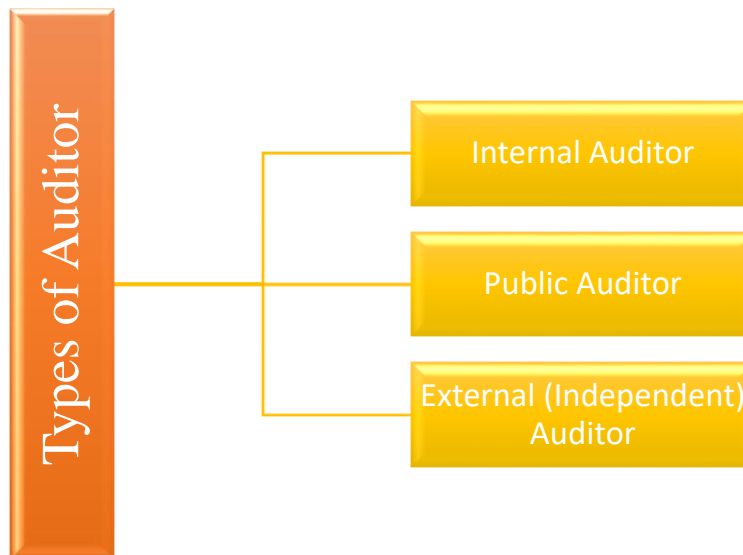


Figure 6. Types of Auditor (Source: Compiled by author)

In this case, the types of auditors are divided into three internal auditor, public auditor, and independent auditor, as indicated in Figure 6.

### ***3.5.1 Internal Auditor***

The internal auditor examines and evaluates the effectiveness and adequacy of the organization's internal control system. These evaluations are made into a report and presented to the management staff. Internal auditors perform their audit activities as permanent staff of the company. They do not express an opinion and conduct compliance and operational audits. Internal auditors ensure that information is flowing to senior management. They conduct audits to evaluate whether the company's assets are protected and whether the activities are carried out effectively and efficiently. Assigned by the management, they strive to establish an internal control system in accordance with the company's policies. Because the existence of a good internal control system in a business contributes to the acceleration of the process by providing an advantage in terms of time for other audits to be made.

Unlike external auditors, internal auditors help organizations succeed by addressing broader issues such as the organization's reputation. Internal auditors should be objective and unaffected by environmental factors. To achieve this, they need to be more knowledgeable and experienced. The internal auditor will evaluate the quality of internal control systems in all parts of an organization to evaluate the way risks are managed. It will report its assessment to the top management while maintaining its independence. The internal auditor notifies senior management that significant risks have been assessed. It then highlights areas that need improvement and intervention. Internal auditors are crucial to senior management as they help demonstrate that senior management is effectively running the organization, representing the owners.

### **3.5.2 *Public Auditor***

The public auditor is a person who works in public institutions and conducts audits in light of laws and regulations in line with the interests of the state. Public auditors conduct audits to meet public needs. They conduct compliance audits or operational audits to determine whether companies comply with the law. Public auditors are appointed by the public. The difference between public auditors and other auditors is that they have enforcement powers.

### **3.5.3 *Independent (External) Auditor***

Independent auditors provide financial statement auditing services to their clients by working independently or within an audit firm. They are auditors who have the necessary professional knowledge and experience and have high moral qualities. Independent auditors are auditors who provide services to various organizations and are paid for their services. Independent auditors do not have any employee-employer relationship with the enterprises they audit.

Independent auditors, unlike other auditors, have responsibilities to detect and prevent fraud. Artificial intelligence platforms, which are also used to prevent errors and fraud in the Big Four audit companies, which constitute the sample of our research, are used

by independent auditors. In the next part of the thesis, the concept of fraud will be evaluated along with accounting scandals and examined in detail.

### ***3.6 Concept of Fraud***

Fraud can be defined as an act done consciously. Behaviors that were previously defined as irregularities by causing misleading information in the financial statements in the auditing standard No. 82 published by the AICPA in 1997 are based on malicious intent with this standard (Küçük and Uzay, 2009). Mistakes are not made intentionally, like frauds. It occurs due to inattention and oversight (Güredin, 2007).

When auditing is done correctly, it is an indispensable function for companies. However, it can cause significant damage if done incorrectly. Whether the audit is done right or wrong is directly related to how much the company attaches importance to ethics in its policies. If the company cares more about its moral reputation than its interests, it bases its policies on an ethical system and develops its activities in this direction. Conversely, if the company cares more about its corporate interests than its ethical reputation in society and the industry, it may resort to fraudulent financial reporting. With this method, they mislead both their stakeholders and the industry by pretending that they did not exist, and they may have to face heavy losses that cannot be compensated afterward.

On the other hand, accounting fraud is an event that involves knowingly or willingly stealing or misusing the assets or resources of the enterprise or trying to provide personal benefits to the employees (Kula, Kaynar, and Köylü, 2008).

In businesses, fraud can be committed by the management as well as the employees. As shown in the table from zdemir (2015), fraud can be committed in a variety of ways. Accordingly, the most common accounting frauds are shown in Table 1.

Table 1. The Most Common Accounting Frauds (Source: Özdemir, 2015)

Failure to show debts or liabilities that should be shown in the balance sheet
Over-representation of active items
Activation of expenses that need to be written expense
No provision for depreciated assets
Failure to reserve a provision for some of the obligations of the company
No provision is made for non-collectible receivables.
Evaluation of foreign currency debts or receivables at low or high exchange rates instead of the exchange rate on the balance sheet date
Failure to reflect the various losses incurred in the balance sheet
Not to record income and expenses in the year they belong,
Showing non-existent stocks on the balance sheet as if they exist,
Purchase of goods without invoice
Loan interest expenses are not reflected in the accounts correctly,
Showing the company's debts less than their real value
Displaying other people's assets as company assets
Storing information that may decrease the value of company stocks,
Keeping some sales off the record by selling invoiced goods,
Understatement or overstatement of depreciation
Increasing earnings per share

### 3.6.1 *Fraud Groups*

Bozkurt (2009) classified the frauds that occur in businesses by dividing them into five groups. These groups are employee fraud, customer fraud, investment fraud, management fraud, and seller fraud (Bozkurt, 2009). Whoever stands to gain, the fraud will be directed in that direction. Therefore, it would be possible to specify fraud groups as in Figure 7.



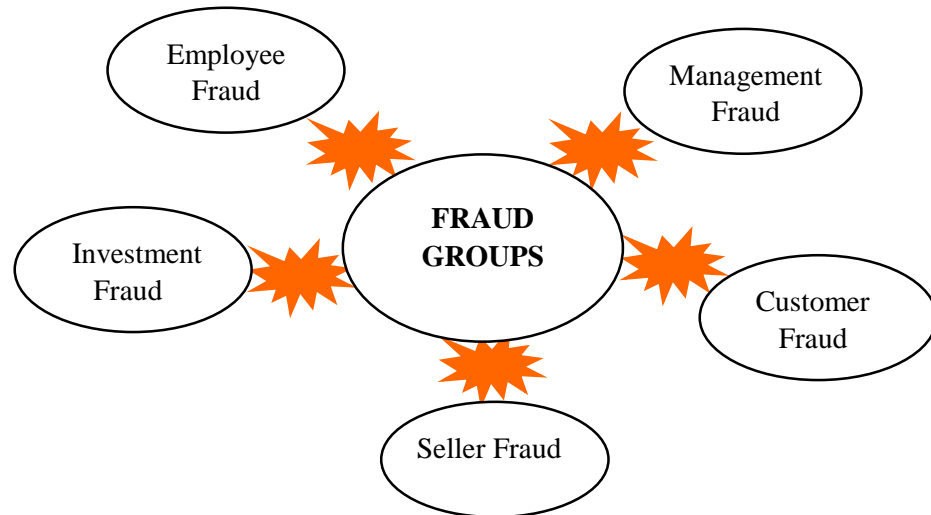


Figure 7. Fraud Groups (Source: Compiled by author)

To briefly examine the fraud groups;

Employee fraud is caused by corruption in businesses due to the low level of income of employees and their desire to live in better conditions. Employee fraud can be defined as malicious employees defrauding the employer illegally by confiscating the assets of the business. This type of fraud can be carried out by stealing fixtures, cash, or other assets from the company (Bozkurt, 2009).

Management fraud can be achieved by making the business look worse than its current situation by manipulating the stocks, hiding the turnover, and showing the expenses as low as possible to pay less tax or not pay at all. In publicly traded businesses, they may resort to fraudulent methods to show the company's status better than it actually is, to increase its market value, to gain prestige for the business, and to easily attract credit (Ertikin, 2017; Bozkurt, 2009). Management fraud is a type of fraud that is mostly done by top managers and causes great damage.

Investment fraud is the act of defrauding the other party by promising to invest. The best example of this type of fraud is the Charles Ponzi incident mentioned in Frankel's (2012) study. Ponzi promised to invest even though there was no investment in the middle and collected money from investors by promising high-interest rates, then he did not make the investments he promised. He also used this money for his expenses,

deceiving the investors who believed in him and going into the history of fraud (Frankel, 2012; Bozkurt, 2009).

Seller frauds are the frauds that occur in the form of poor quality, incomplete delivery, or non-delivery of the products sold by the people who deliver goods or services to the enterprise. By issuing invoices for goods that the seller does not actually sell, the seller may show the price of the products as higher than it actually is (Doğan and Kayakıran, 2017; Bozkurt, 2009).

Customer fraud is caused by customers abusing businesses. It can be expressed as trying to obtain the advantages that the customers cannot obtain under normal conditions by acting against the seller's business. For example, buying goods without paying or buying at a low price can be given (Bozkurt, 2009).

It is possible to encounter cases of fraud on every platform where there are people and the desire to make money. The type of fraud may vary according to the person and groups who will commit it. In the next section, the types of fraud will be explained in detail.

### ***3.6.2 Types of Fraud***

In ACFE (2022) report, fraud is classified in 3 ways as Corruption, Misuse of Assets and Fraudulent Financial Reporting. In Figure 8, fraud types are shown in detail in the fraud tree.

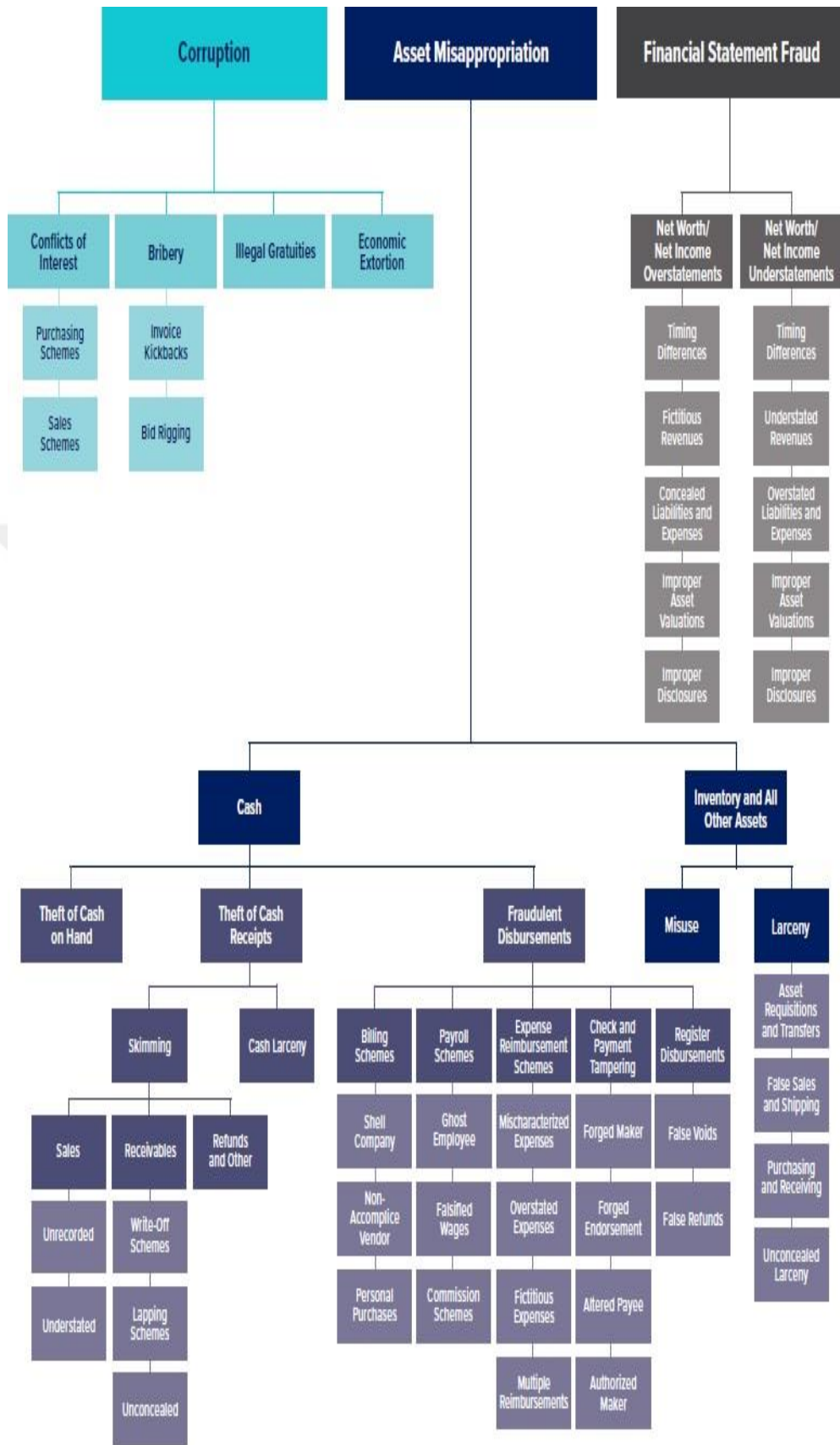


Figure 8. Fraud Tree (Source: ACFE, 2022)

### ***3.6.2.1 Corruption***

As seen in Figure 8, corruption occurs in the form of conflict of interest, bribery, illegal gratuities, and economic extortion. Corruption has become a major problem in growing and developing economies.

The International Monetary Fund (IMF) has estimated that the cost of corruption in the world exceeds 2% of the world's GDP. From a neoclassical economic perspective, corruption exists as an opportunity for economic agents to enrich themselves illegally. Corruption can occur in almost any local, state, or central government (Sahakyan and Stiegert, 2012).

Given that corruption is more common in larger companies and industries with less competition, efforts must be made to prevent corruption in companies in the developing technological world while also increasing competition conditions.

### ***3.6.2.2 Asset Misappropriation***

As can be seen from the fraud tree in Figure 8, asset misappropriation can be done through cash and inventory. Theft of cash occurs in three ways: theft of cash on hand, theft of cash receipts, and fraudulent disbursement. The ones made through inventory and all other assets are of two types: misuse and larceny.

Unlike other frauds, frauds caused by the misuse of assets cause moral as well as material damages. According to economic formations and the law of adding value (Gagliardi, 2014), each abused resource is a major risk factor.

Businesses commit fraud on their assets to better reflect their situation. Manipulations on these assets help the business show its current and fixed assets as different. As a result of the manipulations, it is aimed at appreciating the stocks in the stock market, creating a solid business image for loans, and providing low-interest loans. In line with these benefits, fraudulent financial reporting is applied (Mengi, 2013).

### ***3.6.2.3 Fraudulent Financial Reporting (Financial Statement Fraud)***

Fraudulent financial reporting is the deliberate misrepresentation or concealment of the financial position of the business. People who resort to fraudulent financial reporting use methods such as hiding documents and deflecting the facts. The purpose of using these methods is to prevent the auditors from revealing the truth. Auditors should pose cross-questions, key questions, and analytical questions to the interlocutors, considering all options against the possibility of fraudulent financial reporting. Auditors should analyze the responses they receive to the questions they ask. During the interrogation, the influence of people on each other and the behavior patterns of the people in the answers given should also be taken into consideration (Mengi, 2013).

Fraudulent financial reporting may differ according to the interests of the parties. For example, if it is intended to pay fewer taxes, the company's profitable statements are distorted and shown as losses. Thus, it causes the financial company to pay less tax or even not to pay at all, as intended by the financial company that appears in the loss. On the contrary, companies may want to show their financial statements as profitable even though they are at a loss. It aimed to pay more taxes with the policy it implemented by showing more business income and profit. In this case, the enterprise tried to attract the public's interest as if it were a statist institution. In addition, as a result of the financial statements that seem profitable, it will be easier for the shares of the enterprise to be purchased by third parties and other companies.

Of course, companies that resort to fraud are not only small companies that have not yet gained a reputation in the market. Large and prestigious companies are also trying to mislead the market with various methods by resorting to these tricks. In the next part of the thesis, we will look at some of the most important accounting scandals in the world and how these scandals have affected the auditing industry.

### ***3.7 Accounting Scandals***

Along with the Enron phenomenon, which is the most well-known accounting scandal in world history, important companies such as Xerox, Parmalat, Royal Ahold, and Carme have also been mentioned in accounting scandals. The involvement of large and prestigious companies in such scandals has weakened trust in the audit profession in the eyes of both the public and other companies.

The cost of fraudulent financial reporting costs the world economy billions of dollars a year. It has been estimated that the annual cost of accounting scandals is 600 billion dollars in the USA alone (Bourke and Peursem, 2004). It is estimated that 0.5–5% of the spending of public institutions in the United Kingdom goes to fraudulent activities. This is equivalent to 31 billion and 48 billion pounds. In Australia, it is said that the financial loss caused by accounting scandals is 5–25 billion dollars (International Public Sector Fraud Forum, 2020).

In addition to financial losses, such scandals also cause a loss of reputation in the markets and among companies and a loss of confidence in the profession. And it is impossible for a company whose name is involved in the accounting scandal to clean up this stain. As a result, making a mistake has irreversible consequences.

#### ***3.7.1 Enron Scandal***

The first thing that comes to mind when people think of the accounting scandal is the scandal of Enron, America's largest natural gas energy company. The Enron Scandal can be summarized as Enron's bankruptcy as a result of Arthur Andersen, Enron's audit firm, making Enron more profitable than it is as a result of fraud in the accounting records, and Enron's bankruptcy after the fraud was revealed. The most important event that caused the company to go bankrupt was the use of illegal accounting procedures. Enron took its losses off the balance sheets of other companies through illegal accounting transactions, giving the company a strong image and increasing its stock price. This scandal caused great repercussions in the markets and shaped the future of the profession by bringing various regulations to the audit profession.

The company overstated its profits and understated its losses, destroyed some accounting documents, hid audit documents, and deleted thousands of electronic mails (Atmaca, 2012).

The critical point in the emergence of the Enron scandal was that Bethany Mclean, one of the journalists of that period, wanted to examine the company. In 2001, Bethany McLean published an article titled "Is Enron Overpriced?" Mclean was skeptical of how Enron was able to maintain high share prices with trading volumes at fifty-five times its earnings. The article also addresses the inability of analysts and investors to understand exactly where Enron generates its income (McLean, 2001).

In her research, McLean saw strange business transactions and faced a huge debt. Enron reported sales of \$50.1 billion in July 2001. And this figure exceeds analysts' estimates by 3 cents per share. The company reported a third-quarter loss of \$638 million in October and reported a \$1.2 billion decline in the equity values of its shareholders. This caused the SEC to control the company's accounts. A more comprehensive investigation was then initiated, and in November the company had to restate its financial statements, which contained the loss reports for the previous five years, and disclose a loss of \$586 million. As the facts began to emerge, the company had to declare bankruptcy as investors and lenders pulled their hands from the company (McLean, 2001).

The Enron scandal has affected both the USA and the world economically and socially. As a result of this scandal, 85,000 people in the world and 4,500 people in the USA lost their jobs, and the effect of this scandal on the US economy is approximately 64 billion dollars (Sağlar and Kandemir, 2007).

While Arthur Andersen earned \$25 million from the audit of Enron in 2000, it also earned \$27 million from consulting activities. The size of the audit fee alone inevitably has a significant impact on the partners. Arthur Andersen's fee from Enron alone comprised 27% of the customers in Houston (Healy and Palepu, 2003). Although problematic records were noticed in the reports prepared by Arthur Andersen for

Enron, it was seen that they were not reflected in the reports and gave positive opinions (Atmaca, 2012). Therefore, it is concluded that Arthur Andersen helped them make irregularities in their financial statements in order not to lose their important customer, Enron.

After this scandal, trust in the auditing profession was shaken, and some regulations were made in the accounting and independent auditing sectors, especially in the USA. The Sarbanes-Oxley Act was enacted to prevent a possible accounting scandal. The main purpose of the Sarbanes-Oxley Act is to eliminate the loss of public confidence in the capital markets due to the Enron scandal and to ensure that the listed companies fulfill their responsibilities in terms of transparency, honesty, and disclosure of their financial statements (Dinç and Cengiz, 2014). This law states that an independent audit firm cannot perform any other work while conducting an audit of a business. With the Sarbanes-Oxley law, regulations were introduced to strengthen the independence of the auditors, control the auditing of publicly traded companies, and increase the disclosure responsibility of the company's senior management, and a brand new era began in the auditing industry. The effect of the Sarbanes-Oxley law on Turkey is that in 2011, with the new provisions in the Turkish Commercial Code No. 6102, an independent audit obligation was imposed on capital companies.

### ***3.7.2 WorldCom Scandal***

WorldCom entered the industry as a small telephone company and has since grown to include more than sixty companies in the industry in the last fifteen years. It has become the second-largest company in the United States in the telephone services and computing sectors. In 2002, it was revealed that Worldcom committed accounting fraud totaling 3.8 billion dollars by misrepresenting its financial situation. Just like Enron, it has been revealed that WorldCom's profits of 1.4 billion dollars in 2001 and 130 million dollars in the first three months of 2002 did not reflect the truth. WorldCom announced that it fired its assistant general manager responsible for financial affairs due to fraud of approximately 4 billion dollars in its expenses. It is also noteworthy that Arthur Andersen, the auditing company of Enron, carried out the audit of WorldCom. WorldCom's rapid growth is under scrutiny by the US SEC (New York CNBC-E).



### ***3.7.3 Xerox Scandal***

Xerox Corporation was founded in the United States in 1906 to make and sell photographic paper. From the 1960s on, they bought publishing companies and computer units and expanded their activities by turning to other areas. It experienced a resurgence in the 1980s and 1990s, acquiring some companies specializing in scanning, faxing, and desktop publishing in the 1980s. In the mid-1990s, they developed digital technology. In the late 1990s, Xerox entered a difficult period and faced competition in the market. They could not prevent the copying business from being replaced by desktop printers. At the same time, Xerox lost millions in its insurance and financial services diversification efforts. Still, the firm's chief executive and CFO satisfied investors by driving stock prices higher. Xerox's senior executives have led their accounting departments to commit fraud. The company spokesperson admitted that between 1997 and 2002, the actual revenues of the firm were \$2 billion less than its declared revenues (Butala and Khan, 2008).

### ***3.7.4 Royal Ahold Scandal***

Similar incidents began to occur in Europe outside of the United States. The accounting scandal brought to light a Dutch firm, Royal Ahold, in February 2003. Royal Ahold was the third-largest retail company in the world. This company showed its revenues in 2001 and 2002 were \$500 million more than they should have been, and the company's stocks lost 63 percent of their value due to the inspection of the company by the inspectors (Süer, 2004). The financial problems of Royal Ahold, the world's third-largest retailer, have started to signal that accounting scandals may occur in Europe after America. The firm reported that it fired senior executives involved in the matter. Furthermore, Deloitte, the audit firm that revealed the \$500 million scandal, stated that it had warned the firm ahead of time and had nothing to do with the scandal (Hürriyet, 2003).

### ***3.7.5 Parmalat Scandal***

Another example of an accounting scandal is the Italian company Parmalat, which took place in Europe in December 2003. Parmalat was a food company operating in 29 countries. An investigation into Bank of America's lending to Parmalat was launched.

As a result of the research, it was revealed that 4 billion euros were hidden by fraud. It turned out that this money was transferred to the Cayman Islands. Following these events, the company's owner, Calisto Tanzi, resigned as chairman of the board of directors, causing Parmalat to sign a scandal that shook the world (Rimkus, 2016).

### ***3.7.6 Carme Scandal***

The Carme scandal, on the other hand, is an event that occurred when the CEO, CFO, and sales manager of the company were involved in fraud. To appear profitable at this California-based company, sales invoices were issued to customers every month to create unrealistic sales revenue. An example of this are the invoices that exceed \$800,000 for the Axel Craft Company. It is hoped that by issuing 1.6 million dollars in fake invoices each year, it will be possible to generate excess profit figures. The company continued these actions until September 1994, and as of this date, its sales revenue was declared as \$2.4 million and its net income as \$450,000. During the audit of the Carme Company, details of the \$800,000 account with Axel Craft were requested. Carme's CFO had Axel Craft agree to approve this amount and ensure that the auditor's report was positive. However, the accounting manager noticed this event, and the truth came out (SEC, 1998).

If we need to evaluate accounting scandals in general, it is clear that the basis of the scandal is fraudulent financial reporting. In addition, these fraudulent companies want to reach their peak as soon as possible, so they cannot fully fit their growth strategies into the ethical framework. This greed for winning leads them to make mistakes.

More emphasis should be placed on preventing fraud than detecting it. It is important to establish a robust auditing system to prevent fraud. In this context, anti-fraud systems should be developed and control systems should be established. There will always be a risk of not detecting all of the frauds as a result of the professionalization of the parties who will commit the fraud, due to some of their competent characteristics.

In that case, the need for artificial intelligence, which will reveal even the tricks made so professionally that they cannot be revealed, arises at this point. In today's technological age, can there be an artificial intelligence system that detects fraud and does not allow it to progress? The research question comes to the fore here. In the next part of the thesis, the concept of artificial intelligence will be discussed in detail.

### **3.8 *Concept of Artificial Intelligence***

Artificial intelligence can be briefly defined as technology that automates the work that can normally be done with human intelligence. Artificial intelligence platforms have become a sought-after object with the potential to solve complex problems as a result of computers behaving intelligently. It has been inevitable to keep up with technology and have a strong stance in a market where competition is intense.

Artificial intelligence consists of many algorithms, models, and techniques provided through machine learning, visualization, and databases (Moudud-UI-Huq, 2014). Artificial intelligence is the ability of a machine to perform tasks with the help of features such as human-specific reasoning, generalization, making sense, and learning from past experiences (Nabiyev, 2016).

Technological advancements have introduced a plethora of automation and machines into our daily lives. People were able to divert their attention away from monotonous tasks by utilizing automation. By allowing artificial intelligence, such as machines and algorithms, to do the heavy lifting, humans will be required to focus on more critical issues (Zdoan, 2017). Therefore, people will increase the efficiency of their work by making effort only at critical points.

The increasing number of data points also makes it difficult to track money movements. Thanks to artificial intelligence, a large number of data points will be analyzed comprehensively. At this point, the use of artificial intelligence has become an important issue in examining and determining the records of income and expenses of companies (Turan, 2020). Although it is possible to use artificial intelligence in many sectors, it is possible to use artificial intelligence in the audit sector, which is the

subject of our research. And Deloitte, KPMG, PwC, and EY, known as the "big four" auditing companies, have also started to adopt artificial intelligence.

On the other hand, the widespread use of artificial intelligence raises ethical concerns about data privacy. Topics that require specialist knowledge and support, such as data governance, information technologies, and cybersecurity, should be included in the AI strategy. Otherwise, it will be inevitable to revise the artificial intelligence strategy (Alvero and Cassels, 2020). Due to the change created by digital processes, a new audit environment is emerging in which auditors need to change their audit processes and analyses (AICPA, 2012).

### ***3.8.1 History of Artificial Intelligence***

The use of artificial intelligence in today has been thanks to Alan Turing. Alan Turing, who is known as the founder of artificial intelligence, talked about machines with the ability to think like humans in his article titled *Computing Machinery and Intelligence* published in a magazine in 1950 and suggested the Turing Test to examine whether machines would behave like humans (Turing, 1950).

With the machine named Enigma, which brought success to Germany in World War II, Alan Turing was successful in decoding the Enigma code. In addition, the term artificial intelligence was first mentioned by John McCarthy in the “Artificial Intelligence Dartmouth Summer Research Project” in 1956 (Lin and Hazelbaker, 2019; Lungarella et al., 2007).

In the conferences held afterward, it was emphasized that artificial intelligence is an important research field. Among these conferences, in the conference held in 1956, McCarthy suggested the conference title “Artificial Intelligence”. This has been an important start for artificial intelligence (McCarthy et al., 2006).

The 1960s and 1970s were years when there were no significant developments in artificial intelligence. With the widespread use of PCs in the 1980s, artificial neural networks were reborn, and genetic programming was developed by John Koza in the 1990s (Yıldız, 2009).

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### 3.8.2 Types of Artificial Intelligence

In a study conducted by Mijwel (2015), it was mentioned that there are four different types of artificial intelligence "Type 1, Type 2, Type 3 and Type 4". Artificial intelligence types are also explained in detail in Table 2 (Mijwel, 2015).

Table 2. Types of Artificial Intelligence (Source: Mijwel, 2015)

Type	Opinion
<b>Type 1</b>	Such artificial intelligence is considered a reactive machine. Deep Blue, the chess program of IBM company, can be given as an example of this type of artificial intelligence. Defeating the Russian chess player Gary Kasparov in 1990, this program detects the pieces on the chessboard and makes predictions. However, a shortcoming of the program is that it has no memory and cannot adapt past experiences to the future.
<b>Type 2</b>	This type of artificial intelligence is called limited memory. An example of this is the machines warning the driver when changing lanes in cars. When a driverless vehicle programmed with this type of artificial intelligence sees a pedestrian on the road, it detects it as an obstacle and changes lanes.
<b>Type 3</b>	This type of artificial intelligence is called the theory of mind, but such applications of artificial intelligence are not yet seen. When a driverless vehicle programmed with this type of artificial intelligence sees a pedestrian on the road, it senses that the pedestrian will wait for the vehicle to stop and moves in that direction.
<b>Type 4</b>	This type of artificial intelligence is artificial intelligence in which machines have a consciousness of their own but is not yet seen in practice. When a driverless vehicle programmed with this type of artificial intelligence sees a pedestrian on the road, it decides to stop the vehicle by considering both itself and the pedestrian on the road.

On the other hand, Marr (2018) discussed the operations that the machines in Table 3 can do in his study (Marr, 2018; Serçemeli, 2018).

Table 3. Tasks Machines Can Do (Source: Marr, 2018; Serçemeli, 2018)

<b>Operations That Machines Can Do</b>	<b>How To Do</b>
Accounts payable/receivable processing:	Although there are now AI-powered solutions for managing invoices, they will become much more efficient as they learn the correct accounting codes for each invoice.
Supplier onboarding:	Without human interference, machines may check tax information or credit scores on suppliers, and they can query portals to get all the information they require.
Procurement:	The purchase procedure involves dealing with a lot of documentation in the majority of firms. By eliminating pointless paperwork throughout the automated purchase process, the supply chain will go paperless. Robots will keep an eye on supplier price changes.
Audits:	It will be advantageous to locate the documents needed in the audit process in digital files rather than seeking them in file cabinets as a result of the audit process' digitization. Machine-assisted digital inspections will also boost inspection efficiency because machines have complete (100%) process control.
Monthly/quarterly close process:	The process will speed up as a result of receiving the numbers faster and producing more precise findings, giving businesses more time to strategically consider the transactions they will make with this data.
Expense management:	The machines will complete this task more quickly than the accounting personnel, who may take longer. Machines will read receipts and audit costs, and alert people in the unlikely case that something is not as expected.
AI chatbots:	Customer concerns can be resolved more successfully with the use of chat tools. You can pay off outstanding accounts, invoices, and more with the aid of chat tools.

Artificial intelligence technologies can be used in various fields, such as the economy, health, security, etc. In 2018, an 800-page English book was translated into French with artificial intelligence in 12 hours. In addition, artificial intelligence is also used in the fields of smart homes, cars, financial failure prediction, identifying frauds, determining purchasing behaviors, painting, composition, and smart factories (Yıldız and Ağdeniz, 2019). In this thesis, the research area was narrowed by conducting research and evaluations on the use of artificial intelligence in the audit sector.

### 3.8.3 Concepts Related to Artificial Intelligence

In the 18th century, the invention of steam engines started the First Industrial Revolution, and then, with the developments in technology, smart machines were used in many areas. With Industry 4.0, which is called the Fourth Industrial Revolution, new concepts such as artificial intelligence, the internet of things, machine learning, and blockchain technology have emerged (Arndts and Kappner, 2019).

According to Özdoğan (2017)'s research, technology via blockchain, big data, cloud computing, and artificial intelligence is as follows:

*“Technology: Via the blockchain, it coordinates all the transactions to be made within the accounting records and certain standards. Through big data, it collects and analyzes all the data that can affect business operations. Through cloud computing, a business can do business without regard to time or place. By means of artificial intelligence, it coordinates this whole process as a good manager and affects the distribution of duties in the accounting function of a business” (Özdoğan, 2017).*

Businesses have started to use many new technologies, such as artificial intelligence applications, big data analysis, cloud computing technologies, and blockchain technology. This situation has put the traditional accounting profession in a difficult position. Because the new generation of digitally oriented accounting companies is the one that can show the success of using technology, traditional companies are lacking in this regard. Traditional accounting firms have struggled to meet business expectations as a result (Özdoğan, 2017). As Industry 4.0 brings concepts such as artificial intelligence and machine learning to the fore, companies expect less error and lower costs from artificial intelligence.

Because of Industry 4.0, enterprise audits are likely to use more on-site counts and other methods of physical auditing. RFID sensors will enable businesses to track individual stock items as well as the stages of product conversion on the manufacturing line (Aslan and Özerhan 2017). In addition, thanks to 3D printers, the stock items will



be displayed on the screen in three dimensions, and the risk of the inspection team not counting the wrong product or not being able to recognize the product during the stock count will disappear (Ös, 2021).

The replacement of traditional business models with artificial intelligence has increased businesses' ability to do business faster, more productively, and less costlily. However, in addition to all these, it has been inevitable that new risks, such as cyber risks, will emerge. A study done in 2018 by PwC found that digital crimes are getting worse every day, that cybercrime is one of the most common types of fraud, and that 31% of businesses are at risk of digital fraud.

In this context, the concepts that have entered the literature regarding artificial intelligence and become very common in the sector are shown in Figure 9, and their explanations are given below:

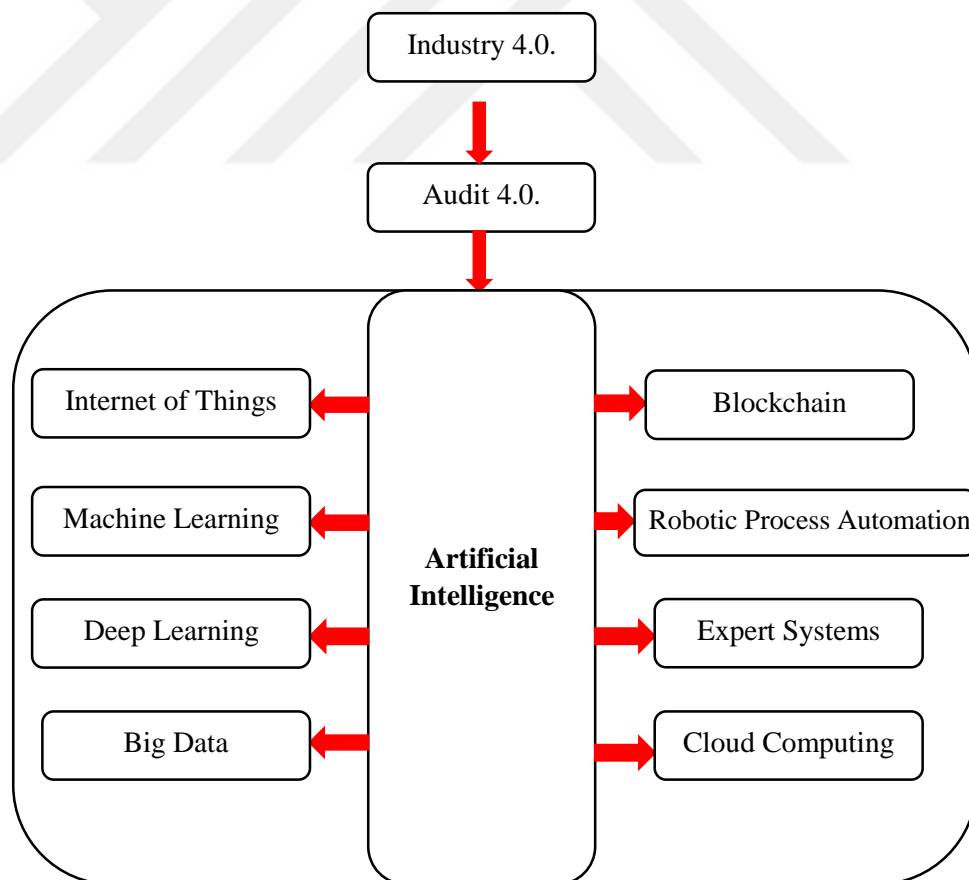


Figure 9. Concepts Related to Artificial Intelligence (Source: Compiled by author)

### 3.8.3.1 Industry 4.0

Industry 4.0, also called the Fourth Industrial Revolution, has emerged as a result of the integration of the physical world of machines and the virtual world of information technologies through the internet (Bayrak, 2018). It is possible to monitor all processes in the supply chain with technology. In this way, the current situation will be analyzed, and the most appropriate decisions can be taken. Industry 4.0 aims to provide a level of automation with high productivity and efficiency (Thames and Schaefer, 2016). Auditors will be able to access a lot of data that can be used in internal and external auditing with the Internet of Things, which is one of the main components of Industry 4.0. This data again constitutes big data, one of the basic components of Industry 4.0 (Yıldız and Ağdeniz, 2019).

### 3.8.3.2 Audit 4.0

The developments within the framework of Industry 4.0 also affected the audit profession, and this change process was named Audit 4.0. Audit 4.0 is defined as the real-time assurance of real-time control of data with technology support. Audit 4.0 refers to the process of managing artificial intelligence, big data, and the internet of things (Yıldız and Ağdeniz, 2019).

Figure 10 is a short summary of Dai and Vasarhelyi's (2016) study on how the auditing field has changed from the past to the present.

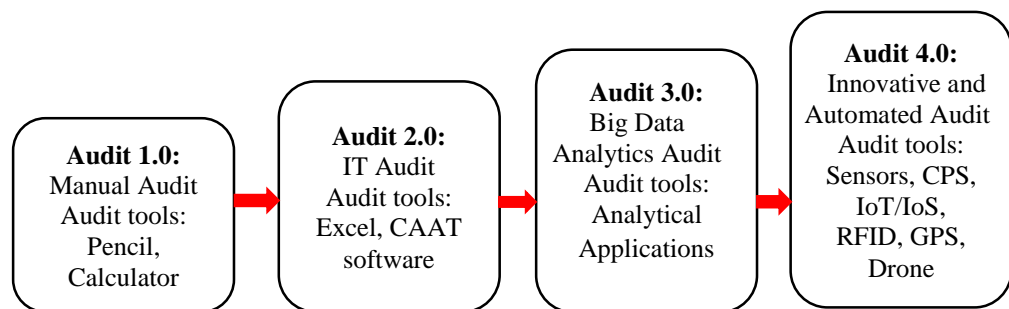


Figure 10. Transformation Process of the Audit Profession (Source: Dai and Vasarhelyi, 2016)

Audit 1.0 refers to the period in which traditional methods were used. The audits made in this period are the audits made by the human brain. In the Audit 2.0 period, the IT audit came to the fore. In this period, due to the inadequacy of inspection techniques and technological infrastructure, inspections were carried out in a limited way. In the period called Audit 3.0, big data analysis came to the fore and started to be used, and the industrial revolution in 2010 carried the audit to the Audit 4.0 stage. Traditional audit approaches have become unsustainable today. Technologies such as the internet of things, artificial intelligence, big data, RFID, and drones have become popular in today's audit approach. Audit 4.0 is an audit process that uses internal and external big data obtained by the internet of things as input and analyzes this data with artificial intelligence technologies. In Audit 4.0, the main focus of the auditor is now risk management and consulting activities (Yıldız and Ağdeniz, 2019).

### ***3.8.3.3 Machine Learning***

Machine learning is an artificial intelligence technology that can expand the decisions made based on human behavior with new data inputs, recode old decisions with this new data, and improve processes (Heller, 2019). It is a basic artificial intelligence technique that learns from data and automatically optimizes algorithms with no or limited human intervention. By successfully fitting complex structures to data, machine learning has achieved successful results in intelligence tasks (Tammenga, 2020).

Automatic tracking of email correspondence is a common method for detecting illegal activity in the financial services industry. It is thought that this predictive power will reach much higher levels with the use of machine learning (Hirsch, 2018). Also, Rosenberg (2017) says that machine learning is thought to be the only way to deal with new and unknown cyber threats.

### ***3.8.3.4 Deep Learning***

Machine learning is a sub-branch of artificial intelligence, and deep learning is a sub-branch of machine learning (Aslan, 2022). According to Kandemir (2021), deep learning is a type of machine learning based on artificial neural networks. A neural network is a group of interconnected neurons that can influence the behavior each network or neuron performs. At its most basic level, a neural network is a collection of nodes divided into three distinct functions. These functions are the input layer, the hidden layer that determines the model by applying an algorithm, and the output layer (Kandemir, 2021). In deep learning, multiple layers of algorithms are stacked to emulate the neurons in the human brain's layered learning process. Each of the algorithms is equipped to remove a certain feature from the data (Kandemir, 2021).

### ***3.8.3.5 Robotic Process Automation (RPA)***

Robotic Process Automation (RPA) can be defined as performing some predefined tasks by imitating an employee through software robots. With this technology, robots help automate processes such as checking invoice amounts and checking emails by completing their tasks without error and logging out of the system. RPA offers significant benefits in increasing enterprise efficiency and controlling costs by integrating into existing infrastructure without requiring any IT infrastructure changes. With RPA, software robots can read, process, and analyze data by learning and imitating the steps that employees take on the software system while performing a task and reporting the result. In this way, time-consuming tasks will be automated, reducing the risk of error and increasing the quality of the work. In addition, software robots work 24 hours a day, preventing disruptions (Vektora Blog, 2022).

In addition, smart robots follow their status and take advantage of timely maintenance work, with the preventive measures they take in maintenance helping to extend the service life of the machine, reduce depreciation costs, and make production sustainable without interruption (Tutar, 2018).

Robotic process automation provides great advantages to businesses in the fields of accounting and finance by automating the process and restructuring financial services. It also helps to record data on issues such as accounts receivable, collections, and invoices (Tutar, 2018). From the audit perspective, it will automate repetitive tasks such as reconciliations, internal control tests, and detail tests. As a result, auditors will reach more resources by searching data for potential anomalies to audit areas that are complex by nature, and as a result, they will reach a higher audit quality (Arslan, 2021).

#### ***3.8.3.6 Internet of Things (IoT)***

The Internet of Things, one of the new concepts provided by Industry 4.0, was first introduced by Kevin Ashton in 1999 (Öztuna, 2017). It is emphasized that information should be collected not only from people but also from objects, considering that human errors will decrease (Erturan and Ergin, 2017).

This technology allows for the collection and sharing of data from the internet network through the sensors inside the objects. In accounting auditing, with this technology, by switching to cyber-physical networks, audits will evolve into a decentralized audit mechanism instead of centralized control. In other words, not only the companies to be audited but also the traces of objects with IP codes can be tracked. The objects will also reduce the time and place costs of the audit by collecting data in connection with one another (Banger, 2018).

In today's audits, data can be collected most easily with the Internet of Things. An example of the use of the Internet of Things in the field of audit is the realization of authorization control with face recognition. In other words, with this technology, a distinction between authorized and unauthorized people will be made by the cameras, and the actions of authorized people will be monitored. Situations such as the working time of a machine and the determination of stock level can also be determined with this technology (Yıldız and Ağdeniz, 2019).

Since the audit firm receives information about the activities instantly and the data can be audited during the activity before the business activities are finished, this is also considered an advantage of the internet of things for the audit sector (Tutar, 2018).

IoT technology will minimize the risk of error thanks to interconnected objects and feedback received through the Internet of Things. Interconnected objects will also increase work efficiency by communicating among themselves. There will also be feedback on future difficulties and costs. The interconnectedness of the systems will allow us to identify possible mishaps that may occur during the production phase. The use of the internet of things in factories will contribute to processes such as stock control, stock counting, stock ordering, monitoring machine maintenance, operational auditing, and error resolution (Erturan and Ergin, 2017).

Therefore, the application of the Internet of Things will also reduce the need for accountants to make manual records, and accountants will be able to deal with other jobs with time savings (Qiu, 2016).

### ***3.8.3.7 Big Data***

The data used in Audit 4.0 is big data. "Big data" includes both data produced by businesses and data to be obtained from outside the business (Yıldız and Ağdeniz, 2019). "Big data" is defined as the realization of the collection, visualization, storage, cleaning, and analysis of large volumes of data created by the systems that emerged with the development of technological infrastructure (Akdoğan and Akdoğan, 2018). "Big data" is data of such a large volume, variety, and variability that it prompts companies to invest in systems and applications specifically designed to process it. This data can be produced by companies or purchased from external sources (IIA, 2017).

Thanks to big data technology, accurate and reliable information can be selected and stored in a virtual environment where there is a lot of information. In this direction, big data includes the processes of storing and managing data obtained from different sources such as social media shares, blogs, web server logs, climate sensors,

information obtained from sensors such as virtual statistics, and information obtained from GSM operators. If big data is analyzed correctly and the right methods are used, it can help businesses make strategic decisions, improve their operations, and analyze risk (EBSO, 2015).

Various companies use these tools, emphasizing the importance of big data analysis to collect large amounts of data and examine competitive environments (Griffin and Wright, 2015). Big data technology aims to save energy, increase the quality of products, and improve material maintenance. Big data will inevitably adapt effectively when various information systems such as accounting, customer relations, and production management are harmonized (Manyika et al., 2011).

With the use of big data in audits, other audit evidence such as video and audio files and GPS locations, which were not included in traditional audits, would be used. With this technology, the quality of audit evidence would increase, and with it, a less costly audit process would be seen compared to traditional audits by taking advantage of technological innovations (Yoon, Hoogduin, and Zhang, 2015). Dai and Vasarhelyi (2016) also thought that audit costs would decrease as they provided more assurance regarding the accuracy of transactions (Dai and Vasarhelyi, 2016).

#### ***3.8.3.8 Cloud Computing***

The general name of computers and other devices that use internet-based computing services that can be used at any time and shared between users is called "cloud computing." The internet of things technology in Industry 4.0 creates cloud computing. Cloud computing plays an important role in the processing and storage of large and complex data. Today, systems and software based on cloud platforms are used by many businesses. It is thought that control systems and production monitoring systems will switch to cloud platforms in the future (Tutar, 2018).

By using cloud computing, the auditors will be able to reach the resources they want effectively and efficiently, and they will be able to perform their audit activities wherever they can access the internet. This situation increases audit quality as it

provides the opportunity to conduct detailed audits and provides a competitive advantage (Ciğer and Kınay, 2018).

### **3.8.3.9 Blockchain**

Blockchain is defined by Ganne (2018) as:

*“It is a technology protocol that allows data sharing with trust-based transactions such as identification and authorization in a decentralized, distributed network environment without the need for approval or control by a central authority”* (Ganne, 2018).

Blockchain technology has developed with the introduction of cryptocurrencies such as Bitcoin. Today, blockchain technology is used in the insurance, banking, and trade sectors (Dai and Vasarhelyi, 2017) and in areas such as cash transfer transactions, digital identity, notary activities, supply chain management, and land registry systems (Usta and Doğantekin, 2017).

In the blockchain system, transactions combine to form blocks, and each block has a connection with another block. Systems become secure and integrated with these connections. Big data collections are formed with a set of transactions (Nofer et al., 2017).

Invoices are sent and tracked in accounting processes using Blockchain technology. By transferring the data to the digital environment, the accounting transactions are shared in real-time. As a result of the digitization of all data, access to information becomes easier, and confidence in information increases. However, the reliability and effectiveness of the audit will increase (Digital Asset, 2016). The emergence of new blockchain-based techniques is pushing auditors to change their skills. For example, the auditor needs to consider both general ledger records and blockchain records to obtain sufficient audit evidence (Celayir and Celayir, 2020).



### ***3.8.3.10 Expert Systems***

Expert systems, adopted in the 1980s, are artificial intelligence programs that have a level of expertise to replace humans in certain decision-making areas. The most widely used artificial intelligence technology is expert systems. The expert system software program can be developed for any problem among a set of options. Areas that require special expertise for a person are seen as more feasible for an expert system (Chukwudi et al., 2018).

Expert systems are used in auditing in areas such as audit planning, audit risk determination, and internal control evaluation. It is also used in internal audits, for example to find transactions that could be used to commit fraud (Chukwudi et al., 2018).

## ***3.9 The Relationship Between Artificial Intelligence and Audit***

Today, the sampling method is generally applied in audits made with traditional methods. The evaluations are made in line with the evidence selected from the population. Since the evaluations are made by human hands, they are more prone to error. In addition, since the whole population could not be examined, the findings may not completely reflect the truth. As a result, there will be a risk that auditors will express a false opinion on the financial statements of the companies they review.

At this point, digital audits with artificial intelligence come into play. In the audit industry, spending too much time on monotonous and repetitive tasks is a waste of both time and money. Artificial intelligence has become a subject that can shape the future by minimizing the risks that may occur in audits and saving time, cost, and labor.

If we ask why the audit is being conducted, we will receive the following response: Auditing is a process applied to ensure that the financial statements of companies are presented with truth, impartiality, and generally accepted principles. This process will provide the most accurate and efficient output in the shortest time by using the

contributions of today's technology age and the advantages of artificial intelligence. Digitizing the process allows auditors to review and evaluate more data than ever before.

With the use of artificial intelligence in the field of accounting, after the invoices are passed through the scanner, the AI will be able to automatically discard the records, just like an accounting employee. However, issues such as the interpretation of data after the analysis, which are outside of such automatic processes, cannot yet be realized by artificial intelligence. For this reason, it is expected that accountants will turn to issues that require interpretation and judgment, such as consulting and financial consulting, in the future, and traditional and routine work will be done by artificial intelligence (Gacar, 2019).

Nowadays, with the recording of data in an electronic environment, it is likely that audit processes will evolve into quality audit processes using information technologies (Celayir and Celayir, 2020). With the technologies used, the auditors will be able to understand the important activities of the customers more clearly, and the important mistakes caused by fraud will be detected by the auditor (Bierstaker, Burnaby, and Thibodeau, 2001).

The fact that many functions of accounting and auditing can be performed by artificial intelligence also changes the roles of accountants and auditors. Now that it will be easier to obtain accounting and auditing data, the important thing will be to manage big data (Serçemeli, 2018). The trend toward the digitalization of auditing reveals the need for auditors to set aside their classical audit understanding and reshape their digital skills and abilities by adapting to new technologies.

During the audit, auditors should be able to use the advantages of digital technology instead of searching the file cabinets to access documents. When audits are done more digitally, they are faster, more accurate, and can cover all of a company's financial transactions (Serçemeli, 2018).

According to Serçemeli (2018), the way to keep up with technological innovations is to adapt and invest in artificial intelligence technologies. This situation is handled in three dimensions, as seen in Figure 11. These are the economic dimension, the development of technical infrastructure, and personnel employment. Companies should create a budget, expand their technological infrastructure processes, and hire personnel who are capable of using these technologies to realize the adaptation of artificial intelligence.

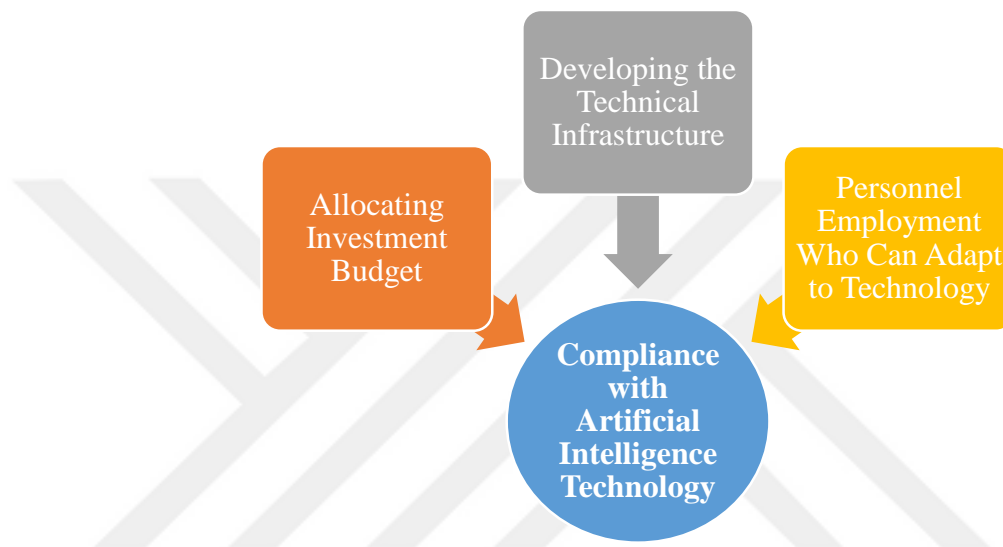


Figure 11. Adaptation Scheme to Artificial Intelligence Technologies (Source: Serçemeli, 2018)

If all of these features are included, companies will find it easy to adapt to artificial intelligence and will be able to succeed in a competitive environment by bringing the power of technological advantages with them.

Since the decision-making aspect of artificial intelligence has not yet been developed, auditors must make decisions and use their professional judgment. In these matters, they will use their time more efficiently and transfer the monotonous work to artificial intelligence. Artificial intelligence can be used for audit planning, analyzing specific accounts, materiality and risk analysis, internal control system evaluation, evaluating evidence, selecting an opinion, and writing a report (Meskovic et al., 2018).

With the widespread use of new technologies such as artificial intelligence, the internet of things, and big data analysis, the scope of the audit is increasing while the time and cost of the audit are decreasing. In addition, thanks to the technological infrastructure of Audit 4.0, auditors will be able to audit all audit areas in the enterprise (Yıldız and Ağdeniz, 2019).

Based on the analysis of the relationship between artificial intelligence and the audit sector, it is seen that there are some disadvantages as well as advantages. The important thing is to benefit from the advantages to the maximum extent possible and to take care to keep the risks that may occur at a minimum level. The advantages and risks of artificial intelligence will be examined in more detail in the next section.

### ***3.10 Advantages and Risks of Artificial Intelligence***

Since artificial intelligence will not be affected by situations where people are psychologically affected, it can make more consistent decisions compared to humans. On the contrary, in situations that a person can detect only with intuition, people are more important decision-makers than artificial intelligence.

Before expert systems and automation became widespread, firm owners and accountants often made decisions based on outdated figures. However, with the automation of data processes, the most up-to-date information about companies is always available (Chukwudi et al., 2018). This will increase the quality of audits tremendously.

Since artificial intelligence systems can learn from data, they can access and develop on their own without the need for a human to do programming (Munoko, Brown Liburd, and Vasarhelyi, 2020).

Artificial intelligence will easily identify the inconsistent situations in the data set, which the auditors manually examine, and will help to distinguish them automatically thanks to the learning function of artificial intelligence (Shimamoto, 2018). In this case, time and cost advantages are inevitable.

Artificial intelligence will help increase tax revenue and establish a fair tax system by preventing possible tax losses and evasion in tax applications (Turan, 2020). By analyzing loopholes in the law, AI can take action and anticipate tax evasion cases that auditors might miss. It can also find risks to taxpayers and important hints about attempts to avoid paying taxes (Gacar, 2019).

To audit risks and big data, internal auditors must be able to use constantly developing technology and have the competence to dominate digital processes. This has transformed the auditors' profiles. The use of new technologies and robot software in auditing has provided internal auditors with time and cost advantages and facilitated the execution of audit work (Bircan, 2020).

(Sheedy, 2017) says that writers, announcers, middle managers, accountants, accounting assistants, salespeople, journalists, and doctors are the most likely to lose their jobs because of AI technology.

According to another view, it has been revealed that the sectors that will be most affected by artificial intelligence applications are accounting and finance. To put it another way, artificial intelligence will primarily replace humans in these areas (ManpowerGroup, 2016).

With a possible leak of information, artificial intelligence applications will jeopardize the confidentiality of financial information. Additional workforce, infrastructure, and costs will be required to prevent hacker attacks. States are also concerned about the presence of critical data only in digital media in the event of natural disasters or electronic warfare. It is also unclear who, if anyone, will assume legal responsibility from the user or manufacturer in the event of an accident (Huang, 2018). It is recommended to give importance to research and development in the field of encryption technologies to prevent the leakage of the other party's information (Zhou, 2019).

The spread of cybercrime has caused one of the foci of internal auditors to be cyber risks and digital crimes, thus expanding the scope of the duties and responsibilities of internal auditors (Bircan, 2020).

The lack of expert IT personnel in the sector is a factor that slows down or hinders the audit process. The fact that businesses use different techniques for data entry prevents artificial intelligence from making sense of the data or prolongs the completion time of the process (Taş and Mert, 2019).

Artificial intelligence can save time in processes, but it cannot express emotions and reason like humans. In addition, artificial intelligence is lacking in "professional judgment and which is an important aspect of the auditing profession. Artificial intelligence is expected to negatively affect the skilled labor market. And it also raises employment concerns in the fields of accounting and auditing. Some researchers also talk about the existence of new job opportunities that may occur as well as those who lose their jobs (Bizarro and Dorian, 2017).

Given the auditors' lack of professional judgment and skepticism, the question of whether artificial intelligence applications will be adequate for expressing opinions has been debated. Although the data collected in the audit processes may seem important, the support of subjective interpretations is needed. Auditors need to perform some tests, such as fraud risk assessment, to support their ideas (Brown-Liburd, Issa, and Lombardi, 2015).

Artificial intelligence, with both its advantages and risks, has been accepted by companies and has started to be used in audit processes. In the next section, the companies adopting artificial intelligence are mentioned, and all developments related to artificial intelligence on the websites of KPMG, Deloitte, PwC, and Ernst & Young, known as the world's four largest audit companies, are examined in detail.

### ***3.11 Companies Adopting Artificial Intelligence***

In 2017, Singularity University organized an event called Exponential Finance Summit. In this event, five companies that successfully realized the university's combination of artificial intelligence and FinTech were emphasized, and what these companies work on was explained. These companies are Numerai, AlphaSense, Opera, AppZen, and CollectAI and are listed below (Fintech Istanbul, 2017).

- **Numerai**; In October 2015, it offers a functioning AI solution, collecting hundreds of thousands of financial models and individual forecasts, along with insights from the community on a network of massive hedge funds. According to Crunchbase data, the company managed to collect \$7.5 million in funds from 11 investors in two different investment rounds with its algorithm.
- **AlphaSense**; Founded in 2010, the company has adapted its search engines to the financial sector. With the artificial intelligence algorithm running in the background, questions resembling a conversation instead of keywords are answered and related reports are displayed on the screen. The company facilitates research by preventing irrelevant results from Google and other search engines.
- **Opera Solutions**; It presents its customers with advanced business intelligence supported by artificial intelligence. It has been in operation since 2004 and has raised more than \$120 million in investments.
- **AppZen**; By patenting its artificial intelligence-based solution, it enables company managers to easily control all employee expenses. AppZen has automated the process of expenses. In this way, the time spent on examining the costs one by one is eliminated. In addition, it also facilitates the approval processes of the suspected expenses for the managers.
- **CollectAI**; It is a cloud-based software based on artificial intelligence. It helps its customers manage their receivables. This company was founded in Hamburg in 2016 and started to make a name for itself in the field of artificial intelligence. The best approach is produced in the cases encountered by imitating the information collection tools together with the continuous learning algorithm.

In the study of Masraff (2021), 5 CIOs who successfully implement and adopt artificial intelligence in their companies are mentioned. These companies that applied artificial intelligence are listed below;

- **Walmart**; CIO Clay Johnson stated that they use hundreds of bots to automate their transactions. The systems give priority to accounts payable and receivable, compensation, and benefits. It has started to be used in areas such as matching purchase orders with invoices.
- **Western Digital**; saves on capital expenditures by using artificial intelligence to optimize test equipment. In the production of hard drives, it is mentioned that hundreds of millions of dollars will be gained for the company with an arrangement to be made during the test phase.
- **Bank of America**; teamed up with Harvard Kennedy School for the development of artificial intelligence. It is stated that as companies compete to develop stronger artificial intelligence systems, they must take more responsibility for negative results.
- **7-Eleven**; uses chatbots and voicemail. This company uses Facebook Messenger chatbots for user registration, finding store locations and campaigns.
- In **Pearson**; artificial intelligence is not only used in the fields of information technologies and digital transformation. In addition to these, it uses artificial intelligence systems that learn with feedback in developing education systems along with issues such as product development, supply chain, and customer service.

The evaluation of the adoption of artificial intelligence in terms of Turkey was made on the website of the World Newspaper (2019). Microsoft and Ernst & Young prepared a report on the use of artificial intelligence by companies in the Middle East and Africa region. According to this report, more than a hundred companies operating in Turkey, Saudi Arabia, United Arab Emirates, Jordan, and South Africa were interviewed, and as a result of the "Artificial Intelligence in Middle East and Africa" report, Turkey became the leading country in the region that invested most in artificial intelligence. In the report, it is stated that 80% of the companies in Turkey handle their artificial intelligence strategies in senior management. While 25% of companies consider AI among their strategic digital priorities, 60% of them acknowledge the importance of AI for their core business. 35% of companies in Turkey actively use pilot artificial intelligence technologies, while 15% consider themselves advanced in terms of



artificial intelligence maturity. In addition, it was stated in the report that artificial intelligence in Turkey is mostly used for automation, estimation, personalization of services, creating insight, and taking precautions (World Newspaper, 2019).

In the research conducted by Maguire (2022), it is argued that artificial intelligence has the potential to increase profitability rates by 38% on average and can lead to an economic increase of 14 trillion dollars in additional gross value added by 2035 (Maguire, 2022).

As can be seen, artificial intelligence has been adopted in many sectors. Considering the adoption of artificial intelligence in the audit sector in accordance with the purpose of our research, it has been seen that these applications exist in the big four audit companies. In line with the reports on the websites of these companies, their research on the use of artificial intelligence and the artificial intelligence applications that they included in their processes were examined in detail.

### ***3.12 Artificial Intelligence Applications in Big Four Audit Companies***

#### ***3.12.1 Artificial Intelligence Applications in KPMG***

In line with the information obtained from the “Turkey on the Road to Digitalization 2021” report published by KPMG, important studies related to artificial intelligence are listed below (KPMG, 2021):

- In international research conducted by KPMG among 90 companies, it was determined that 60% of the participating organizations use smart automation systems, and 52% of them have invested more than 10 million dollars in these systems. This situation reveals that companies benefiting from smart automation plan to use these systems within their structure and make investments.
- In another research conducted by KPMG, it is predicted that smart automation investments will increase every year and reach 231 billion dollars in 2025.
- In another study, approximately 34% of companies using artificial intelligence and smart automation applications stated that they do not have the appropriate systems to control these applications. For this reason, it is recommended that people determine the issues that will cause errors since they delegate the tasks they carry out to robots. For this, the process should be examined from beginning to end and the factors that may cause errors in artificial intelligence models and software teams should work together.
- According to the data of KPMG's report titled “The Future of HR: The New Reality Report”, it was concluded that 3 out of 10 employees need to develop their current skills and abilities in the next 2 years.
- In 2019, KPMG conducted research on 1201 senior Human Resources executives operating in 31 different sectors from 4 countries. The result obtained from the research is that the expectations for artificial intelligence and robotic technologies change in companies in 1 year. According to the research, it has been stated that artificial intelligence is a major threat to employment. 60% of the human resources managers who made up the research sample stated that artificial intelligence would eliminate more jobs than it created. 36% of these managers stated that they have started to use artificial intelligence in their processes, and 50% of them stated that they have not used artificial intelligence yet and are not sure that the transition process will take

place in the next few years. 42% of executives think AI transformation will be one of the biggest transformation challenges they will face in the next 5 years. 50% of the executives stated that they are not yet ready to approach the AI transformation from a strategic point of view (Würsching, 2019).

Some of the highlights from KPMG's report titled "Living in an AI World - Achievements and Challenges in Artificial Intelligence Across Five Industries" published in 2020 are as follows (KPMG, 2020);

- A study was conducted with participants from 5 sectors. According to the research, it was stated that among the artificial intelligence applications, 2 subjects (machine learning with 48% and robotic process automation with 41%) came to the fore. 89% of the participants in the health sector said that artificial intelligence increased their activity and customer communication efficiency, and 68% said that they could diagnose diseases thanks to artificial intelligence. On the other hand, 80% of the participants in the retail sector stated that the problems in customer service decreased with artificial intelligence. 85% of respondents in the financial services industry stated that they were confident that artificial intelligence would detect cases of abuse. It is stated that 82% of the participants in the transportation sector expect autonomous vehicles to enter our lives in the next ten years and 35% within five years. In addition, 2 out of 5 employees stated that they have fear of losing their job. Among the employees, 70% stated that artificial intelligence may pose a threat to data security, and 90% stated that companies should implement some ethical principles on artificial intelligence.

Some highlights from KPMG's report titled "Thriving in an AI World - Unlocking the Value of AI Across Seven Key Industries" published in 2021 are as follows (KPMG, 2021);

- KPMG conducted a survey of 950 executives from the industrial manufacturing, pharmaceutical, healthcare, retail, financial services, technology, and public sectors. Participating managers are in a decision-making position between artificial intelligence technologies and information technologies. It has been stated that the companies participating in the research are companies with annual revenue of at least 1 billion dollars. Managers were asked about the percentages of using artificial

intelligence and 79% of them stated that they partially implemented artificial intelligence in their companies, and 43% stated that they applied it completely. The leading sectors in artificial intelligence applications have been determined as follows; industrial production at 93%, financial services at 84%, and technology at 83%. 85% of the executives stated that artificial intelligence should accelerate implementation studies in their companies. 90% of the participants stated that they followed the agenda related to artificial intelligence, and 69% stated that they had difficulty in keeping up-to-date information due to the continuous development of applications. In the research, it has been determined that the sectors that reflect the ethics of artificial intelligence in their activities are industrial production at 89%, retail at 78 %, technology at 71%, pharmaceuticals at 59%, and public sectors at 53%. When companies were asked about the departments that would benefit most from artificial intelligence, they said that; 34% were information technologies, 13% were data analytics, 12% were administrative affairs, 11% were customer services, 8% were marketing-communications, 6% were sales and finance, and 5% were human resources. In the financial services sector, artificial intelligence has been applied in the areas of fraud detection and prevention, risk management, and process automation.

The information obtained from the KPMG website regarding KPMG's best-known Artificial Intelligence application, KPMG Clara, is as follows;

KPMG Clara is an intelligent auditing platform powered by Microsoft Azure. This platform is a leading innovation in the industry and is a scalable, integrated, and cloud-based system. This platform enables advanced auditing methodology by providing a data-efficient workflow. Control automation, data science, and data visualization were used in the platform, and new and emerging technologies were integrated. Clara offers its customers a 24/7 auditing platform where they can monitor all of them from a single window. In addition, while KPMG uses the Clara platform in audits, it wants to be unrivaled by taking advantage of technology giants such as Microsoft (KPMG, 2022a).

KPMG Clara ensures that relationships between clients and the audit team are seamless and transparent. This platform, as a single source, provides important information exchange in audits and seamlessly implements artificial intelligence solutions with a single smart platform. This allows KPMG professionals to gain deeper knowledge in audits and benefit from more extensive advanced technologies. During the audit activity with KPMG Clara, the status of the audits will be monitored continuously by accessing the Client Collaboration site. KPMG also works in partnership with key leading technology companies Microsoft and IBM Watson (KPMG, 2022a).

In summary, the digital audit platform KPMG Clara will provide 24/7 access to audit status at any time. Collaborating with the audit team will increase the value of the audit and transform its capabilities. It will also be globally beneficial, able to work collaboratively with the team, run efficient operations and strengthen engagement with the audit team.

The value KPMG Clara will bring to firms is summarized in Figure 12, and KPMG Clara's contribution to audits is summarized in Figure 13.



Figure 12. Values that KPMG Clara Bring to Companies (Source: KPMG, 2022b)

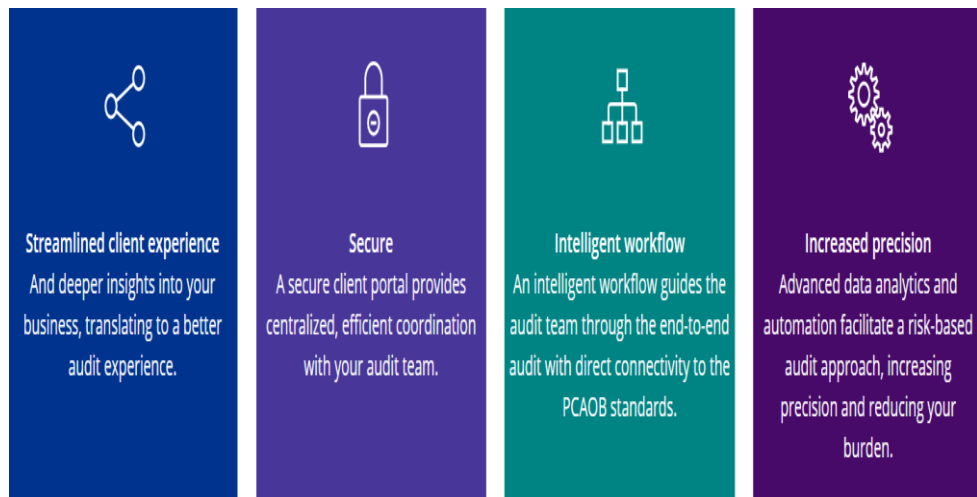


Figure 13. The Benefits of KPMG Clara For Audit (Source: KPMG, 2022c)

As shown in Figure 13, it will provide a better audit experience, more efficient coordination with the audit team, standards guidance to the audit team, and take advantage of advanced data analytics when combined with the KPMG Clara platform.

KPMG Digital Gateway is another platform. This platform is also supported by Microsoft Azure. It is a platform that provides access to all tax and legal technologies by being created in the cloud. KPMG Digital Gateway helps to deal with legal changes in tax, legal, and finance. KPMG says it has invested more than \$1 billion in tax and legal technologies. In addition, this platform also has a mobile application service. It provides an advantage for remote monitoring (KPMG, 2022d).

### ***3.12.2 Artificial Intelligence Applications in Deloitte***

The highlights of Deloitte's report titled "AI leaders in financial services" are as follows (Deloitte, 2019);

Deloitte surveyed 206 financial services executives operating in the United States from different industries applying artificial intelligence. This survey was conducted to understand how companies use artificial intelligence and its impact on their business. 65% of the respondents are senior managers. As a result of the research, they found that companies can be divided into three clusters depending on the number of full AI

applications and the financial return from them. These clusters represent participants at different stages of current AI journeys, called frontrunners, followers, and starters.

-Frontrunners: It has been determined that 30% of the respondents work for companies that generate the highest financial returns from artificial intelligence applications.

-Followers: It was determined that 43% of the respondents work for companies in the middle of artificial intelligence applications and financial returns.

-Starters: It was determined that 27% of those surveyed work for companies that are at the forefront of their AI processes or lagging in terms of returns from AI applications.

As a result of the research, it was understood that the main feature that distinguishes frontrunners from others is the inclusion of artificial intelligence in strategic plans and their ability to emphasize an organization-wide implementation plan.

The highlights of the article titled “Reimagining The Audit Experience” on Deloitte's website, written by Kakoullis, are as follows (Kakoullis, 2018);

It has been a matter of curiosity how auditors will skillfully bridge the gap in traditional analysis. Auditors use technology to improve audit quality and shape the future of the profession. The timing and scope of inspections will change with innovative technologies, and errors will decrease. And with cloud systems, these capabilities will be used more and more. The future of auditing is also linked as organizations like Deloitte learn to maximize new tools. For example:

- Cognitive and analytical tools analyze large volumes of data, helping auditors use this technology to read contracts and invoices and process important information. With these tools, systems can be taught to recommend audit procedures to assess the different risks identified.
- With natural language generation (NLG), teams identify the most important information stuck in the data, helping it generate a language for possible next actions.
- Robotic process automation (RPA) mechanizes working papers and approval request generation to increase efficiency and speed up processes.
- Digital assistance contributes to making research smarter. For example, it can pinpoint the exact location in a document to answer an auditor's query. In addition, chatbots use natural language generation processes to determine the user's intentions and guide the user to the correct answer accurately and quickly.

- Blockchain automates accounting processes. In this way, auditors receive and analyze their data directly from the blockchain.
- With sensors known as the Internet of Things (IoT), auditors collect data to calculate the depreciation of physical assets. Such new capabilities improve audit quality.

With the fusion of technology and human judgment, audits will be more valuable and consistent. Technology automates routine processes, increases efficiency, and streamlines workflow. The quality of each task increases because auditors will free up the space and time they need.

The highlights of Deloitte's report titled "Technology, Media, and Telecommunications Predictions 2019" are as follows (Deloitte, 2019):

According to Deloitte, it will become more widespread to use cloud-based artificial intelligence software globally. In the published report, 70% of companies using artificial intelligence will have artificial intelligence applications with cloud-based enterprise software, and another 65% will have artificial intelligence applications thanks to cloud-assisted development services. In addition to all these, it is estimated that the shares of corporate software prepared with artificial intelligence and cloud-based artificial intelligence development services will increase to 87% and 83%, respectively.

In Deloitte's 2016 report titled "The Power of Advanced Audit Analytics, Everywhere Analytics," written by Davenport, Deloitte's artificial intelligence platform Argus is mentioned (Davenport, 2016).

Deloitte's first cognitive control application is Argus. It leverages advanced machine-learning techniques and natural language processing by learning from human interaction. As a result of supporting document reviews with technology, the time spent will be reduced compared to the past. Thanks to artificial intelligence, auditors can inspect larger samples, even 100% of documents.

Even with these technological tools, no one at Deloitte thinks that human auditors will disappear in the future of the firm. In fact, with such technologies, the auditors' efficiency will increase. Auditors will spend their time practicing their professional



judgment and improving the quality of their estimates. It is mentioned that audits will become more automated in the future and that human auditors will still exist but play significantly different roles. Some will be intimately involved with advanced audit analytics and automation systems, while others will examine the high-level results of automated and semi-automated audit processes. For sure, auditors will continue to evaluate key assumptions and estimates in critical accounting and auditing matters, drive professional skepticism, and add value to the overall financial reporting process.

It will be inevitable for auditors to develop their skills. They have to be more tech-savvy for advanced audit analytics.

Deloitte's consulting business has a predictive analytics tool. This tool leverages Deloitte data scientists to analyze publicly available financial information to predict and evaluate fraud, persistence, and re-disclosure potential scores.

Another artificial intelligence application developed by Deloitte is CortexAI.

The cortex extracts and prepares data and then works efficiently with advanced technologies to harness the power of data. With this platform, artificial intelligence and machine learning projects are used in a safe and integrated approach, helping to become artificial intelligence-oriented businesses. By optimizing the cloud, data, artificial intelligence, and security, a result is obtained according to the output. CortexAI has turned what appeared to be a challenge into a reality by utilizing artificial intelligence and machine learning. This platform provides companies with scalable, fully customized AI solutions using prebuilt, ready-to-deploy capabilities. Together, Deloitte and CortexAI strive to maximize their business performance by creating more value. As a result, organizations adopting AI should take the initiative to promote the reliable implementation of AI while taking risks into account. To realize this use, it is necessary to understand the qualities of trust. Figure 14 shows the dimensions of Deloitte's Trusted AI Framework. Artificial intelligence should be fair, impartial, robust, reliable, transparent, and explainable. It should also give importance to safety, security, and privacy issues, along with responsible and accountable features (Deloitte, 2022a).

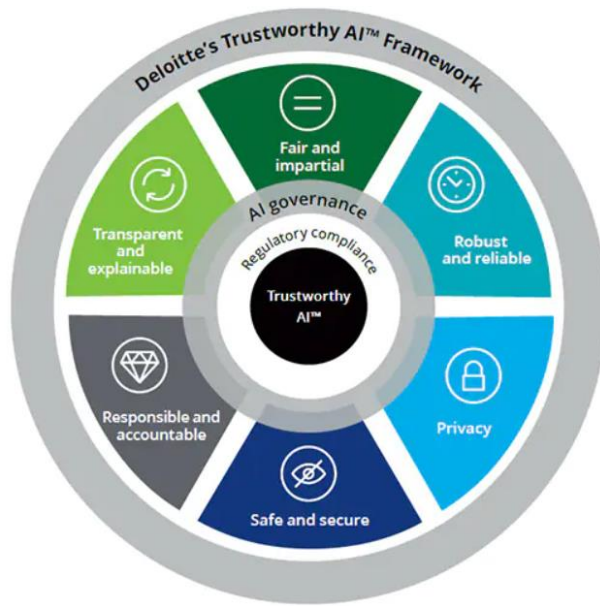


Figure 14. Deloitte AI Trustworthy (Source: Deloitte, 2022a)

In Deloitte's report titled "Delivering smarter audits Insights through innovation", artificial intelligence platforms such as Signal, Optix, and Reveal are also mentioned in addition to CortexAI (Deloitte, 2017);

-Using trend and regression analysis, Signal helps identify potential risks and provides a more comprehensive risk assessment by examining a variety of publicly available financial information.

-By analyzing large journal entry datasets, Optix identifies patterns that can lead to control and operational insights.

-Reveal applies a regression analysis. This platform is intended to help auditors identify audit interests for further review by examining account balance relationships.

Another artificial intelligence platform from Deloitte is Cognitive Spend Analytics. In this platform, while expenses are automatically classified, invoices can be monitored in real-time in the product, vendor, and regional environments. This system can go into detail by analyzing expenditures in multiple dimensions. It categorizes spending based on natural text processing that identifies key invoice data points and estimates the expense category, ultimately reducing manual effort. It detects non-standard procurement behavior by identifying non-preferred vendors and non-catalog purchases

and performs trend analysis of expenditures. It performs price optimization for products purchased at different prices from sellers in different locations (Deloitte, 2022b).

### ***3.12.3 Artificial Intelligence Applications in PwC***

The highlights of the PwC report titled "The Productivity Agenda: Moving Beyond Cost Reduction in Financial Services" are as follows (PwC, 2019):

Robotic process automation (RPA) has been a common first step for customers in integrating digital labor into businesses. Artificial intelligence not only automates the tasks that humans do but also performs tasks that no human can do. This would have huge potential for productivity. Leading companies in the industry are adapting artificial intelligence to credit scoring, robo-advising, and customer support. According to the result of the report, it has been seen that thanks to artificial intelligence, the cost has been reduced and the customer experience has been improved. Artificial intelligence has also created new products and services.

It is stated in the report that many companies have difficulties with digital transformation. It has been stated that the reasons for the stalling of progress with robotic process automation may be due to the high cost of technology, poor selection of business cases, human resistance to automation, and the resulting job losses.

According to PwC's productivity survey, it was determined that 71% of the respondents were not successful because of "bad practices" and 59% of them because of "a lack of coordinated strategy." According to PwC, customers lack a rigorous method for identifying where in their processes they will benefit most from digital labor. For this reason, institutions produce inconsistent results on where to best implement digital labor. According to the report, the main challenge of artificial intelligence is not technology but the right management phenomenon. Managing the challenges of using the cloud and taking a careful approach to data privacy issues are often seen as determinants of success.

The highlights of the PwC report titled "2018 AI Predictions" are as follows (PwC, 2018):

According to the report, 78% of employees stated that they are willing to work with an AI manager, provided that they balance their workload. 65% of employees think that they can get rid of monotonous jobs thanks to artificial intelligence. 64% of employees think that artificial intelligence applications will create new job opportunities for them. 50% of employees are willing to use artificial intelligence to help them manage a project more efficiently.

PwC's report contains information about how artificial intelligence will find a place in companies and how they prepare their employees for innovation, based on the experiences of scientists, visionaries, and consultants who are experts in the field of artificial intelligence. According to the results of the report, it was stated that correct infrastructure work and the integration of artificial intelligence into processes are required for employees to work more efficiently than before. In addition, it has been mentioned that a robot with artificial intelligence is never enough on its own and that there must be a human who programs or uses it. This shows that the importance of employees will also increase gradually. Even if the need for people in repetitive jobs decreases, new business lines that will replace these professions will emerge, and the value of employees with the skills to work with artificial intelligence will increase.

The highlights of PwC's research titled "How will automation affect existing businesses?" are as follows (PwC, 2020):

According to PwC's analysis, artificial intelligence, robotics, and other smart automation have the potential to contribute \$15 trillion to global GDP by 2030. This contribution will create demand for some jobs and create fear of the disappearance of existing jobs. PwC conducted a study of the potential impacts of automation over the next two decades, examining more than 200,000 existing jobs in 29 countries. Three possible waves of automation have been identified as a result of these analyses. These are the first wave, the second wave, and the third wave. The first wave refers to the beginning of the 2020s, the second wave refers to the end of the 2020s, and the third wave refers to the middle of the 2030s. During the first wave, 3% of jobs are expected

to be done by machines by the early 2020s. Automation technologies need to be developed to do business with the help of more machines.

According to the results obtained from the report, it is thought that 30% of the jobs will be automated by the mid-2030s. Since the male population has a higher share of employment in these jobs, the use of autonomous vehicles in this wave will affect the male population more than the female population. In addition, women will face the risk of automation in the first and second waves, as women are more involved in office and administrative work than men. These data have been prepared based on the median values of 29 countries. As a result of the research, it was stated that long-term automation has the potential to be realized above the average by 40%, while it is below the average by 20–25% in Asian and Scandinavian countries.

In PwC's report titled "Technology in the PwC Audit Driving Innovation" information is provided on artificial intelligence platforms Aura, Halo, and Connect (PwC, 2016); Aura ensures that work is done globally and locally in a uniform, consistent, and efficient manner. This platform is used by 87,000 auditors at every PwC audit worldwide.

Aura is a systematic, risk-based approach. It is a global ERP system. It has workflow technology that performs inspection procedures and individual tasks. It has the advantage of being accessible anywhere and anytime on mobile devices. By making risk comparisons, Aura obtains information by making comparisons across the customer portfolio. It takes into account risk levels and control tests by making a risk assessment. It helps to identify the right risks to reduce repetition and neglect. As indicated in Figure 15, PwC Aura saves time and exchanges information faster, conducts deeper analysis by focusing on relevant risk areas, and enables smarter inspections by increasing quality and efficiency.

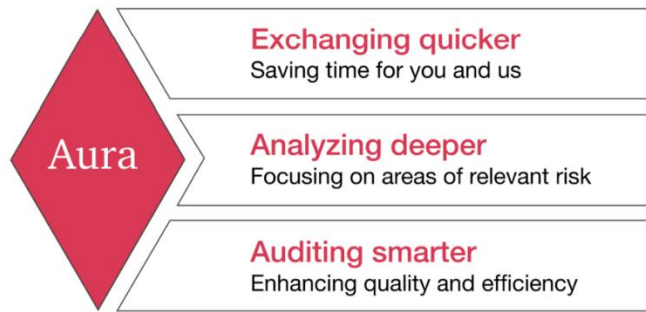


Figure 15. PwC Audit Technology Solutions (Source: PwC, 2022)

Halo is a leading technology that revolutionizes audits by harnessing the power of data. It scans large amounts of data and performs risk assessment, analysis, and testing. Halo improves test quality, allowing better assessment of risk to focus on truly critical issues. With Halo, now testing can be performed out of the area and at any time of the year. This means a smoother inspection process. Halo applications have been created for different industrial risks. These applications are listed below;

- Halo for ERP: Includes data extraction algorithms to automate audit testing and risk assessment.
- Halo Performance Analyzer: Analyzes key indicators of business performance to assess risk and identify outliers.
- Halo for Mid-tier: Used as a data auditing tool for companies using smaller ERP systems. It contains important insights and audit tests. It also supports risk assessment.
- Halo for Investments: Investment valuation auditing tool, it analyzes clients' investment portfolios, from risk assessment to concrete tests, using higher quality data.

Connect is a workflow tool that securely and quickly shares information at all stages of the audit. It is a platform that monitors the status of information flows. It allows for on-the-go control anytime, anywhere, on smartphones, tablets, and computers. With this platform, audit documents and outputs can be requested; these documents and outputs can be accessed and changed; and the status of information requests can be examined. It allows monitoring of the status of customers and auditors with real-time monitoring. It also allows the notification of upcoming events and deadlines to be shared with team members.

In the article titled "AI and the audit" on PwC's website, Cash.ai, an artificial intelligence platform used for cash audits, is mentioned (PwC, 2022a);

Cash.ai is involved in the execution of cash audit procedures. Under the name "cash auditing," it provides services in the fields of cash balances, bank reconciliation, bank approvals, foreign exchange, and economic statusification, bank approvals, foreign exchange, and economic status. The process is very fast and hassle-free. In this way, the audit quality increases, and it has important details in terms of accuracy and reliability.

The Cash.ai platform works quickly and accurately to perform the monotonous work that auditors used to do manually, assisting in the timely completion of key touches to events. It also gained prominence by completing events that would have taken days in minutes and becoming the award-winning Audit Innovation of the Year.

Another artificial intelligence platform, GL.AI, is mentioned in the article titled "Harnessing the Power of AI to Transform the Detection of Fraud and Error" on PwC's website (PwC, 2022b);

PwC has made a significant investment in artificial intelligence by partnering with a Silicon Valley company to create a bot that could be called a revolution. This system, called GL.ai, is used to detect unusual situations in the ledger. GL.AI was named Audit Innovation of the Year in October 2017. GL.AI uses trained algorithms to replicate the thinking and decision-making processes of expert auditors. It examines every transaction, every user, every amount, and every account to detect potential errors or fraud in the ledger. This platform has been successfully implemented in twenty audits in twelve countries, including Germany, the United Kingdom, and Canada. These applications confirm that GL.AI's ability to analyze large amounts of data has been born, speeding up the audit process, increasing efficiency, and allowing attention to be focused on real risk areas.

#### ***3.12.4 Artificial Intelligence Applications in Ernst & Young***

The highlights of the article titled "How does artificial intelligence become intelligently automated?" on the website of Ernst & Young are stated below (EY, 2020):

In the EY report, it is stated that artificial intelligence uses machine learning to handle processes and provide insights into customer decision-making.

EY offers an emerging technology within a framework of factors such as robotic process automation, machine learning, cognitive and agile learning, natural language processing, and blockchain. In the research, they started with the problem of a business. As a result of the wrong calculation of the arrival times of the ships entering and leaving the port, heavy costs are in question for the port. Starting from this problem, the scope of the research is to support human and machine management by developing an approach to accurately predict ship movements.

EY has developed 3 hypotheses: accurately predicting the movements of ships in and out of the port; allocating machinery in real-time; and better planning human resources. They used artificial intelligence and machine learning for prediction. Ultimately, they supported the creation of more than twenty artificial intelligence models. As a result of the research, it was found that automatic artificial intelligence solutions significantly increase the efficiency of the port and reduce its cost. The company saved about 10.2 million dollars as the accuracy of ship movement increased by 3% thanks to artificial intelligence.

The topics mentioned in the article titled "How can artificial intelligence help organizations serving in the defense sector become more agile and stronger?" on the EY website, written by Serhat Akmeşe, are as follows (Akmeşe, 2020);

As in other sectors, the defense sector is also affected by artificial intelligence. It has been stated that autonomous robots used without human intervention in future wars will be seen more frequently. In this respect, artificial intelligence is evolving not to replace humans but to be used to empower them. According to EY's research, the US Department of Defense has set aside \$ 2 billion for artificial intelligence between 2018 and 2023. China, on the other hand, plans to become a global AI leader by 2030 and has already started to partner with research institutes to develop artificial intelligence.



The Russian army is also determined to develop and implement such projects. According to the study, incorporating artificial intelligence into robotic systems and platforms will reduce casualties in wars.

EY uses EY Canvas, an artificial intelligence platform. EY Canvas is the first fully online platform in the business, as well as a system located in the private cloud. It brings the audit team and the customers together, wherever the audit is carried out. It provides high benefits by reducing the burden on customers and leading to higher-quality audits. It allows the audit team to carry out the audit process on a global scale without any problems. This platform was developed to help auditors focus on their responses to risks. It encourages auditors to devote more time to the most important areas of the audit process. Thanks to the online global inspection platform, a smooth inspection will be carried out. It provides rapid reporting of findings along with real-time monitoring. Through the online portal, customers will be able to monitor the progress of their audit requests in real-time. In addition, the EY Canvas Mobile App Suite supports clients even when employees are on the go, allowing auditors to receive updates on audit status, collect evidence, and manage their assignments. EY has developed three mobile applications to save customers' time. These are EY Canvas Engage, EY Canvas Inventory, and EY Canvas Pulse.

- EY Canvas Engage displays the actions that must be taken on a contract, allowing the audit process to continue and taking into account deadlines. Audit teams will be able to examine documents with this application even when they are traveling. Additionally, audit evidence will be collected and uploaded to EY Canvas with ease thanks to the camera feature. Hence this application will save time. It is also an important detail that the collected evidence will not be stored in the camera rolls of smartphones.

- EY Canvas Inventory allows them to save their inventory counts on their mobile devices and upload them to EY Canvas.

- EY Canvas Pulse provides customers with status updates as employees are on the go, with instant viewing of timelines, attendance status, and team performance (EY, 2022a).

Another artificial intelligence platform from EY is EY Helix. EY has adopted an analytics-driven audit approach with this platform. With this approach, it plans audits that provide higher quality and a higher level of professional skepticism. In addition, steps are being taken to become more relevant to customers. EY Helix's analytics are used more than 70,000 times around the world and can analyze larger amounts of data. EY Helix supports auditing from risk assessment to execution by covering the entire company cycle. Examples of areas of usage for analytics are sales invoices, the effect of credit notes, and how invoices are settled. By using this platform, they will be able to better control both trade receivables and revenue. Key analyzers in EY Helix are:

- GL Analyzer; examines and analyzes ledgers of all sizes.
- Group Scope Analyzer; helps auditors present financial data to inform audit strategy.
- Inventory Analyzer; makes analyzes to better understand the inventory.
- Trade Payables Analyzer; analyzes trade payables and expenses.
- Revenue and Trade Receivables Analyzer; analyzes income and receivables by analyzing from order to cash.
- Mortgage Analyzer; assesses the risk profile of firms' mortgage portfolio by assigning weights to risk factors.

With EY Helix, auditors can more easily identify the points where they will spend their time and instead of collecting data, they increase their curiosity and skepticism and channel them into the audit (EY, 2022b).

Another artificial intelligence platform called EY Helix GL Anomaly Detector, or Helix GLAD, develops models and systems for inspection. Applying machine learning to accounting data, this platform detects abnormal entries in large databases through machine learning. With this platform, it was desired to see artificial intelligence correctly revealing fraudulent journal entries and correctly directing the audit (EY, 2022c).

Based on the research conducted by the big four auditing companies on artificial intelligence and the artificial intelligence automation they have included in their processes, it is seen that the common goal of all of them is to increase efficiency, save time, make routine work automated, and benefit from auditors in jobs that require qualifications. The auditors working in the big four audit firms operating in Turkey were taken as a sample, and these auditors' levels of recognizing artificial intelligence, the processes in which they used artificial intelligence the most, their attitudes towards fraud, and their contribution to auditing, were analyzed through a questionnaire and examined in detail in the next section.



## **CHAPTER 4: METHODOLOGICAL FRAMEWORK**

### ***4.1 Purpose and Importance of the Research***

The research aims to measure the attitudes of the auditors operating in Deloitte, KPMG, PwC, and Ernst & Young, which are called the "big four audit companies," in the provinces of Istanbul, Ankara, and Izmir, towards the use of artificial intelligence in the audit sector.

This research is important in terms of providing general feedback that will enable the auditors to see the general situation of the auditors on the level of recognition of artificial intelligence, in which processes artificial intelligence platforms are used most, the attitudes of the auditors towards fraud, and the contribution of artificial intelligence platforms to the audit in the processes.

In line with the answers given by the auditors to the survey questions, it is important in terms of revealing the opinions of the auditors on the adaptation of artificial intelligence to the audit profession in the auditing industry in Turkey. By evaluating the results, a discussion environment was created about the strengths and weaknesses of artificial intelligence, and it was aimed to contribute to the future of the audit profession.

### ***4.2 Research Questions and Research Model***

The first question to be asked based on the purpose of the research is:

RQ1: What is the current status of the use of artificial intelligence in audits in Turkey?

Survey questions were prepared in line with this research question. In chapter 5, the attitudes and perceptions of the auditors on this subject will be examined in detail.

Another question to be asked while creating the research model is as follows;

RQ2: Why is artificial intelligence used in audits?

The reason for the use of artificial intelligence in audits is to minimize the cost by shortening the audit time and duration. The main reason for using artificial intelligence platforms in this field is to minimize the audit duration and maximize the audit quality. Maximum audit quality means maximum reliability in the decision to be made. In other words, the auditor will increase the quality of his decision on the financial statements. Accordingly, it is possible to create the model in Figure 16.

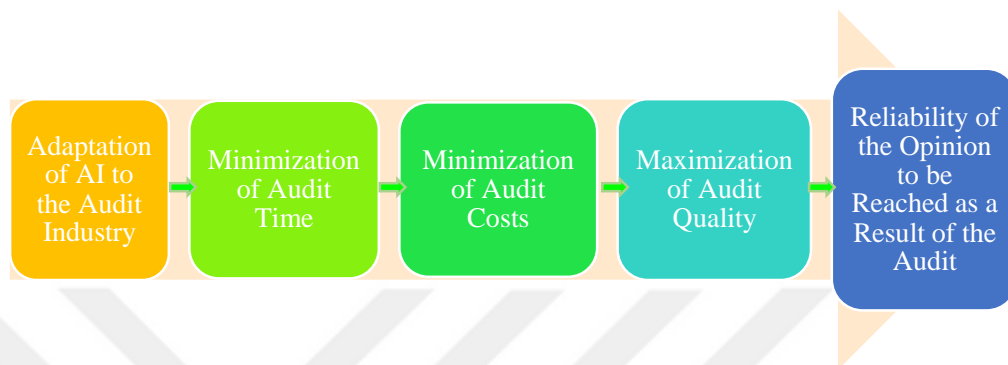


Figure 16. Research Model (Source: Compiled by author)

From the answers given by the auditors to the survey questions, the adaptability of artificial intelligence to the audit processes will be determined, and accordingly, whether our research model is supported will be examined in Chapter 5.

### ***4.3 Method and Scope of the Research***

To adapt artificial intelligence to audit processes, conditions such as technological infrastructure, a qualified workforce, and the ability to easily adapt to technology should be in question. There are only Deloitte, KPMG, PwC, and Ernst & Young, known as the "big four" audit firms, which operate globally in the audit industry. As mentioned in the previous parts of the thesis, these companies have proven how closely they are interested in artificial intelligence, machine learning, and robotic processes and how stable they are in including them in their processes by conducting various research on artificial intelligence. So, this issue was taken into account when the sample for the research was chosen, and the big four audit firms were chosen as the population.

The branches of the Big Four located in Turkey are:

Deloitte operates in the provinces of Istanbul, Ankara, Izmir, Bursa, and Adana.

KPMG operates in the provinces of Istanbul, Ankara, Izmir, and Bursa.

PwC operates in the provinces of Istanbul, Ankara, Izmir, Bursa, and Eskişehir.

EY operates in the provinces of Istanbul, Ankara, Izmir, and Bursa.

In this thesis, the scope of the research was formed by the auditors operating in Istanbul, Ankara, and Izmir. The auditors who work for the "big four" audit companies were asked how much they knew about artificial intelligence and how they felt about fraud. They were also asked how they felt about artificial intelligence's contribution to the audit.

The questionnaire method was used as a data collection method. The auditors in the sample group were asked to support their participation in the survey by making phone calls to some senior citizens in advance. Later, the questionnaire prepared for the auditors was sent to 615 people via email, LinkedIn, and Whatsapp, and feedback was received from 259 people. Since the survey questions were sent to the provinces of Istanbul, Ankara, and Izmir, they were prepared in Turkish, and the participants were asked to fill them in.

All of the questions in the questionnaire were created by the author. The questionnaire consists of 4 parts and includes 38 questions in total.

In the first part, there are six questions about the demographic characteristics of the auditors. Age, gender, current position, duration of experience, education level, and the province they work in were asked as demographic characteristics.

In the second part, five questions were asked of the auditors under the title "artificial intelligence recognition level."

In the third part, five questions were asked of the auditors by considering the fraud prevention dimension of artificial intelligence and the issue of who resorts to fraud the most.

In the fourth part, there are 22 questions prepared using the 5-point Likert scale to measure the attitudes of the auditors toward artificial intelligence. Participants were asked to answer the questions by grading them between (1) strongly disagree and (5) strongly agree.

The data obtained in the research were analyzed using the free trial version of SPSS Statistics (Statistical Package for Social Sciences) for the Windows 25.0 program. Descriptive statistical methods were used while evaluating the data (number, percentage). Chi-square analysis was applied to test the relationship between the variables.

The findings and results of the research are examined in detail in Chapter 5.

## CHAPTER 5: ANALYSIS AND FINDINGS

Table 4. Distribution of the participants in the research according to their socio-demographic characteristics

Variables		n	%
Age	20-30	164	63.3
	31-40	50	19.3
	41 and above	45	17.4
Gender	Female	90	34.7
	Male	169	65.3
Current Position	Assistant	65	25.1
	Senior	82	31.7
	Manager	45	17.4
	Director	33	12.7
	Partner	34	13.1
Experience Duration	1-5 year	151	58.3
	6-10 year	37	14.3
	11-15 year	29	11.2
	16-20 year	23	8.9
	21 years and above	19	7.3
Educational Status	Undergraduate	199	76.8
	Graduate	60	23.2
State of Employment	İstanbul	136	52.5
	Ankara	65	25.1
	İzmir	58	22.4
<b>Total</b>		<b>259</b>	<b>100.0</b>

The distribution of the participants according to their socio-demographic characteristics is given in Table 4. When the distribution of the participants by age is analyzed, it is seen that 63.3% of the participants are between 20 and 30 years old, 19.3% are between 31 and 40 years old, and 17.4% are 41 and over. It is seen that 34.7% of the participants are female and 65.3% are male.

When the distribution of the participants according to their current positions is examined, it is seen that 25.1% of the participants are assistants, 31.7% are seniors, 17.4% are managers, 12.7% are directors, and 13.1% are partners. When the distribution of the participants according to their experience period is analyzed, 58.3% of the participants are 1–5 years old, 14.3% are 6–10 years old, 11.2% are 11–15 years old, 8.9% are 16–20 years old, and 7.3% are 21 years or older.



When the distribution of the participants according to their educational status is examined, it is seen that 76.8% of them are undergraduates and 23.2% are graduates. When the participants' cities of employment are examined, it is discovered that 52.5% of them work in Istanbul, 25.1% in Ankara, and 22.4% in Izmir.

Table 5. Distribution of the participants in the research according to the level of recognition of artificial intelligence

Variables		n	%	
The case of using artificial intelligence in audits	Yes	114	44.0	
	No	49	18.9	
	Partially	96	37.1	
<b>Total</b>		<b>259</b>	<b>100.0</b>	
Audit stage using AI	In the Stage of Selection of Client and Acceptance of the Job	Yes	26	13.5
		No	167	86.5
	In the Stage of Audit Planning	Yes	88	45.6
		No	105	54.4
	In the Stage of Execution of the Audit	Yes	184	95.3
		No	9	4.7
	In the Stage of Reporting	Yes	67	34.7
		No	126	65.3
	Other	Yes	2	1.0
		No	191	99.0
	<b>Total</b>		<b>193</b>	<b>100.0</b>
	The state of thinking that artificial intelligence platforms are suitable for the nature of the audit profession	Yes	176	68.0
No		10	3.9	
Partially		73	28.1	
The state of thinking that there are enough auditors with the competence to use artificial intelligence in the audit process in the company work for	Yes	98	37.8	
	No	93	35.9	
	Partially	68	26.3	
The situation of thinking that artificial intelligence applications are given enough importance in the audit sector	Yes	60	23.2	
	No	119	45.9	
	Partially	80	30.9	
<b>Total</b>		<b>259</b>	<b>100.0</b>	

The distribution of the participants in the research according to their level of recognition of artificial intelligence is given in Table 5. When the distribution of the participants according to the use of artificial intelligence in audits is examined, it is seen that 44% of the participants answered yes, 18.9% answered no, and 37.1% partly.

When the participants are distributed according to the stage in which artificial intelligence is used in the audit, it is seen that 13.5% of them answered in the stage of client selection and acceptance of the job, 45.6% in the stage of audit planning, 95.3% in the stage of audit execution, 34.7% in the stage of reporting, and 1% in other.

When the distribution of the participants according to their thinking about whether those artificial intelligence platforms are suitable for the nature of the audit profession is seen, it is seen that 68% answered yes, 3.9% answered no, and 28.1% answered partially.

When the participants were distributed according to their belief that there are enough auditors with the competence to use artificial intelligence in the audit process in the company they work for, it was found that 37.8% answered yes, 35.9% answered no, and 26.3% answered partially. When the participants were divided into groups based on whether they believe artificial intelligence applications are given enough importance in the audit sector, 23.2% said yes, 45.9% said no, and 30.9% said partly yes.

Table 6. Distribution of the participants in the research according to the artificial intelligence's prevention of fraud

Variables		n	%	
The situation of encountering fraud cases in audits		Yes	126	48.6
		No	133	51.4
Those who appear to be the party that may resort to a possible fraud	Company Owners/Partners	Yes	209	80.7
		No	50	19.3
	Top Managers	Yes	208	80.3
		No	51	19.7
	Sub-Employees	Yes	111	42.9
		No	148	57.1
	Auditor/Audit Company	Yes	39	15.1
		No	220	84.9
Reason for a possible fraud case	Pressure/Threat	Yes	135	52.1
		No	124	47.9
	Inadequacy of Internal Control System	Yes	218	84.2
		No	41	15.8
	Conflict of Interest	Yes	152	58.7
		No	107	41.3
	Increased Business Volume	Yes	80	30.9
		No	179	69.1
	The Complexity of the Accounting System	Yes	86	33.2
		No	173	66.8
	Other	Yes	8	3.1
		No	251	96.9
The state of thinking that the use of artificial intelligence prevents fraud in audits		Yes	87	33.6
		No	42	16.2
		Partially	130	50.2
The state of thinking that artificial intelligence is more successful than human auditors in detecting fraud		Yes	71	27.4
		No	99	38.2
		Partially	89	34.4
<b>Total</b>			<b>259</b>	<b>100.0</b>

The distribution of the participants in the research according to the artificial intelligence used to prevent fraud is given in Table 6. When the distribution of the participants according to the situation of encountering the fraud case during the audits is analyzed, it is seen that 48.6% answered yes and 51.4% answered no. When the distribution of the participants according to those who appear to be potential fraudulent parties is analyzed, it is seen that 80.7% of them are company owners or partners, 80.3% are top managers, 42.9% are subordinates, and 15.1% are auditors or auditing companies.

When the distribution of the participants according to the reason for the occurrence of possible fraud cases is examined, 52.1% of the participants are pressure or threats, 84.2% are inadequate internal control systems, 58.7% are conflicts of interest, 30.9% are increasing business volume, 33.2% are the complexity of the accounting system, and 8% gave the other answer. Participants stated that the reason for the occurrence of a possible fraud case in the other option is the manipulation of financial statements, opportunity, rationalization, insufficient salary, incentives, attitudes, lack of responsibility of the top management after the management period, tax avoidance, and benefits to the top management.

When the participants were divided into three groups based on their belief that the use of artificial intelligence prevents fraud in audits, 33.6% said yes, 16.2% said no, and 50.2% said partially. When the participants were distributed according to whether they think artificial intelligence is more successful than human auditors in detecting fraud, it was found that 27.4% answered yes, 38.2% answered no, and 34.4% answered partially.

Table 7. Distribution of the answers given by the participants to the statements

Statements		Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
		n	%	n	%	n	%	n	%	n	%
1	Artificial Intelligence audits 100% of the data.	39	15.1	107	41.3	55	21.2	55	21.2	3	1.2
2	Artificial Intelligence increases the effectiveness and efficiency of auditing.	22	8.5	5	1.9	17	6.6	154	59.5	61	23.6
3	Artificial intelligence works more efficiently than human auditors.	18	6.9	59	22.8	73	28.2	88	34.0	21	8.1
4	Audits made with Artificial Intelligence increase the quality of the decisions to be made.	16	6.2	21	8.1	51	19.7	140	54.1	31	12.0
5	I trust the audits made by artificial intelligence.	13	5.0	39	15.1	96	37.1	100	38.6	11	4.2
6	Whether Artificial Intelligence will contribute to the audit or not depends on which stage of the audit it is used.	22	8.5	15	5.8	25	9.7	130	50.2	67	25.9
7	The installation and adaptation process of Artificial Intelligence tools causes loss of time and extra costs for audit firms.	47	18.1	104	40.2	51	19.7	46	17.8	11	4.2
8	There are laws and regulations that encourage the use of artificial intelligence in auditing.	59	22.8	74	28.6	90	34.7	31	12.0	5	1.9
9	Artificial Intelligence applications cause cyber security threats in terms of data privacy.	39	15.1	68	26.3	66	25.5	75	29.0	11	4.2
10	Artificial intelligence speeds up the audit process.	26	10.0	5	1.9	15	5.8	129	49.8	84	32.4
11	The use of artificial intelligence in routine work enables auditors to focus on more qualified subjects.	22	8.5	7	2.7	15	5.8	98	37.8	117	45.2

Table 7. Distribution of the answers given by the participants to the statements (cont'd)

	Statements	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
		n	%	n	%	n	%	n	%	n	%
12	Audits with artificial intelligence reduce audit costs.	25	9.7	37	14.3	41	15.8	109	42.1	47	18.1
13	Artificial intelligence is a deterrent platform for fraudsters.	33	12.7	43	16.6	68	26.3	93	35.9	22	8.5
14	There are also frauds that artificial intelligence cannot detect.	27	10.4	6	2.3	30	11.6	127	49.0	69	26.6
15	Artificial intelligence platforms are easy to use.	15	5.8	40	15.4	110	42.5	79	30.5	15	5.8
16	I have sufficient knowledge and training in using Artificial Intelligence in an audit process.	16	6.2	64	24.7	69	26.6	97	37.5	13	5.0
17	The training given by our company about using Artificial Intelligence in an audit process are sufficient.	29	11.2	57	22.0	69	26.6	92	35.5	12	4.6
18	The training given by the relevant professional chambers is sufficient for using Artificial Intelligence in an audit process.	84	32.4	94	36.3	56	21.6	21	8.1	4	1.5
19	Auditors should learn to use robotic process automation and shape their skills in this direction.	22	8.5	16	6.2	33	12.7	128	49.4	60	23.2
20	I think AI is making auditors lazy.	68	26.3	108	41.7	37	14.3	37	14.3	9	3.5
21	With the widespread use of artificial intelligence, there will be pressure to dismiss auditors.	54	20.8	97	37.5	40	15.4	52	20.1	16	6.2
22	Since artificial intelligence does not have human intuition, it will fall short of professional skepticism.	30	11.6	24	9.3	45	17.4	84	32.4	76	29.3

The distribution of the answers given by the participants to the statements is given in Table 7.

Table 8. The relationship between the use of artificial intelligence in audits and the variables

		The Case of Using Artificial Intelligence in Audits						Test Value	P
		Yes		No		Partially			
		n	%	n	%	n	%		
The state of thinking that there are enough auditors with the competence to use artificial intelligence in the audit process in the company you work for	Yes	51	44.6	12	24.5	35	36.5	14.024 **	0.007*
	No	28	24.6	26	53.1	39	40.6		
	Partially	35	30.7	11	22.4	22	22.9		
The state of thinking that the use of artificial intelligence prevents fraud in audits	Yes	43	37.7	13	26.5	31	32.3	6.337 **	0.175
	No	13	11.4	13	26.5	16	16.7		
	Partially	58	50.9	23	46.9	49	51.0		
The state of thinking that artificial intelligence is more successful than human auditors in detecting fraud	Yes	40	35.1	4	8.2	27	28.1	13.338 **	0.010*
	No	42	36.8	23	46.9	34	35.4		
	Partially	32	28.1	22	44.9	35	36.5		
<b>Total</b>		<b>114</b>	<b>100.0</b>	<b>49</b>	<b>100.0</b>	<b>96</b>	<b>100.0</b>		

\*p<0.05, \*\* Chi-square analysis

Chi-square analysis was applied to test the relationship between the participants' use of artificial intelligence in audits and the variables. As a result, there is a statistically significant relationship between the use of artificial intelligence in audits and the belief that there are enough auditors competent to use artificial intelligence in the audit process in the company you work for, as well as the belief that artificial intelligence is more successful than human auditors in detecting fraud (p<0.05).

Table 9. The relationship between the belief that AI platforms are good for the nature of auditing and the belief that using AI stops fraud in audits.

		The state of thinking that artificial intelligence platforms are suitable for the nature of the audit profession						Test Value	p
		Yes		No		Partially			
		n	%	n	%	n	%		
The state of thinking that the use of artificial intelligence prevents fraud in audits	Yes	73	41.5	0	0.0	14	19.2	34.577**	0.000*
	No	23	13.1	7	70.0	12	16.4		
	Partially	80	45.5	3	30.0	47	64.4		
<b>Total</b>		<b>176</b>	<b>100.0</b>	<b>10</b>	<b>100.0</b>	<b>73</b>	<b>100.0</b>		

\*p<0.05, \*\* Chi-square analysis

Chi-square analysis was applied to test the relationship between the participants' thinking that artificial intelligence platforms are suitable for the nature of the audit profession and their state of thinking that the use of artificial intelligence prevents fraud in audits. As a result, it is seen that there is a statistically significant relationship between the state of participants' thinking that artificial intelligence platforms are suitable for the nature of the audit profession and the state of thinking that the use of artificial intelligence prevents fraud in audits (p<0.05).



Table 10. The relationship between the encounters with fraud in audits and the variables

		Encountering a Fraud Case in Audits				Test Value	p
		Yes		No			
		n	%	n	%		
The state of thinking that the use of artificial intelligence prevents fraud in audits	Yes	34	27.0	53	39.8	5.098**	0.078
	No	24	19.0	18	13.5		
	Partially	68	54.0	62	46.6		
The state of thinking that artificial intelligence is more successful than human auditors in detecting fraud	Yes	35	27.8	36	27.1	2.220**	0.330
	No	53	42.1	46	34.6		
	Partially	38	30.2	51	38.3		
<b>Total</b>		<b>126</b>	<b>100.0</b>	<b>133</b>	<b>100.0</b>		

\*p<0.05, \*\* Chi-square analysis

A Chi-square analysis was applied to test the relationship between the participants' encounters with fraud cases during the audits and the variables. As a result of this, it is seen that there is no statistically significant relationship between the situation of the participants encountering a fraud case in the audits, the state of thinking that the use of artificial intelligence prevents fraud in the audits, and the state of thinking that artificial intelligence is more successful than human auditors in detecting fraud ( $p>0.05$ ).

Table 11. The relationship between the use of artificial intelligence in audits and statements

Statements		The Case of Using Artificial Intelligence in Audits						Test Value	p	
		Yes		No		Partially				
		n	%	n	%	n	%			
2	Artificial Intelligence increases the effectiveness and efficiency of auditing.	Strongly Disagree	13	11.4	0	0.0	9	9.4	35.892**	0.000*
		Disagree	3	2.6	2	4.1	0	0.0		
		Undecided	3	2.6	9	18.4	5	5.2		
		Agree	59	51.8	36	73.5	59	61.5		
		Strongly Agree	36	31.6	2	4.1	23	24.0		
4	Audits made with Artificial Intelligence increase the quality of the decisions to be made.	Strongly Disagree	11	9.6	0	0.0	5	5.2	21.859**	0.005*
		Disagree	6	5.3	8	16.3	7	7.3		
		Undecided	17	14.9	16	32.7	18	18.8		
		Agree	61	53.5	21	42.9	58	60.4		
		Strongly Agree	19	16.7	4	8.2	8	8.3		
6	Whether Artificial Intelligence will contribute to the audit or not depends on which stage of the audit it is used.	Strongly Disagree	12	10.5	1	2.0	9	9.4	21.426**	0.006*
		Disagree	3	2.6	0	0.0	12	12.5		
		Undecided	8	7.0	6	12.2	11	11.5		
		Agree	55	48.2	28	57.1	47	49.0		
		Strongly Agree	36	31.6	14	28.6	17	17.7		
10	Artificial intelligence speeds up the audit process.	Strongly Disagree	16	14.0	1	2.0	9	9.4	24.414**	0.002*
		Disagree	1	0.9	3	6.1	1	1.0		
		Undecided	5	4.4	4	8.2	6	6.3		
		Agree	46	40.4	34	69.4	49	51.0		
		Strongly Agree	46	40.4	7	14.3	31	32.3		
12	Audits with artificial intelligence reduce audit costs.	Strongly Disagree	14	12.3	1	2.0	10	10.4	11.390**	0.181
		Disagree	21	18.4	5	10.2	11	11.5		
		Undecided	15	13.2	8	16.3	18	18.8		
		Agree	44	38.6	28	57.1	37	38.5		
		Strongly Agree	20	17.5	7	14.3	20	20.8		



Table 11. The relationship between the use of artificial intelligence in audits and statements (cont'd)

Statements		The Case of Using Artificial Intelligence in Audits						Test Value	p	
		Yes		No		Partially				
		n	%	n	%	n	%			
15	Artificial intelligence platforms are easy to use.	Strongly Disagree	10	8.8	2	4.1	3	3.1	18.671**	0.017*
		Disagree	22	19.3	7	14.3	11	11.5		
		Undecided	37	32.5	31	63.3	42	43.8		
		Agree	37	32.5	8	16.3	34	35.4		
		Strongly Agree	8	7.0	1	2.0	6	6.3		
16	I have sufficient knowledge and training in using Artificial Intelligence in an audit process.	Strongly Disagree	5	4.4	7	14.3	4	4.2	26.988**	0.001*
		Disagree	21	18.4	19	38.8	24	25.0		
		Undecided	30	26.3	15	30.6	24	25.0		
		Agree	48	42.1	7	14.3	42	43.8		
		Strongly Agree	10	8.8	1	2.0	2	2.1		
17	The training given by our company about using Artificial Intelligence in an audit process is sufficient.	Strongly Disagree	13	11.4	8	16.3	8	8.3	25.463**	0.001*
		Disagree	12	10.5	17	34.7	28	29.2		
		Undecided	30	26.3	14	28.6	25	26.0		
		Agree	50	43.9	10	20.4	32	33.3		
		Strongly Agree	9	7.9	0	0.0	3	3.1		
18	The training given by the relevant professional chambers is sufficient for using Artificial Intelligence in an audit process.	Strongly Disagree	40	35.1	20	40.8	24	25.0	16.167**	0.040*
		Disagree	34	29.8	14	28.6	46	47.9		
		Undecided	24	21.1	14	28.6	18	18.8		
		Agree	14	12.3	1	2.0	6	6.3		
		Strongly Agree	2	1.8	0	0.0	2	2.1		
<b>Total</b>			<b>114</b>	<b>100.0</b>	<b>49</b>	<b>100.0</b>	<b>96</b>	<b>100.0</b>		

\*p<0.05, \*\* Chi-square analysis

Chi-square analysis was applied to test the relationship between the participants' use of artificial intelligence in audits and the statements. As a result, it is seen that there is a statistically significant relationship between the participants' use of artificial intelligence in audits and the answer given to the statement. "Artificial intelligence increases the effectiveness and efficiency of auditing." "Audits made with artificial intelligence increase the quality of the decisions to be made." Whether artificial intelligence will contribute to the audit or not depends on which stage of the audit it is used at. "Artificial intelligence speeds up the audit process." "Artificial intelligence platforms are easy to use." "I have sufficient knowledge and training on using artificial intelligence in an audit process." "The training given by our company about using artificial intelligence in an audit process is sufficient." "The training given by the relevant professional chambers is sufficient for using artificial intelligence in an audit process." ( $p < 0.05$ ).

Table 12. The relationship between the thinking that artificial intelligence platforms are suitable for the nature of the audit profession and the statements

Statements		The state of thinking that artificial intelligence platforms are suitable for the nature of the audit profession						Test Value	p	
		Yes		No		Partially				
		n	%	n	%	n	%			
5	I trust the audits made by artificial intelligence.	Strongly Disagree	9	5.1	2	20.0	2	2.7	46.742**	<b>0.000*</b>
		Disagree	20	11.4	5	50.0	14	19.2		
		Undecided	51	29.0	3	30.0	42	57.5		
		Agree	85	48.3	0	0.0	15	20.5		
		Strongly Agree	11	6.3	0	0.0	0	0.0		
9	Artificial Intelligence applications cause cyber security threats in terms of data privacy.	Strongly Disagree	30	17.0	1	10.0	8	11.0	11.705**	0.165
		Disagree	47	26.7	2	20.0	19	26.0		
		Undecided	39	22.2	6	60.0	21	28.8		
		Agree	50	28.4	1	10.0	24	32.9		
		Strongly Agree	10	5.7	0	0.0	1	1.4		
<b>Total</b>			<b>176</b>	<b>100.0</b>	<b>10</b>	<b>100.0</b>	<b>73</b>	<b>100.0</b>		

\*p<0.05, \*\* Chi-square analysis

Chi-square analysis was applied to test the relationship between the participants' thinking that artificial intelligence platforms are suitable for the nature of the audit profession and the statements. As a result, it is seen that there is a statistically significant relationship between the participants' thinking that artificial intelligence platforms are suitable for the nature of the audit profession and the answer given to the expression "I trust the audits made by artificial intelligence." ( $p < 0.05$ ).



Table 13. The relationship between the thinking that artificial intelligence applications are given enough importance in the audit sector and the statements

Statements		The situation of thinking that artificial intelligence applications are given enough importance in the audit sector						Test Value	p	
		Yes		No		Partially				
		n	%	n	%	n	%			
8	There are laws and regulations that encourage the use of artificial intelligence in auditing.	Strongly Disagree	15	25.0	34	28.6	10	12.5	10.970**	0.203
		Disagree	18	30.0	29	24.4	27	33.8		
		Undecided	19	31.7	40	33.6	31	38.8		
		Agree	8	13.3	12	10.1	11	13.8		
		Strongly Agree	0	0.0	4	3.4	1	1.3		
17	The training given by our company about using Artificial Intelligence in an audit process is sufficient.	Strongly Disagree	7	11.7	14	11.8	8	10.0	8.531**	0.383
		Disagree	12	20.0	30	25.2	15	18.8		
		Undecided	20	33.3	31	26.1	18	22.5		
		Agree	16	26.7	40	33.6	36	45.0		
		Strongly Agree	5	8.3	4	3.4	3	3.8		
18	The training given by the relevant professional chambers is sufficient for using Artificial Intelligence in an audit process.	Strongly Disagree	22	36.7	47	39.5	15	18.8	14.608**	0.067
		Disagree	19	31.7	38	31.9	37	46.3		
		Undecided	15	25.0	21	17.6	20	25.0		
		Agree	3	5.0	10	8.4	8	10.0		
		Strongly Agree	1	1.7	3	2.5	0	0.0		
<b>Total</b>			<b>60</b>	<b>100.0</b>	<b>119</b>	<b>100.0</b>	<b>80</b>	<b>100.0</b>		

\*p<0.05, \*\* Chi-square analysis

A chi-square analysis was applied to test the relationship between the participants' thinking that artificial intelligence applications are given sufficient importance in the audit sector and the statements. As a result, it is seen that there is no statistically significant relationship between the participants' thinking that artificial intelligence applications are given sufficient importance in the audit sector and their answers to the statements "There are laws and regulations that encourage the use of artificial intelligence in auditing," "The training given by our company about using artificial intelligence in an audit process is sufficient," and "The training given by the relevant professional chambers is sufficient for using artificial intelligence in an audit process" ( $p > 0.05$ ).





Table 14. The relationship between the encounters with the fraud case in the audits and the statements

Statements		Encountering a Fraud Case in Audits				Test Value	p	
		Yes		No				
		n	%	n	%			
13	Artificial intelligence is a deterrent platform for the fraudsters.	Strongly Disagree	11	8.7	22	16.5	10.633**	<b>0.031*</b>
		Disagree	20	15.9	23	17.3		
		Undecided	27	21.4	41	30.8		
		Agree	54	42.9	39	29.3		
		Strongly Agree	14	11.1	8	6.0		
14	There are also frauds that artificial intelligence cannot detect.	Strongly Disagree	10	7.9	17	12.8	12.909**	<b>0.012*</b>
		Disagree	5	4.0	1	0.8		
		Undecided	13	10.3	17	12.8		
		Agree	54	42.9	73	54.9		
		Strongly Agree	44	34.9	25	18.8		
<b>Total</b>			<b>126</b>	<b>100.0</b>	<b>133</b>	<b>100.0</b>		

\*p<0.05, \*\* Chi-square analysis

Chi-square analysis was applied to test the relationship between the participants' encounters with the fraud case during the audits and the statements. As a result, it is seen that there is a statistically significant relationship between the participants' thinking about the situation of participants encountering fraud cases in audits and their answers to the statements "Artificial intelligence is a deterrent platform for the fraudsters." and "There are also frauds that artificial intelligence cannot detect." ( $p < 0.05$ ).



Table 15. The relationship between the thinking that the use of artificial intelligence prevents fraud in audits and the statements

Statements		The state of thinking that the use of artificial intelligence prevents fraud in audits						Test Value	p	
		Yes		No		Partially				
		n	%	n	%	n	%			
13	Artificial intelligence is a deterrent platform for the fraudsters.	Strongly Disagree	14	16.1	8	19.0	11	8.5	22.903**	0.003*
		Disagree	8	9.2	12	28.6	23	17.7		
		Undecided	17	19.5	14	33.3	37	28.5		
		Agree	38	43.7	5	11.9	50	38.5		
		Strongly Agree	10	11.5	3	7.1	9	6.9		
14	There are also frauds that artificial intelligence cannot detect.	Strongly Disagree	12	13.8	3	7.1	12	9.2	8.771**	0.362
		Disagree	2	2.3	2	4.8	2	1.5		
		Undecided	11	12.6	4	9.5	15	11.5		
		Agree	47	54.0	18	42.9	62	47.7		
		Strongly Agree	15	17.2	15	35.7	39	30.0		
<b>Total</b>			<b>87</b>	<b>100.0</b>	<b>42</b>	<b>100.0</b>	<b>130</b>	<b>100.0</b>		

\*p<0.05, \*\* Chi-square analysis

Chi-square analysis was applied to test the relationship between the participants' thinking that the use of artificial intelligence prevents fraud in audits and the statements. As a result, it is seen that there is a statistically significant relationship between the tendency of the participants to think that the use of artificial intelligence prevents fraud in audits and their answers to the statement "Artificial intelligence is a deterrent platform for fraudsters." ( $p < 0.05$ ).



Table 16. The relationship between the thinking that artificial intelligence is more successful than human auditors in detecting fraud and statements

Statements		The state of thinking that artificial intelligence is more successful than human auditors in detecting fraud						Test Value	p	
		Yes		No		Partially				
		n	%	n	%	n	%			
3	Artificial intelligence works more efficiently than human auditors.	Strongly Disagree	7	9.9	9	9.1	2	2.2	32.939**	<b>0.000*</b>
		Disagree	9	12.7	37	37.4	13	14.6		
		Undecided	19	26.8	26	26.3	28	31.5		
		Agree	28	39.4	26	26.3	34	38.2		
		Strongly Agree	8	11.3	1	1.0	12	13.5		
5	I trust the audits made by artificial intelligence.	Strongly Disagree	6	8.5	5	5.1	2	2.2	60.217**	<b>0.000*</b>
		Disagree	9	12.7	26	26.3	4	4.5		
		Undecided	11	15.5	50	50.5	35	39.3		
		Agree	38	53.5	16	16.2	46	51.7		
		Strongly Agree	7	9.9	2	2.0	2	2.2		
<b>Total</b>			<b>71</b>	<b>100.0</b>	<b>99</b>	<b>100.0</b>	<b>89</b>	<b>100.0</b>		

\*p<0.05, \*\* Chi-square analysis

Chi-square analysis was applied to test the relationship between the participants' thinking that artificial intelligence is more successful than human auditors in detecting fraud and making statements. As a result, it is seen that there is a statistically significant relationship between the situation of participants thinking that artificial intelligence is more successful than human auditors in detecting fraud and their answers to the statement "Artificial intelligence works more efficiently than human auditors." and "I trust the audits made by artificial intelligence." ( $p < 0.05$ ).



## CHAPTER 6: DISCUSSION

According to the analysis, it is seen that artificial intelligence applications are mostly used in the Audit Execution phase and then in the Audit Planning phase. The activities to be carried out during the planning stage of the audit can be summarized as applying analytical examination procedures, determining and evaluating the audit risk and the level of materiality. The activities to be carried out during the execution of the audit can be summarized as conducting internal control tests and substantive tests, detecting and preventing errors and fraud. In addition, as a result of the analysis, it is seen that 44% of the auditors answered yes, 18.9% answered no, and 37.1% answered partially the question "Do you use artificial intelligence in audits?" It has been concluded that artificial intelligence is widely used in audits (because of the 44% of those who answered yes) and that it is in the transition phase in some auditing companies (because of the 37.1% of those who answered partially). Therefore, as a result of this thesis study, it is seen that there are auditors who include artificial intelligence platforms in their processes and that these platforms are actively used. It would be correct to interpret that the answers to other questions were also answered within the framework of artificial intelligence awareness. In the literature, similar to the findings of this thesis study, it is mentioned in the PwC (2016) report that Aura and Halo artificial intelligence platforms are used for risk assessment, control, and audit tests. Contrary to the findings of this thesis in the literature; Awuah, Onumah, and Duho (2021) researched large Ghanaian companies for the adoption of CAATTs in their internal audit units and found that CAATTs had little actual use in risk assessment, fraud detection, application of analytical procedures, and substantive testing. In this case, the level of inclusion of artificial intelligence in the audit processes of Ghana and Turkey was not the same. It has been concluded that Turkey is more adaptable to automation practices in auditing processes compared to Ghana.

According to the research conducted by Würsching (2019) on KPMG's human resources managers, 36% of the managers stated that they have started using artificial intelligence in their processes, 50% of them have not used it yet, and that there may be a transition period in the next few years. It is seen that the situations predicted by Würsching about the future are exactly similar to the results of this thesis. (As 44%

answered yes and 37.1% partially answered the question "Do you use artificial intelligence in audits?")

Based on the finding that artificial intelligence is used largely and partially in some processes in audits, some results that are not common with another study in the literature have been reached. Bierstaker, Janvrin, and Lowe (2014) concluded that they do not use these tools systematically and frequently, by applying a sample survey of 181 people working in big four audit companies and other audit companies. Ahmi and Kent (2013) chose small-scale audit companies instead of the big four auditors in their research on the use of Generalized Audit Software (GAS) by 205 auditors operating in the UK. As a result of the research, it has been an important finding of the studies that the use of GAS by small-scale audit firms is very low, and traditional manual auditing methods are preferred in audits. The reason for this study to reach a different finding from our thesis study is that the group taken as the target audience is the auditors working in small audit companies. Because artificial intelligence platforms are primarily used in large global audit firms.

As a result of the analyzes made, 42.5% of the auditors agreed, 30.9% disagreed with the statement of "Having sufficient knowledge and training on using artificial intelligence in an audit process", and 26.6% of the auditors stated that they were undecided. While 40.2% of the auditors agreed that "the training provided by the audit companies is sufficient", 33.2% disagreed, and 26.6% of the auditors stated that they were undecided. In addition, 9.7% of the auditors agreed that "the training provided by the professional chambers is sufficient", 68.7% disagreed and 21.6% of the auditors stated that they were undecided. Therefore, it can be said that the training given by audit firms to their employees is sufficient, but it would be more beneficial if it were increased. However, the auditors participating in the survey think that the training provided by the relevant professional chambers is largely inadequate. In the studies of Bierstaker, Janvrin, and Lowe (2014), the authors concluded that training programs should be developed to increase the use of these tools in audits. In the survey study conducted by Shihab et al. (2017) on 141 auditors working in the public sector, they concluded that for the adoption of CAATTs in the audit sector, auditors should have sufficient knowledge and training to increase their skills. As a result of their



studies, Braun and Davis (2003) stated that few auditors are trained and they need additional training. In the Deloitte (CortexAI) article, it was mentioned that organizations adopting artificial intelligence should take initiatives to promote its implementation. Therefore, although this situation is similar to that in the literature, it supports the result of increasing the training to be given. In addition, since 2003, this issue has been constantly on the agenda, and the same complaint has been voiced again in the analysis made in 2022. The same result means that this issue has been ignored and training should be started as soon as possible.

To the statement "Do you think artificial intelligence platforms are suitable for the nature of the auditing profession?" 68% of the auditors participating in the research answered yes, 3.9% answered no, and 28.1% answered partially. According to this result, the majority of the participants think that the use of artificial intelligence platforms in the audit sector and audit processes is appropriate. 36.3% of the auditors participating in the research agreed, 21.2% disagreed with the statement that "AI platforms are easy to use," and 42.5% of the auditors stated that they were undecided. It is seen that they generally have an undecided attitude on this issue. Siew, Rosli, and Yeow (2020) surveyed 158 auditors to evaluate the use of CAATTs in Malaysia and concluded that the complexity of using CAATTs did not significantly affect the adoption of these tools. Therefore, the findings obtained from the study are similar to those in the literature.

83% of the auditors participating in the research agreed, 10.4% disagreed with the statement that "artificial intelligence increases the effectiveness and efficiency of the audit," and 6.6% of the auditors stated that they were undecided. Moreover, 42.9% of the auditors participating in the research agreed, 20.1% disagreed with the statement of "trusting the audits made by artificial intelligence," and 37.1% of the auditors stated that they were undecided. The results obtained from the survey study they conducted on the Audit Command Language (ACL), a type of CAATT used by the auditors participating in Braun and Davis' (2003) research and applied to 90 public auditors, are as follows: ACL increases the effectiveness and efficiency of audits, but it has been reported that auditors have confidence problems in designing commands and defining input files. Kakoullis (2018) also stated that RPA is used to increase productivity. In

the PwC (2016) report, it was stated that the Aura platform increased quality and efficiency, enabling smarter inspections. Therefore, the findings about increasing the effectiveness and efficiency of audits by using artificial intelligence platforms are similar to those in the literature. However, our study is not similar to the literature on trust in artificial intelligence platforms. This may be because public inspectors are more skeptical about trusting robotic platforms. In addition, since this study in the literature was carried out in 2003, and considering the current state of technology in those years, it can be considered normal that they have less confidence in artificial intelligence platforms compared to today's conditions.

42.1% of the auditors participating in the research agreed, 29.7% disagreed, and 28.2% stated that they were undecided. Among the participants, it is largely thought that artificial intelligence works more efficiently than human auditors. In the literature, Khan, Adi, and Hussain (2020) compared artificial intelligence inspections to manual inspections and concluded that artificial intelligence is 95% more effective and 92% more efficient than a human auditor. Arslan (2021) concluded that with the use of RPA in inspections, robots will work more accurately than humans. Therefore, the results obtained are similar to those in the literature.

33.6% of the auditors participating in the research answered yes, 16.2% answered no, and 50.2% partially answered the statement, "Do you think the use of artificial intelligence prevents fraud in audits?" Participants generally think that artificial intelligence platforms prevent fraud. Moreover, 75.7% of the auditors agreed, 12.7% disagreed, and 11.6% stated that they were undecided. Therefore, the auditors participating in the survey also think that artificial intelligence cannot detect all fraud. Abbasi et al. (2012) concluded in their study that the meta-learning framework, which is an artificial intelligence model, is effective in detecting financial fraud. Wyrobek (2020) concluded that artificial intelligence and machine learning algorithms related to financial irregularities occurring in companies can recognize and detect fraud patterns. In the KPMG (2021) report, it was concluded that artificial intelligence is used in the field of fraud detection and prevention in the financial services sector. It is seen that the results obtained in detecting and preventing fraud by artificial intelligence are similar to those in the literature.

48.6% of the auditors participating in the research answered yes, and 51.4% of the auditors answered no to the statement, "Have you encountered a case of fraud in audits?"

Participants see the parties that can resort to possible fraud, respectively, as company owners, top managers, subordinates, and auditors. 209 people chose the owners, 208 people chose top managers, 111 people chose subordinates, and 39 people chose the auditor or audit company. When we examine the worldwide accounting scandals, it is seen that frauds are generally committed by the company owners and top management, and in some cases, audit companies are involved in this cooperation for their own interests. Auditors participating in the survey agree with the literature that frauds are committed by company owners and top management, just like in accounting scandals. However, since the audit firm was the least chosen option and the survey questions were directed to audit companies, it can be interpreted that in such a case, they might not have been chosen because they avoided disclosing themselves.

The auditors participating in the research stated that the reason for the occurrence of a possible fraud case was the inadequacy of the internal control system (218 people), conflict of interest (152 people), pressure threat (135 people), complexity of the accounting system (86 people), and increased business volume (80 people), and stated that there are other options. Therefore, the most popular option was the inadequacy of the internal control system. Leonov et al. (2020) concluded in their study that an effective internal control system should be established to detect fraudulent activities. It is seen that similar conclusions have been reached with the literature on this subject.

72.6% of the auditors participating in the research agreed, 14.7% disagreed with the statement that "auditors should learn to use robotic process automation and shape their skills in this direction," and 12.7% of the auditors stated that they were undecided." This situation reveals the necessity for auditors to adopt the features required by the development of technology. Auditors who cannot adapt to the conditions will not be able to survive. Auditors with the ability to use autonomous processes will always be one step ahead. Tarek et al. (2017) concluded in their study that the use of artificial intelligence in audits is significantly affected by the IT expertise of the auditors.

KPMG's (2021) report concluded that three out of 10 employees will need to develop their current skills and abilities in the coming years. Therefore, the results obtained from our research and the literature show similar results.

82.2% of the auditors participating in the research agreed, 12% disagreed with the statement that "artificial intelligence speeds up the audit process," and 5.8% of the auditors stated that they were undecided. 83% of the auditors agreed, 11.2% disagreed with the statement, "In the case that the use of artificial intelligence in routine work leads the auditors to more qualified subjects," and 5.8% of the auditors stated that they were undecided." According to the results of the research, artificial intelligence will accelerate the audit process and help auditors deal with issues that require more qualification. Arslan (2021) concluded in his study that the use of RPA in audits will shorten monotonous work. Kakoullis (2018) also stated that RPA is used to increase efficiency and audit speed and that technology will free up auditors' space and time by automating routine processes, increasing the quality of each task. It is stated that with the EY Canvas platform, time savings will be achieved in audits. Our research findings are compatible with the literature regarding the acceleration of audit processes and the automation of work, as well as the tendency of auditors to focus on issues that require more qualification.

26.3% of the auditors participating in the research agreed, 58.3% disagreed with the statement that "there will be dismissal pressure on auditors with the widespread use of artificial intelligence," and 15.4% of the auditors stated that they were undecided. The results show that the vast majority of auditors are not concerned about employment. Moreover, 37.8% of the auditors participating in the research answered yes, 35.9% answered no, and 26.3% partially answered the statement, "Do you think there are sufficient numbers of auditors competent enough to use artificial intelligence in the audit process in the company you work for?" This situation does not support the conclusion that the auditors are competent enough. Although the answers are close to each other, it is clear that the auditors are in a hesitant situation. While this situation reveals the need for qualified auditors, it also reveals that the number of auditors equipped with knowledge of artificial intelligence should increase. In the literature, it was stated in the research conducted by Würsching (2019) on KPMG's human

resources managers that artificial intelligence is a major threat to employment. While human resource managers are concerned about employment, auditors, on the other hand, do not think that artificial intelligence will completely replace their current jobs. The need for humans in various ways, such as commissioning each automation, will always be on the agenda at this point. In the KPMG (2020) report, it is stated that 2 out of every 5 employees experience fear of losing their job. In an article written by Davenport (2016) about the Deloitte Argus platform, it is stated that Deloitte employees do not think that human auditors will disappear. In the PwC (2018) report, it is mentioned that artificial intelligence alone is not enough for the processes; there should be a person who uses and programs it. It has been stated that although the need for people in repetitive jobs will decrease, new business lines will emerge and the value of employees who have the skills to work with artificial intelligence will increase. While our research results are similar to Deloitte and PwC reports, they differ from those of KPMG.

33.2% of the auditors participating in the research agreed, 41.3% disagreed with the statement that "artificial intelligence applications will cause a cyber security threat in terms of data privacy," and 25.5% of the auditors stated that they were undecided." 13.9% of the auditors participating in the research agreed, 51.4% disagreed with the statement, "In the case of laws and regulations that encourage the use of artificial intelligence in auditing," and 34.7% of the auditors stated that they were undecided. Therefore, it is seen that the majority of auditors think that artificial intelligence will not pose any cybersecurity threat in terms of data privacy. On the other hand, the fact that auditors think that laws and regulations on artificial intelligence are lacking is an important finding for the future of the profession. In the KPMG 2020 report, 70% of employees stated that artificial intelligence can pose a threat to data security, and 90% stated that companies should implement some AI principles. In KPMG's report, the threat of artificial intelligence to data security is not similar to the findings of the thesis study. This can be explained by the confidence of auditors in artificial intelligence, as the use of AI in actual audits is becoming more widespread day by day. On the other hand, the KPMG report emphasizes that some principles and regulations should be put into practice in the same way as the findings of our thesis study. In the work of Bierstaker, Janvrin, and Lowe (2014), it has been revealed that recent auditing

standards have led to the adoption of CAATTs to increase the efficiency of audits. This situation is not similar to the auditing standards in Turkey. The absence of laws, regulations, standards, etc. that will encourage the use of artificial intelligence platforms in Turkey is an important finding of this study and an important deficiency in the audit sector.

66% of the auditors participating in the research agreed, 14.3% disagreed with the statement that "the audits with artificial intelligence will increase the quality of the decisions to be made," and 19.7% of the auditors stated that they were undecided. Hooda, Bawa, and Rana (2018) concluded in their study that machine learning is important for increasing the quality of future audits. Kakoullis (2018) concluded that RPA will increase audit quality with new capabilities such as IoT. Davenport (2016) commented that with the Deloitte Argus platform, auditors will spend their time practicing their professional judgments, thereby increasing audit quality. According to preliminary findings, the PwC Cash.ai platform will improve audit quality. It is stated that with the EY Canvas platform, auditors can focus on important areas of audits and increase the quality of audits. It would be correct to comment that artificial intelligence improves the quality of audits, taking into account the studies in the literature and those conducted by the big four audit companies themselves. Since the increase in audit quality will lead to an increase in the quality of the decisions to be made in the audits, it is seen that the findings obtained in our research support the literature and the results of the big four audit companies. In the PwC (Gl.ai) report, it was stated that the Gl.ai platform increased efficiency by accelerating the audit process and improved the decision-making processes of auditors by focusing on real risk areas. Therefore, our research findings gave similar results to this study.

22.4% of the auditors participating in the research agreed, 56.4% disagreed with the statement that "artificial intelligence audits 100% of the data," and 21.2% of the auditors stated that they were undecided. This finding in the study differs from the literature. Bierstaker, Janvrin, and Lowe (2014) stated that CAATTs enabled them to test 100% of the population. Davenport (2016) also mentioned in his study that 100% of large samples and documents can be examined with the Deloitte Argus platform. However, in this thesis, auditors who actively use artificial intelligence platforms in

their processes do not think in the same way. In this case, it becomes necessary to make more efforts to create systems where 100% of the data can be audited and to develop the systems more.

61.8% of the auditors participating in the research agreed, 20.8% disagreed with the statement, "Because AI lacks human intuition, it will lack professional skepticism," and 17.4% of the auditors stated that they were undecided." This situation indicates that artificial intelligence will be lacking in professional skepticism, and human auditors will undertake the task of professional skepticism. In the literature, Davenport (2016) thinks that auditors will continue to move forward with professional skepticism and add value to the reporting process. In the EY (Helix) report, it is stated that auditors will increase their skepticism and channel it toward the audit instead of collecting data by more easily identifying the points where they will spend their time with EY Helix. Therefore, it is seen that auditors are always needed in terms of professional skepticism, as the studies in the literature and the findings in our research give similar results. In the future, it can be said that necessary technical studies should be done to use artificial intelligence in a decision-making position in an audit process.

60.2% of the auditors participating in the research agreed, 23.9% disagreed with the statement that "auditing with artificial intelligence will reduce audit costs," and 15.8% of the auditors stated that they were undecided. Moreover, 22% of the auditors participating in the research agreed, 58.3% disagreed with the statement that "the installation and adaptation process of artificial intelligence tools will cause loss of time and extra cost for audit firms," and 19.7% of the auditors stated that they were undecided. According to our research findings, the vast majority of auditors think that artificial intelligence reduces audit costs and does not cause extra costs in the installation and adaptation processes. In the PwC (2019) report, it is mentioned that costs are reduced thanks to artificial intelligence. Therefore, our research findings and PwC's findings support each other.

Although not included in the literature, the points that we can reveal as a finding of this study are as follows:

23.2% of the auditors participating in the research answered yes, 45.9% answered no, and 30.9% partially answered the question, "Do you think that artificial intelligence applications are given enough importance in the audit sector?" This result is supported by the absence of laws and regulations encouraging the use of artificial intelligence in audits and the insufficient training provided by professional chambers. Based on this result, it is clear that the auditors do not give enough importance to artificial intelligence applications in the audit sector, and if the necessary care is taken, it will have positive results for the audit sector.

In our study, where artificial intelligence is mostly used in the stages of audit planning and audit execution, its use has been revealed by showing similarities with the literature. However, in addition to the literature, it was stated by the participants in the research that artificial intelligence is also used in the fields of confirmation letter selection and accounting tax. Furthermore, 76.1% of the auditors polled agreed, 14.3% disagreed, and 9.7% were undecided with the statement that "the situation that whether artificial intelligence will contribute to the audit or not will vary depending on which stage of the audit is used." It is seen that artificial intelligence cannot provide the same contribution at every stage, and it is mostly used in subjects such as conducting some tests and determining risk levels (based on the votes of the participants, it is mostly used in the Stage of Execution of the Audit and Audit Planning). It has been determined that artificial intelligence is used less in the stages of selection of the client and acceptance of the job and in the stage of reporting of the audit compared to the other two stages (audit planning and execution) since situations such as selection of the client and acceptance of the job and reaching an opinion on the financial statements require more professional judgment.

In the results of the research, inconsistent with the literature, the inadequacy of the internal control system was determined as the first cause of fraud. In addition to the reasons for fraud, the participants used expressions such as manipulation of financial statements, opportunity, rationalization, insufficient salary, incentives, attitudes, lack of responsibility of the top management after the management period, avoidance of



tax, and benefits to the top management. The fact that top management is one of the parties that can commit fraud backs up this claim, since participants often talk about the problems or personal goals of the top management.

To the statement, "Do you think artificial intelligence is more successful than human auditors in detecting fraud?" 27.4% of the participants answered yes, 38.2% answered no, and 34.4% answered partially. According to this result, although auditors trust the audits performed by artificial intelligence, they think that human auditors are more successful in detecting fraud. This situation can be explained by showing a skeptical attitude towards fraud and approaching the events with professional skepticism. The fact that the auditors acted more successfully than artificial intelligence in adopting an attitude of professional skepticism again supports this statement.

44.4% of the auditors participating in the research agreed, 29.3% disagreed with the statement, "In the case of artificial intelligence as a deterrent platform for fraudsters," and 26.3% of the auditors stated that they were undecided. Although the auditors participating in the research think that human auditors are more successful than artificial intelligence in detecting fraud, they also think that artificial intelligence platforms can be deterrents for parties that may resort to fraud. Parties who want to resort to fraud will see the existence of artificial intelligence platforms backed by the power of technology as a threat, thus minimizing the tendency of fraudsters to turn to fraud.

17.8% of the auditors participating in the research agreed, 68% disagreed with the statement that "artificial intelligence makes auditors lazy," and 14.3% of the auditors stated that they were undecided. This, on the other hand, supports the situation that human auditors will turn to areas that require qualifications, with artificial intelligence taking over the routine work, which was revealed in the research. Auditors will use their spare time for routine work by working more efficiently in other areas over a longer period of time. Since it will not be possible for the auditors to be idle in terms of business, there will be no such situation as laziness.

Based on all these comments, it is clear that the findings obtained through the questionnaire support the questions that form the basis of our research model, which is also the answer to RQ2.

The adaptation of artificial intelligence to audit processes has been realized to a large extent;

➡ This situation causes shortening of audit periods,

➡ With the shortening of the audit period, the audit costs are also reduced to the minimum,

➡ With the shortening of the time and the reduction of the cost, the quality of the audits has reached the maximum by making larger expenditures and investments in more important areas,

➡ It has been concluded that with the maximum quality, the reliability of the opinion to be reached as a result of the audit will also be maximum.

## CHAPTER 7: CONCLUSION

As the companies' business volumes increased, so did the amount of data that needed to be audited. The volume of data has grown to the point where only human hands can work for days, if not weeks, at a time. At this point, the need for the use of artificial intelligence algorithms that will shorten the processes, increase efficiency, and save auditors from doing repetitive and time-consuming work as required by our age and technology comes to the fore. Algorithms can finish the work that humans would do for days, maybe in minutes. At this point, the important thing is to assign the jobs that are suitable for artificial intelligence algorithms to the algorithms and leave the jobs that are not suitable for the algorithms to human auditors. As a result, artificial intelligence's making a wrong decision without human intuition, professional judgment, and professional skepticism may have irreversible consequences for a company. Contrary to this situation, having the routine processes that artificial intelligence can perform faster, more efficiently, and error-free than humans, and organizing this division of labor plan perfectly, would be the key to the success of the audit processes. After all, the aim at this point is to integrate technology into the processes of audit companies to provide better-quality audit services to their customers and to ensure customer satisfaction. The correct implementation of this technological placement should be supported by obtaining the thoughts and ideas of every senior auditor who actively works in audit. Likewise, the reputation of the auditing profession has been damaged by the accounting scandals, and it has become an important issue for this profession to regain trust with new initiatives. Our research aims to get the opinions of the auditors to serve the purpose of improving the audit processes and to see the current situation of artificial intelligence applications in the audit sector in Turkey. According to the results of our research, artificial intelligence platforms have become an area that accelerates and adds value to the audit processes that auditors use with a positive attitude.

According to the results obtained from the research, it has been understood that artificial intelligence platforms are used in global audit companies in Turkey and that these platforms are in a transition period since some auditors stated that they use them

partially. It would be fair to say that in the near future, the process of adapting will speed up and these platforms will be used in real life.

It has been seen that artificial intelligence platforms are mostly used in the stage of execution of the program of audit activities (in the areas of conducting internal control tests, performing substantive tests, and detecting errors and fraud) and secondarily in the stage of planning the audit (in the areas of determining and evaluating the audit risk, determining the level of materiality, and evaluating it). It is seen that it is used less in the selection of clients and acceptance of the job (in the areas of preliminary research on the client and making audit contracts) and in the reporting stage (in the areas of reaching an opinion on the financial statements and writing a report). Aside from that, the participants contributed to the literature by mentioning that they used artificial intelligence applications in the fields of confirmation letter selection and accounting-tax.

The auditors stated that they agreed with the statement that "artificial intelligence cannot provide the same efficiency at every stage and that the contribution status will change depending on which stage it is used." At this point, issues that require qualification, professional skepticism, and professional judgment, such as reaching an opinion on financial statements, cannot be transferred to artificial intelligence, and human auditors will always be needed in this regard. Auditors also support this view, agreeing to a large extent with the statements that, with the increase in the use of artificial intelligence in routine work, auditors should focus on issues that require more qualifications and that auditors should learn to use robotic process automation and shape their skills in this direction. In addition, auditors do not agree with the idea that they will become lazy with the spread of artificial intelligence platforms and feel the pressure to be laid off. Because there will always be a need for auditors in special areas required by artificial intelligence, and there will be no such thing as being lazy or dismissed.

While the auditors find the training provided by their companies sufficient, they find the training provided by the professional chambers insufficient. In addition, it is understood from the results of our research that there is a lack of laws, regulations, etc.

that encourage the use of artificial intelligence. In support of these statements, auditors stated that artificial intelligence applications are not given enough importance in the audit sector. The attitude of the auditors in this regard may be due to their concern about the future of their profession, or it can be interpreted as their desire to professionalize their processes as soon as possible and transform their business into a quality-centered structure.

Auditors believe that AI applications will improve audit efficiency, be more efficient than human auditors, improve the quality of decisions made with the adaptation of AI applications to processes, AI platforms will be reliable, AI applications will speed up the audit process, AI applications will reduce audit costs, and the installation and adaptation process of AI platforms will not incur additional costs or time loss.

Auditors think that 100% of the data cannot be audited with artificial intelligence. Auditors are largely undecided about whether AI platforms will be easy to use. This situation coincides with the inadequacy of the training given by the professional chambers.

Auditors mostly see the inadequacy of the internal control system as the reason for the occurrence of possible fraud cases. In addition to the answers in the questionnaire, they helped to contribute to the literature by using the expressions of manipulation of financial statements, opportunity, rationalization, insufficient salary, incentives, attitudes, lack of responsibility of the top management after the management period, tax avoidance, and benefits to the top management.

Auditors think that there may be cases of fraud that artificial intelligence cannot detect, but the existence of artificial intelligence platforms will be a deterrent for parties who will resort to fraud.

When the results are evaluated in general, the use of artificial intelligence in audits has been a factor that adds value to audit companies to a greater extent. In this regard, companies that are successful in incorporating artificial intelligence platforms into their processes will be one step ahead of their competitors. The era we live in now

requires industries, companies, and employees to transform their qualifications and attitudes. Those who cannot keep up with the digital transformation will not be able to prevent their competitors from getting ahead. At this point, it has been decisive to transform and change by breaking away from traditional judgments.

The questions "The current situation of artificial intelligence applications in Turkey (RQ1) and why artificial intelligence will be used in audits (RQ2)" formed the general framework and limitations of the survey questions. In this context, it has been concluded that artificial intelligence applications in Turkey are actively used by global audit companies and partially used in some areas. The use of artificial intelligence platforms in audits is generally intended to improve the quality of the audit framework. Shorter timeframes, reduced costs, increased quality decisions, and ultimately maximum reliability are brief summaries of the use of artificial intelligence in audits.

Managers who are decision-makers in audit companies have a critical role in the future of the audit profession, which is being reshaped by digital processes. It will be possible for the audit profession and the audit sector to receive the respect they deserve by increasing the consciousness, awareness, and education levels of all employees in the sector. In this context, it is a critical issue that audit companies and the organizations that the auditors are affiliated with create value for the audit industry and the audit profession by increasing the training they provide.

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*Appendix A - Form For Ethics Committee Approval*

**SAYI** : B.30.2.İEÜ.0.05.05-020-246

24.11.2022

**KONU** : Etik Kurul Kararı hk.

**Sayın Prof. Dr. Coşkun Küçüközmen ve Yağmur Şen,**

**“Dört Büyük Denetim Şirketinde Faaliyet Gösteren Denetçilerin Yapay Zeka Kullanımına İlişkin Tutumları Üzerine Bir Araştırma”** başlıklı projenizin etik uygunluğu konusundaki başvurunuz sonuçlanmıştır.

Etik Kurulumuz 24.11.2022 tarihinde sizin başvurunuzun da içinde bulunduğu bir gündeme toplanmış ve Etik Kurul üyeleri projeleri incelemiştir.

Sonuçta 24.11.2022 tarihinde **“Dört Büyük Denetim Şirketinde Faaliyet Gösteren Denetçilerin Yapay Zeka Kullanımına İlişkin Tutumları Üzerine Bir Araştırma”** konulu projenizin etik açıdan uygun olduğuna oy birliğiyle karar verilmiştir.

Gereği için bilgilerinize sunarım.

Saygılarımla,

**Prof. Dr. Murat Bengisu**

**Etik Kurul Başkanı**



## Appendix B - Questionnaire Form

Dear Participant,

This study was prepared within the scope of the master's thesis titled "A Study on the Attitudes of the Auditors Operating in the Big Four Audit Companies to the Use of Artificial Intelligence" in the Finance Economics Master's Program of the Social Sciences Institute of the Izmir University of Economics. Your information and survey results will not be shared with third parties. Thank you in advance for your dedication to completing the questionnaire.

### **CHAPTER 1: DEMOGRAPHIC FEATURES**

<b>DEMOGRAPHIC FEATURES</b>						
1)	<b>Your age?</b>	20-30 ( )	31-40 ( )	41-50 ( )	51-60 ( )	61 and above ( )
2)	<b>Your Gender?</b>	Female ( )	Male ( )			
3)	<b>Your Current Position?</b>	Assistant ( )	Senior ( )	Manager ( )	Director ( )	Partner ( )
4)	<b>Your Experience Period?</b>	1-5 year ( )	6-10 year ( )	11-15 year ( )	16-20 year ( )	21 years and above ( )
5)	<b>Your Education Status?</b>	Bachelor's Degree ( )	Master's Degree ( )	Doctor of Philosophy ( )		
6)	<b>City you work in?</b>	İstanbul ( )	Ankara ( )	İzmir ( )		

### **CHAPTER 2: RECOGNITION LEVEL OF ARTIFICIAL INTELLIGENCE**

7) Do you use Artificial Intelligence in audits?

- Yes  
 No  
 Partially

8) Which stages of the audit do you use Artificial Intelligence?

\* If your answer to the above question is yes or partially, answer this question, if no, do not answer. In addition, multiple options can be marked.

- Selection of Client and Acceptance of the Job (Making a preliminary research on the client business, making an audit contract)  
 Audit Planning (Determination and evaluation of audit risk and materiality level)  
 Execution of the Program of Audit Activities (Performing internal control and substantive tests, detecting errors and frauds)  
 Completion of the Audit and Reporting the Findings (Reaching an opinion on financial statements, writing reports)  
 Other ...

**9)** Do you think Artificial Intelligence platforms fit the nature of the audit profession?

- Yes
- No
- Partially

**10)** Do you think that there are enough auditors with the competence to use artificial intelligence in the audit process in the company you work for?

- Yes
- No
- Partially

**11)** Do you think that Artificial Intelligence applications are given enough importance in the audit sector?

- Yes
- No
- Partially

### **CHAPTER 3: ANTI-FRAUD DIMENSION OF ARTIFICIAL INTELLIGENCE**

**12)** Have you encountered a case of fraud in audits?

- Yes
- No

**13)** Which of the following do you see as a potential fraudulent party?

\* More than one option can be marked.

- Company Owners/Partners
- Top Managers
- Sub-Employees
- Auditor/Audit Company

**14)** What do you think might be the reason for a possible fraud case?

- Pressure/Threat
- Inadequacy of Internal Control System
- Conflict of Interest
- Increased Business Volume
- Complexity of the Accounting System
- Other...

**15)** Do you think the use of Artificial Intelligence prevents fraud in audits?

- Yes
- No
- Partially

**16)** Do you think artificial intelligence is more successful than human auditors in detecting fraud?

- Yes
- No
- Partially

## **CHAPTER 4: EVALUATION OF THE CONTRIBUTION OF ARTIFICIAL INTELLIGENCE TO AUDIT**

\* In this section, the questions will be marked by grading between Strongly Disagree and Strongly Agree.

	<b>Statements</b>	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Undecided</b>	<b>Agree</b>	<b>Strongly Agree</b>
<b>1</b>	Artificial Intelligence audits 100% of the data.	( )	( )	( )	( )	( )
<b>2</b>	Artificial Intelligence increases the effectiveness and efficiency of auditing.	( )	( )	( )	( )	( )
<b>3</b>	Artificial intelligence works more efficiently than human auditors.	( )	( )	( )	( )	( )
<b>4</b>	Audits made with Artificial Intelligence increase the quality of the decisions to be made.	( )	( )	( )	( )	( )
<b>5</b>	I trust the audits made by artificial intelligence.	( )	( )	( )	( )	( )
<b>6</b>	Whether Artificial Intelligence will contribute to the audit or not depends on which stage of the audit it is used.	( )	( )	( )	( )	( )
<b>7</b>	The installation and adaptation process of Artificial Intelligence tools causes loss of time and extra costs for audit firms.	( )	( )	( )	( )	( )
<b>8</b>	There are laws and regulations that encourage the use of artificial intelligence in auditing.	( )	( )	( )	( )	( )
<b>9</b>	Artificial Intelligence applications cause cyber security threats in terms of data privacy.	( )	( )	( )	( )	( )
<b>10</b>	Artificial intelligence speeds up the audit process.	( )	( )	( )	( )	( )
<b>11</b>	The use of artificial intelligence in routine work enables auditors to focus on more qualified subjects.	( )	( )	( )	( )	( )
<b>12</b>	Audits with artificial intelligence reduce audit costs.	( )	( )	( )	( )	( )
<b>13</b>	Artificial intelligence is a deterrent platform for the fraudsters.	( )	( )	( )	( )	( )
<b>14</b>	There are also frauds that artificial intelligence cannot detect.	( )	( )	( )	( )	( )
<b>15</b>	Artificial intelligence platforms are easy to use.	( )	( )	( )	( )	( )
<b>16</b>	I have sufficient knowledge and training in using Artificial Intelligence in an audit process.	( )	( )	( )	( )	( )
<b>17</b>	The training given by our company about using Artificial Intelligence in an audit process is sufficient.	( )	( )	( )	( )	( )
<b>18</b>	The training given by the relevant professional chambers is sufficient for using Artificial Intelligence in an audit process.	( )	( )	( )	( )	( )
<b>19</b>	Auditors should learn to use robotic process automation and shape their skills in this direction.	( )	( )	( )	( )	( )
<b>20</b>	I think AI is making auditors lazy.	( )	( )	( )	( )	( )
<b>21</b>	With the widespread use of artificial intelligence, there will be pressure to dismiss auditors.	( )	( )	( )	( )	( )
<b>22</b>	Since artificial intelligence does not have human intuition, it will fall short of professional skepticism.	( )	( )	( )	( )	( )