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ARTIFICIAL INTELLIGENCE APPLICATION IN AUDITING

Artificial intelligence (AI) is a rapidly evolving technology that has gained prominence in various industries, including auditing. AI enhances the effectiveness of auditors by automating routine tasks and improving data analysis. Major audit companies, such as EY and PwC, have integrated AI into their practices to save time, increase accuracy, and provide better services to clients. AI applications in auditing include anomaly detection, fraud prevention, revenue analysis, risk assessment, and financial data analysis. Machine learning algorithms, a subset of AI, play a crucial role in analyzing large volumes of financial data, identifying patterns, and making predictions.

AI implementation in auditing involves different stages, including pre-planning, planning, contracting, control risk assessment, and substantive tests. The benefits of AI for auditors and clients include improved data analysis, reduced human error, increased efficiency, and enhanced audit quality. However, the successful implementation of AI in auditing requires a clear understanding of its strengths, limitations, and challenges, as well as interdisciplinary collaboration and the development of specialized frameworks.

AI has the potential to transform audit procedures, but human expertise and understanding are still essential for its proper use. It is important to recognize that while AI can automate certain tasks, it cannot replace auditors' judgment and critical thinking skills.

There are also challenges associated with AI implementation in auditing. These include the need for extensive data preparation, ensuring data quality and integrity, managing complex algorithms, and addressing regulatory and compliance issues. Furthermore, auditors must stay updated with the latest advancements in AI and continuously adapt their skills to leverage the technology effectively.

Keywords: Artificial intelligence, auditing, audit procedures, data analysis, machine learning, fraud detection.

Introduction and research problem. The capacity of robots to mimic human cognition and natural intelligence is known as artificial or machine intelligence. But it also is a new trend in the global economy. Artificial intelligence (AI) is defined by IBM company as a field combining computer science and robust datasets to enable problem-solving (IBM, 2023). Since the last century, it has been evolving enormously from simple algorithms of video games to complex systems that may learn, adapt, and solve many different problems.

The Organization for Economic Co-operation and Development (OECD) defines Artificial intelligence (AI) as a "machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations or decisions influencing real or virtual environments" (IBM, 2023). AI excels at modelling non-linear relationships in vast amounts of unstructured data, and it effortlessly handles various data formats such as text, images, video, and voice.

AI has become an integral part of business, exerting a significant impact across various industries and professions. It has led to increased efficiency in tasks and processes. Although different industries have adopted AI at varying rates, the technology demonstrates its ability to transform how business is conducted. Companies utilize AI to automate tasks previously performed by humans, such as fraud detection and loan applications, freeing up human resources for more complex activities. Additionally, chatbots are replacing customer service representatives to handle basic inquiries. Given this widespread adoption, it was only a matter of time before AI made its way into the realm of auditing.

Currently, AI has started to serve as a valuable tool for auditors, enhancing their efficiency and effectiveness by automating routine tasks. So, what good does AI have for auditing, and why are audit companies starting to use it? And another question remains: can AI completely replace auditors and independently conduct every auditing procedure, including examining a company's financial statements?

Recent publications analysis. Artificial intelligence is an important step that is able to make audit procedures not the same as they were before.

R. Banham from Forbes writes: "Powered by adaptable artificial intelligence, machine learning, and other automation technology, the technology is changing how the audit is done" (Banham, 2022). Virtually all big audit companies nowadays use AI in their daily practice.

EY carefully considered how AI affects its auditing services. It found ways to give its employees more time so they could focus on the most crucial tasks. They automated more than 250 operations throughout the globe using AI capabilities, sponsored by Microsoft. This enhanced quality and accuracy and saved an estimated 2,000,000 human hours yearly (How EY is Empowering Business with Artificial Intelligence, n. d.).

PwC uses AI in its practice as well. "PwC is actively engaged across all areas, both thinking about how we can maximize the opportunities from this technology internally and for the benefit of our clients. Internally, this includes developing platforms and solutions to be used alongside our people to free them up for more value-added tasks and to provide greater efficiency. With our clients, we are working with them to embed AI into the services we offer and the solutions we provide to solve their business challenges" says Jon Andrews, a member of PwC UK's Executive Board with responsibility for Technology and Investments (Lauder, 2017).

It is clear that AI is helping auditors in many ways. For instance, L. Bradley, the Global Head of Audit for KPMG International, also gives a comment on the use of AI in their company: "Change has already brought us a long way: we established the first cloud-based auditing platform, KPMG Clara, which embeds digital technologies into the audit and leverages the power of emerging technologies such as AI and machine learning. This helps our auditors see meaningful patterns across a business at a deeper level while at the same time providing a more intuitive and collaborative experience" (Bradley, 2022). So, AI and digital technologies make audit procedures more automatic in tasks that require a lot of manual work.

It is also important to mention that the application of AI technologies is popular not only among big auditing companies. Right now, the use of AI in the process of auditing is becoming known and used across the whole profession. According to the statistics provided by J. Boillet, Global Assurance Innovation leader at EY, in 2019 73 % of CEOs were already adopting AI or planning to adopt it into their business practice in the next 2 years. Moreover, it was also mentioned by her that the World Economic Forum published statistics that showed that 30 % of every corporate audit will be performed by AI by 2025 (ACCA Global, 2018).

The popularity of AI in auditing can be attributed to two significant factors. Firstly, it alleviates the workload of auditors by automating routine tasks and streamlining processes. Secondly, AI brings about a fundamental shift in audit procedures, making them more efficient and effective.

Unsolved parts of the problem. Advancing the application of AI in auditing requires a clear understanding of its current state, addressing general AI application challenges, and establishing scientifically grounded methodologies. This involves assessing the strengths and limitations of AI in auditing, tackling issues like data quality and bias, and developing comprehensive frameworks. Collaboration between auditors, AI researchers, and regulatory bodies is crucial to drive progress and ensure effective and responsible AI integration in auditing practices.

Research goal and questions. To advance the theory and practice of AI application in auditing, several key areas need attention. Firstly, there is a need for a clear understanding of the current state of AI in auditing, including its strengths, limitations, and practical implications. This involves assessing the existing use cases, identifying successful applications, and recognizing areas where AI can bring the most value to the auditing process.

Secondly, it is essential to address general AI application problems specific to the field of auditing. This includes tackling issues related to data quality, model transparency and interpretability, bias detection and mitigation, ethical considerations, and compliance with auditing standards and regulations. These challenges require interdisciplinary collaboration and the development of specialized frameworks tailored to the unique requirements of auditing.

Furthermore, coherent and integrated concepts grounded in scientific methodology are needed to guide the AI application in auditing. This entails establishing robust methodologies and standards for AI-driven auditing procedures, data analysis techniques, risk assessment frameworks, and decision-making processes. A scientifically rigorous approach will enhance the reliability, consistency, and effectiveness of AI-based auditing practices.

Main findings. It is well known that in order to obtain audit evidence special audit procedures should be performed. Audit procedures (evidence-gathering techniques) include inquiry, observation, inspection (of tangible assets, records, or documents), recalculation, reperformance, confirmation, and analytical procedures (Hayes et al., 2014). All these audit procedures require a lot of time and attention from auditors.

The audit industry relies heavily on processing large volumes of data. The efficiency of an audit and the income of auditing firms are closely tied to the availability and ease of interpretation of this data. The more data auditors have and the more straightforward it is to interpret, the more efficient the audit process becomes, ultimately impacting the financial success of auditing firms. AI can perform repetitive tasks, provide greater insights, and improve efficiencies and quality, allowing auditors to better use their skills, knowledge, and professional judgment. The auditing process can improve both its quality (through a decrease in error rate) and efficiency (via the automation of tasks like fraud detection) by leveraging its precisely defined objectives and the accuracy of its predictions, particularly in identifying anomalies. In terms of specific AI applications, the main areas where AI is used in audits are anomaly detection and fraud prevention (by using machine learning for pattern analysis), revenue analysis (e.g., order/invoice matching, mapping receivables with cash receipts), financial risk assessment, bank secrecy and anti-money laundering, optical character recognition to review contracts and leases, and analysis of large public databases (big data) for benchmarking (Fedyk et al., 2022).

It is the AI algorithm's capacity to repeat a process, such as reviewing invoices or managing payments and inventory. According to (Vuković et al., 2023), through the use of pre-programmed algorithms, artificial intelligence enables the determination of extreme and negative values, extraordinarily high payments made during the off-season, double entries of suppliers, and invoices.

The use of AI starts with machine learning. Machine-learning algorithms detect patterns and learn how to make predictions and recommendations by processing data and experiences, rather than by receiving explicit programming instruction. The algorithms also adapt in response to new data and experiences to improve efficacy over time (Suman, 2019).

Types of machine learning are supervised learning and unsupervised learning.

In supervised learning an algorithm uses training data and feedback from humans to learn the relationship of given inputs to given outputs (e.g., how the inputs "time of year" and "interest rates" predict real estate prices). It is used when we know how to classify the input data and the type of behaviour we want to predict, but we need the algorithm to calculate it on new data.

Unsupervised learning – an algorithm explores input data without being given an explicit output variable (e.g., explores customer demographic data to identify patterns). It is used when we do not know how to classify the data, and we want the algorithm to find patterns and classify the data for us.

Machine learning can be used to analyze large volumes of financial data, identify patterns or anomalies, and make predictions about future performance. A wide range of machine learning algorithms can be used to classify transactions based on different criteria such as expense type, supplier, or department. This can help auditors identify patterns or trends in financial data and assess the accuracy and completeness of the financial statements. Also, machine learning can be used to detect potential fraud by identifying transactions or behaviour that deviates significantly from normal patterns. This can help auditors identify suspicious activity and prioritize further investigation. Moreover, it can help assess the risk of material misstatement by analyzing financial data and identifying potential areas of risk.

The use of machine learning also brings a wide range of improvements to the audit process and is capable of generating independent estimates that are more accurate and of higher quality when compared to management's established estimates (Barr-Pulliam et al., 2022). KPMG also mentioned the use of machine learning in the work of its auditors and cited as an example that this technology can help auditors obtain more information from unstructured data (contracts, documents, invoices, or drawings) and can potentially improve the results of assessments for large data scales (Automating the Auditor – KPMG Switzerland, 2023).

AI encompasses more than just machine learning. While machine learning is a prominent subfield of AI, AI as a whole encompasses a broader range of technologies and techniques that enable machines to perform tasks requiring human-like intelligence. These include natural language processing, computer vision, expert systems, robotics, and more. Therefore, AI extends beyond machine learning and encompasses various methodologies to simulate intelligent behaviour in machines.

One remarkable example of how the use of artificial intelligence can ease the process of auditing is the application of document readers to the process. Moreover, clients may upload their documents on common cloud software and also check the process of auditing.

The full implementation of AI in audit entails various stages. There is a differentiation in the phases of automated audit processes that developed with the tools of AI technologies, such as:

– pre-planning – in this stage, the AI system takes in information about the client's organizational structure, operational methods, accounting, and financial systems. The AI system then assesses internal controls and risk factors, analyzing data from financial statements, operating procedures, and organizational structures;

– planning – during the planning phase, AI acquires initial knowledge of the client and industry, estimating audit hours and fees. For example, ChatGPT might be used to create a base audit program or help auditors collect and check information (Jaleel, 2023);

– contracting – AI analyzes the database of contracts and prepares the contract itself, replacing the traditional process of the auditor preparing an engagement letter. The contract is then signed by both the auditor and the client;

– control risk assessment – continuous control monitoring systems examine controls on an ongoing basis. AI, through process mining, verifies the proper implementation of internal controls. This eliminates the need for lengthy procedures such as risk assessment for each attribute, control testing, risk reassessment, testing of control documentation, and sampling-based tests. The nature, extent, and timing of control tests depend on the results of AI-driven analyses;

– substantive tests – continuous data quality assurance is performed by AI to ensure the quality of data and evidence. AI examines data provenance, reducing the need for auditors to manually examine these aspects.

EY believes that artificial intelligence technologies, in particular machine learning, allow data analysis using advanced pattern recognition and have a number of advantages for both auditors and clients (Audit innovation, n. d. – Table 1).

KPMG notes that there are some ways in which AI and machine learning technologies could change the way audits are conducted in the future (KPMG: On the 2023 board agenda, 2022): sampling will become obsolete; evidence can be auto-verified; control verification will be proactive; more data points will be treated as evidence; continuous auditing will be a reality; auditors will morph into data scientists; explainable ai will become important; audit reporting will become continuous; audit standards will be redefined; auditors will become strategic advisors.

AI implementation profoundly impacts work and audit procedures. Here is how.

1. Increased efficiency: AI automates data input, verification, analysis, and other time-consuming manual tasks, reducing the need for auditors to go through numerous paper documents and files. This saves auditors valuable time, enabling them to focus on complex tasks requiring human knowledge and judgment.

2. Better accuracy: AI's ability to handle large volumes of data in real time reduces the chances of losing crucial information and increases the likelihood of identifying mistakes in reports. Precise recalculations are crucial for auditors as they directly impact audit results and decisions.

3. Ability to detect fraud: AI assists auditors in detecting fraud and money laundering by analyzing extensive data sets, performing deep inspections, and identifying fraud patterns and irregularities that humans may overlook. This enhances the effectiveness of fraud detection efforts.

4. Improved audit reports: AI tools aid auditing firms in streamlining the creation of audit reports. Auditors can quickly generate graphs, spreadsheets, and visuals using artificial intelligence, simplifying the reporting process and enabling faster report publication.

5. Improved audit quality: By leveraging AI, auditors can minimize errors resulting from negligence or calculation mistakes. AI's capability to detect patterns and anomalies beyond human capabilities enhances the overall quality and detail of audits, surpassing traditional audit procedures.

In summary, AI implementation revolutionizes work and audit procedures, boosting efficiency, accuracy, fraud detection capabilities, report generation speed, and overall audit quality.

However, it has to be noted that even though AI takes a lot of work from auditors and is able to change the auditing procedures, it can be used

Table 1. **Benefits of AI for auditors and the clients**

Benefits of AI for auditors	Benefits of AI for clients
• analyze and extract data from unstructured data such as contracts, invoices, and images for additional audit evidence • analyze large data sets to identify, assess, and respond to risks of material misstatement due to fraud • reading and interpretation of business documents, which will allow expanding the number of documents that auditors analyze, as well as increase speed and accuracy	• greater confidence and trust: by working with AI tools, the chances of human error are reduced. They provide consistent reasoning with high accuracy, objectivity, and precision • increased quality: quality is increased by facilitating the analysis of larger samples • increased value: AI allows us to shape our approach, optimize our time and provide better service to our customers

properly when people know how to work with it. As A. Hasan (2022) mentions in his article: "Accountants and auditors cannot be replaced by artificial intelligence when it comes to exercising human creativity and judgments. Technological, regulatory, and economic shifts will continue to test the profession's historical approaches and ways of thinking, which is a good thing."

We must also not forget that AI may not be correct sometimes. According to Gartner's 2018 CIO Agenda Survey, mentioned in the EY event report: 85 % of AI projects through 2020 will deliver erroneous outcomes due to bias in data, algorithms, or development teams (ACCA Global, 2018). Especially today, when using ChatGPT and other artificial intelligence, it is possible to find some disinformation and mistakes that may be used by people. Therefore, audit firms must check what they get from an AI in order not to get in trouble or be sued.

Currently, AI serves as a valuable tool for auditors, enhancing efficiency and effectiveness by automating routine tasks. However, the question remains: can AI fully replace auditors and independently perform all audit procedures without human assistance? To explore this, we will examine the pros and cons of implementing AI in the audit process.

The integration of AI in auditing offers several benefits such as enhanced efficiency, reduced errors and fraud risks, accelerated audit completion, improved analytics capabilities, and targeted focus on high-risk areas. However, the utilization of AI in auditing also presents certain drawbacks. Ethical concerns may arise, including the potential introduction of biases if AI is programmed to prioritize specific information. Employment implications and data security issues, such as the risk of breaches or unauthorized access to sensitive data, should be considered. Limited human oversight poses a challenge, as AI lacks decision-making abilities and subjective assessment skills, potentially leading to undetected errors. The complexity of AI algorithms may hinder auditors' understanding of decision-making processes, impacting transparency and error detection. Lastly, the adoption of AI in auditing may involve significant challenges, such as organizational changes and high implementation costs (Table 2).

AI utilizes pattern recognition, visualization methods, and data quality checks to detect anomalies and draw conclusions. While there is ongoing debate about the current capabilities of AI, it is expected to improve in performing these tasks. However, there are inherent limitations to AI replacing certain aspects of auditing that rely on human qualities such as experience, instinct, trust, and compassion. Human auditors bring valuable personal and professional expertise, establishing trust-based relationships with clients and providing guidance on complex business challenges. Effective communication skills are crucial for auditors to build partnerships based on trust and confidence. Judgment, experience, and industry knowledge remain critical as AI machines have limited learning capabilities. While AI can automate tasks like sampling, contract review, and anomaly detection, it cannot apply professional judgment or consider non-programmed factors. Therefore, human intervention is necessary to ensure the quality of audit work while leveraging the capabilities of AI.

Conclusions and further research proposals. AI significantly improves audit efficiency, saving time and reducing errors and fraud risks, while enhancing analytics capabilities. However, the implementation of AI in auditing comes with its own set of risks, including ethical considerations, data security issues, lack of transparency, and integration challenges. It is important to note that AI cannot fully replace tasks that involve client relationships and judgment calls. While automating routine tasks with low error risks simplifies auditors' work, human judgment remains crucial for financial assessment and drawing conclusions.

The integration of AI in auditing revolutionizes the field by automating tasks and enhancing risk assessment. However, a complete replacement of human auditors is unlikely due to the complex nature of auditing, which requires judgment, scepticism, and contextual understanding that experienced auditors possess. Although AI can automate certain aspects of auditing, it lacks the ability to replicate the nuanced judgment and professional expertise of human auditors.

Table 2. **Application of artificial intelligence (AI) in auditing**

#	Pros	Cons
1	Enhanced Effectiveness	Ethical Issues
2	Enhancing Audit Quality	Hazards to Data Security
3	Lower Costs	Little Human Control
4	Better Analytics	Lack of Transparency
5	Improved Risk Assessment	Integration Issues

Several unresolved aspects surround the use of AI in financial statement audits. These include challenges in interpreting complex transactions, ensuring transparency in AI decision-making, limited availability of high-quality training data, adapting to evolving regulations, addressing ethical concerns and biases, and maintaining appropriate human oversight. While AI can assist with data extraction and preliminary analysis, it falls short in terms of financial interpretation and evaluation.

To address these challenges, collaboration, research, and the establishment of robust guidelines for responsible AI use are essential. Collaboration among auditors, AI experts, and regulatory bodies fosters knowledge sharing, drives research advancements, and facilitates the development of best practices. By clarifying the current state, addressing general AI application problems, and establishing sound methodologies, the auditing field can harness the full potential of AI for improved practices.

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ЗАСТОСУВАННЯ ШТУЧНОГО ІНТЕЛЕКТУ В АУДИТІ

Мета дослідження: розвиток теорії та практики застосування штучного інтелекту (ШІ) в аудиті шляхом розуміння його поточного стану для вирішення проблем, характерних для аудиту під час здійснення аудиторських перевірок і розроблення науково обґрунтованих пропозицій подальшого розвитку досліджень.

Методи дослідження: позитивізм, який передбачає наявність і застосування різноманітних наукових парадигм та теорій у межах окремих наукових дисциплін; огляд літератури, експертні інтерв'ю та цитування, кейсові дослідження та приклади, концептуальний аналіз, емпіричний метод і метод ідеалізації; порівняння, аналіз, синтез, інтерпретація, узагальнення.

Результати дослідження. ШІ може автоматизувати рутинні завдання, надавати інформацію та підвищувати ефективність і якість процесів аудиту. Алгоритми машинного навчання можуть аналізувати фінансові дані, виявляти закономірності чи аномалії та робити прогнози щодо майбутніх показників. ШІ може допомогти у виявленні аномалій, запобіганні шахрайству, аналізі доходів, оцінюванні ризиків та аналізі великих наборів даних під час аудиту. Впровадження штучного інтелекту в аудит охоплює такі етапи, як попереднє планування, планування, укладання контрактів, оцінювання ризиків контролю та тестування по суті. Технології штучного інтелекту, включно з машинним навчанням та засобами читання документів, можуть полегшити процес аудиту та надати переваги аудиторам

і клієнтам. Впровадження ШІ в аудит підвищує ефективність, точність, можливості виявлення шахрайства, поліпшує аудиторські звіти та загальну якість аудиту. ШІ має потенціал змінити спосіб проведення аудитів у майбутньому, включно з усуненням вибірки, автоматичною перевіркою доказів, проактивною контрольною перевіркою, обробкою більшої кількості точок даних як доказів, безперервним аудитом і переосмисленням стандартів аудиту.

Можливе застосування результатів дослідження: на підставі узагальнених положень можливе подальше розроблення організаційних та методичних концепцій аудиту в умовах застосування технологій штучного інтелекту.

Висновки. ШІ має потенціал для підвищення ефективності, точності та результативності процесів аудиту, але для його належного використання потрібні знання та досвід. Впровадження штучного інтелекту революціонізує роботу й процедури аудиту, забезпечуючи такі переваги, як підвищення ефективності, більша точність, виявлення шахрайства, поліпшені аудиторські звіти та загальна якість аудиту. Однак тлумачення та оцінювання результатів аудиту залишаються за людиною.

Ключові слова: штучний інтелект, аудит, процедури аудиту, аналіз даних, машинне навчання, виявлення шахрайства.