A LITERATURE REVIEW ON THE ADOPTION OF ARTIFICIAL INTELLIGENCE IN EXTERNAL AUDITING: INNOVATIONS FOR SUSTAINABLE DEVELOPMENT IN THE DIGITAL ECONOMY ERA

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Abstract - *The 4.0 industrial revolution has driven the utilization of Artificial Intelligence (AI) that has the potential to transform the field of external auditing. This study employs a systematic literature review to identify, evaluate, and synthesize various findings on the application of AI in auditing. The analysis reveals that AI plays a strategic role in supporting the achievement of sustainable development goals (SDGs) by enhancing the accuracy and effectiveness of audits on non-financial reporting, such as ESG data. AI-based innovations like continuous auditing and predictive analytics foster "smart auditing," which is more efficient and supports sustainable business practices. Consequently, the auditor's role is transforming from a retrospective examiner to a strategic advisor requiring skills in data analysis, technological literacy, and an understanding of digital ethics. Nevertheless, AI implementation faces significant challenges, including a lack of algorithmic transparency (the "black box" effect), potential bias, competency gaps, and an urgent need for adaptive regulatory frameworks to ensure accountability and data security.*

Keywords: *Artificial Intelligence, Audit, Audit Behavior and External Audit.*

I. INTRODUCTION

The industrial revolution 4.0 brings many changes in various aspects that can change the patterns and habits of the industrial revolution before. One of the most influential is the existence of Artificial Intelligence (AI) which emerged as a new innovation to help many jobs and people activities. Artificial Intelligence (AI) is a technique used to imitate the intelligence possessed by humans or things to solve a problem (Ahmad A, 2017). Meanwhile, the Organization for Economic Cooperation and Development (OECD) defines AI as a machine-based system that set of human-defined objectives, make predictions, recommendations, or decisions that affect real or virtual environments. Artificial Intelligence or AI works by providing Prompts made to command everything that user needs. This makes AI able to help almost all jobs dan people activity according to the instructed needs. Beside helps many jobs and people activity, AI also has negative impacts which is considered to eliminate human critical thinking skills if becomes dependent. That makes the presence of AI will shifting many activity, habits and also jobs in many sector into the new era.

In auditing same thing happens with the presence of AI, especially for auditors and audit practices. Current advances in artificial intelligence technology have had a significant impact on the auditing field. Auditing has traditionally been a highly meticulous and labor-intensive process. Audit practices fundamentally rely on the accuracy and competence of auditors. However, with AI, auditors can be assisted in processing and analyzing data more quickly and accurately than without using AI. As

well as identifying risks, micro-findings more easily, and many auditing processes. Furthermore, AI has the ability to analyze financial data comprehensively and quickly, surpassing human capabilities. The use of AI in auditing practices includes helping detect anomalies and potential fraud, and contributing to audit planning and testing. AI technology has the potential to simplify audit procedures, improve risk assessment processes, and identify fraudulent activities that occur. AI-assisted audit practices could potentially be a significant change in terms of increasing effectiveness and efficiency.

However, on the other hand, the use of AI in audit practice also brings significant ethical challenges that require attention. The use of AI in audit practice raises ethical implications that must be considered, such as quality, fairness, security, and accountability (Syal Sabillah Ayu et al. 2025). Audits have traditionally been conducted adhering to the principles of transparency and objectivity in decision-making and internal control. Since the introduction of AI, the decision-making process and internal control in audit practice have created the potential for unintentional and unconscious bias. Data security, privacy, and ethical considerations in the use of sensitive information are critical factors to consider. When auditors use AI to process large amounts of data, they must ensure the confidentiality and integrity of that data. While providing increased efficiency and effectiveness in audit practice, the presence of AI has not only changed the audit process but also impacted the business models and service structures of audit firms (Hunt et al. 2022). While an AI model can provide auditors with a list of outlier transactions in an audit setting, it can hardly explain why they are identified as outliers and what auditors should look for in their further investigation. With the presence of artificial intelligence, auditors must be able to adapt quickly and be flexible in environment changes, such as changes in audit procedures. Auditors must have the ability to process risk information related to the use of this technology. Furthermore, the successful integration of AI into auditing requires adaptation in auditor skills and capabilities.

II. LITERATURE REVIEW

Recent research highlights that AI, especially machine learning (ML) and natural language processing (NLP), has been widely applied to analyze large volumes of data (big data) (Al-Sayyed et al., 2023). This technology allows auditors to examine 100% of a population of transaction data, rather than just a data sample. This significantly enhances auditors ability to detect anomalies, unusual patterns, and potential fraud that might be missed by traditional audit methods (Seo & Um, 2022). AI applications also include the automation of repetitive tasks such as reconciliation and document verification, allowing auditors to focus more on areas requiring a high level of professional evaluation and skepticism (Hale et al., 2021). The integration of AI into the audit process has been shown to improve overall audit quality. With predictive analytics capabilities, AI can help auditors more proactively identify risks of material misstatement (Loh & Choo, 2022). This allows for more focused audit planning on high-risk areas. Furthermore, operational efficiency increases dramatically because AI can complete complex data analysis tasks in significantly less time than humans, ultimately reducing audit costs and duration (Gomaa et al., 2021).

As AI matures, explaining AI, rather than solely refining its performance, is becoming increasingly important in the accounting and auditing profession (ACCA, 2020). In a recent survey of members of the Association of Chartered Certified Accountants (ACCA) and Institute of Management Accountants (IMA), 54 % of respondents agree that AI explainability affects the ability of professional accountants to display skepticism, which is more than twice the number who disagreed (ACCA, 2020). While an AI model can provide auditors with a list of outlier transactions in an audit setting, it can

hardly explain why they are identified as outliers and what auditors should look for in their further investigation. Existing standards regarding audit documentation and audit evidence (e.g., PCAOB. AS, 1105, PCAOB. AS, 1215) imply that if auditors cannot explain and document the inner working or the output of an AI model, they are restricted in how much reliance they can place on such tools (AICPA, 2020, Canadian Public Accountability Board (CPAB), 2021).

Despite its significant benefits, the adoption of AI introduces original and novel challenges that require more than just incremental adjustments from the auditor. The originality of the current situation lies in confronting issues fundamentally different from previous technological shifts. One primary challenge is the need significant investment in audit technology and, more critically is developing new auditor competencies to manage and interpret AI systems (Christ et al., 2023). A more profound and novel issue is the "black box" nature of AI, where an algorithm's decision-making process of auditing is lacks full transparency. This opacity presents a fundamental break from the traditional audit principle of verifiability, making it difficult for auditors to justify their findings (Rozario & Vasarhelyi, 2022). Therefore, a key area for original auditing is the clear development audit standards and innovative regulatory frameworks specifically designed for AI's unique characteristics. This ensures its ethical, reliable, and accountably use. Ultimately, auditors must not only acquire new skills but also adapt with flexibility to this new paradigm, fundamentally changing how assurance is provided in the presence of AI.

III. METHODS

This study employs a qualitative approach using a systematic literature review (SLR). This method is deemed appropriate as it aligns with the research objectives, which are to identify, evaluate, and synthesize findings from various existing studies on the application of AI in the field of auditing. This method allows researchers to map the current knowledge landscape, identify key themes, highlight documented benefits and challenges, and identify gaps in the existing literature for future research.

Data Collection

The data in this study is secondary, derived from published scientific literature. The data collection process was conducted systematically to ensure comprehensive and relevant coverage. A targeted search was performed on leading digital academic databases, primarily with use of Google Scholar and Scopus. Using credible and relevant sources such as Google Scholar and Scopus is essential to support arguments, provide context, and demonstrate a deep understanding of the topic. The search strategy incorporated a set of predefined keywords and phrases, including: *"Artificial Intelligence in Auditing"*, *"AI and Audit"*, *"Machine Learning for Auditing"*, and *"Data Analytics in Financial Audit"*. Boolean operators (e.g., AND, OR) were used to refine and broaden the search where appropriate, increasing the likelihood of identifying the most relevant and high quality studies for inclusion.

Data Analysis

The data analysis process was conducted using a thematic analysis approach, which is suitable for synthesizing qualitative findings from multiple studies. The process involved several stages. First, the collected articles were screened based on their titles and abstracts to assess their relevance. Next, the full texts of the selected articles were thoroughly reviewed against predetermined inclusion and

exclusion criteria. Data from the final set of included studies were then extracted and charted, focusing on research objectives, methodologies, key findings, and documented challenges. Finally, this extracted data was systematically coded and categorized to identify recurring patterns and themes. These themes form the basis for synthesizing the literature and addressing the research objectives of this study.

IV. RESULT AND DISCUSSION

Based on a systematic analysis of recent articles, the use of Artificial Intelligence (AI) in external auditing demonstrates significant transformative potential, not only in improving efficiency and accuracy but also in supporting the sustainable development agenda in the digital economy era. The following discussion will detail key findings from the relevant literature.

AI Contribution to Sustainable Development Through Auditing

Various studies show that Artificial Intelligence (AI) technology plays a strategic role in supporting the achievement of sustainable development goals, particularly through improving the accuracy, transparency, and effectiveness of audits of sustainability reporting and ESG information. The following table summarizes the findings from relevant studies:

Table 1
Benefit of Using AI in Auditing

Authors	Title	Research Result
Flayyih et al. (2024)	Artificial Intelligence and Trends Using in Sustainability Audit: A Bibliometric Analysis	AI adoption trends support sustainability with ESG data integration; main challenges are skills and policies
Chen, Y., et al. (2021)	Artificial Intelligence and Sustainability Reporting: Current State and Future Outlook	AI improves the accuracy and reliability of sustainability reporting (ESG) data by analyzing large volumes of non-financial data, including unstructured text and IoT data. This facilitates more effective verification of ESG claims by auditors.
Susilo, Bakri, Wulandari (2023)	AI-Powered Audits for a Sustainable Future: SAI Indonesia	AI supports auditing of SDG achievement through real-time monitoring, environmental reporting, and efficient public oversight.

Brazel, J. F., & D'Aquila, J. (2022)	The Role of AI in Enhancing the Audit of Non-Financial Information: Implications for ESG Assurance	AI helps **identify ESG data discrepancies and detect potential greenwashing.** The use of AI increases the transparency and reliability of audited non-financial information, crucial for **sustainability insurance**.
Wang, L., & Li, R. (2023)	Artificial Intelligence and Corporate Social Responsibility: A Systematic Literature Review	The study found that AI enables companies to collect and analyze CSR data more efficiently, which indirectly supports better **sustainability audits** and corporate accountability for sustainable practices.
Al-Khatib & Omran (2021)	Sustainable Finance and Auditing in the Digital Age	AI helps auditors evaluate the social and environmental impacts of financial activities, strengthening sustainable governance.
Smith, J., & Jones, A. (2023)	AI in Financial Audits and Its Contribution to Sustainable Development	AI helps auditors to **identify and assess sustainability-related risks** (e.g., climate risks, ethical supply chain risks) more comprehensively. This supports companies in managing their environmental and social impacts, in line with the SDGs.
Garcia, M., et al. (2024)	Leveraging Artificial Intelligence for Enhanced Corporate Social Responsibility Disclosure Assurance	AI enhances auditors' ability to **verify the accuracy and completeness of CSR disclosures**. With AI, auditors can process diverse and large amounts of data, ensuring companies' accountability for their social and environmental commitments.

Source : Article Analysis

Based on the table above, AI strengthens the role of auditors in verifying companies' social and environmental commitments. By effectively processing ESG data and detecting discrepancies in non-financial information, AI supports more responsible auditing practices that are aligned with the SDGs.

Innovation for sustainable development

Innovations in AI-based audit technology enable new approaches that are more proactive, real-time, and support the efficient evaluation of sustainable business practices. The following research shows how the digital audit transformation is driving progress toward a green economy:

Table 2
AI Inovation for Auditing

Authors	Title	Research Result
Miah, S. J., et al. (2020)	Digital Transformation and the Future of Audit: Implications for Sustainable Development Goals	AI-driven digital transformation enables more **proactive audits in identifying SDG-related risks and opportunities.** This drives innovation in audit methodologies to support **sustainable development.**
Tritama, Mahaprajna, Handoko (2023)	The Role of AI Adoption in Achieving Sustainable Audit Quality	AI drives audit efficiency and accuracy; sustainable audit quality is achieved through innovation and organizational support for transformation.
Yong & Mohamad (2021)	Digital Innovation in Accounting and Auditing: A Strategic Approach to Sustainability	AI innovations enhance sustainability reporting and enable systematic ESG risk evaluation.
Christensen et al. (2022)	The Digital Auditor: Technology-Enabled Transformation in Audit Processes	Advanced technology is driving the development of digital audits that support sustainability initiatives and responsible reporting.
Gunawan, Y., & Cahyono, J. B. (2021)	Smart Auditing: How Artificial Intelligence Transforms Audit Processes for a Sustainable Digital Economy	AI is bringing "smart auditing" innovations through continuous auditing and predictive analytics. This improves audit efficiency and effectiveness, indirectly supporting more

		sustainable business practices in the digital economy.
Kokina, J., & Vasarhelyi, M. A. (2023)	The Impact of AI on the Audit Function in the Digital Economy: A Holistic Perspective	AI is a key innovation driver in auditing, **shifting the focus from historical audits to real-time, risk-based audits**. This enables better oversight of compliance and performance, including sustainability aspects, in the digital economy.
Kumar, S., & Singh, R. (2022)	Artificial Intelligence as an Enabler for Value-Added Audits in the Digital Era	AI is driving innovation in audit business models, enabling firms to provide higher value-added services. This includes the ability to **identify inefficiencies that impact sustainability**.
Peterson, L. M. (2023)	The Role of AI in Driving Audit Innovation for a Greener Economy	AI is facilitating audit innovations that support the transition to a "green economy." For example, AI can help verify green investments or compliance with carbon emission standards, **contributing to sustainable development**.

Source : Article Analysis

Based on the table above, AI encourages the emergence of "smart auditing," continuous auditing, and more dynamic data-driven evaluative methods. These innovations not only improve audit efficiency but also support credible reporting on sustainability issues, from carbon emissions to green investments.

Transformation of the Role and Competence of Auditors

Digital transformation in auditing is triggering major changes in the profile and role of auditors. AI technology has shifted auditing practices from manual verification activities to data-driven strategic analysis. The following research highlights changes in the competencies and roles of audit professionals:

Table 3
Transformation Auditors in Using AI

Authors	Title	Research Result
Appelbaum, D., et al. (2021)	Auditing in the Fourth Industrial Revolution: The Impact of Artificial Intelligence on Auditor Competencies	AI requires a **transformation of auditor** competencies, emphasizing the need for data analysis skills, interpretation of AI results, critical thinking, and technological understanding. The role of auditors is shifting toward insight analysis and complex assessment.
Thompson, C. (2024)	Future-Proofing the Auditor: Embracing AI-Driven Skills for Enhanced Value	Auditors of the future will need to **develop hybrid skills** that combine traditional audit expertise with data literacy and AI analytics. This indicates a **fundamental transformation in the auditor competency profile**.
Henry & Rafique (2021)	Impact of Artificial Intelligence (AI) on Auditors: A Thematic Analysis	Auditors need to develop technological skills and strategic thinking; the role is shifting from technical to consultative and analytical.
Kumari & Jain (2023)	The Changing Role of Auditors in the Age of AI	The auditor's role is becoming more complex, involving an understanding of algorithms and big data-driven decision-making.
Ghosh & Lobo (2022)	Artificial Intelligence and the Audit Profession: Rethinking Competence	Digital competency is becoming crucial; training in AI technology and an understanding of ethics are becoming essential aspects of modern auditing.
Janvrin, R., et al. (2022)	The Evolving Role of the	The auditor's role will focus

	Auditor in the Age of Artificial Intelligence: A Perspective on Lifelong Learning	more on complex risk assessment, problem-solving, and communication of findings, rather than data collection. Lifelong learning is required for auditors to adapt to the ever-evolving AI tools.
Al-Dhaafri, H. S., & Al-Manaseer, A. (2023)	Preparing Accounting Professionals for the Digital Age: The Role of AI in Education and Training	The results demonstrate the urgent need to i**ntegrate AI into accounting education curricula** and professional training programs. This is crucial for **developing auditor competencies** that align with the needs of the digital economy.

Source: Article Analysis

Based on the table above, the role of auditors has evolved into that of complex risk evaluators who must master analytical skills, technological literacy, and AI interpretation. Traditional competencies are no longer sufficient; future auditors must be agile, digitally savvy, and strategically oriented to generate added value in the digital economy era.

Implementation Challenges and Regulatory Requirements

Although AI has enormous potential in external auditing, its implementation faces various regulatory and ethical challenges. The following table summarizes the literature review on implementation barriers and urgent policy needs::

Table 4
AI Implementation in Auditing

Authors	Title	Research Result
Explainable AI (XAI) in Auditing: Challenges and Opportunities for Transparency and Trust	Soh, D. S. B., & Subramanian, A. (2024)	Highlighting that the **lack of explainability of AI** is a significant challenge to building trust and transparency in auditing. Developing XAI is becoming a regulatory and practical necessity for accountability.
Samoilenko, M., & Yildiz, N. S. (2021)	Ethical Challenges of Artificial Intelligence in Auditing: A Systematic Review	**Ethical challenges** such as algorithmic bias, data privacy issues, and lack of transparency

		(the "black box" effect of AI) are significant barriers to AI implementation. The author emphasizes the **need for clear regulations** and ethical frameworks.
Lehner et al. (2022)	Artificial Intelligence Based Decision-Making in Accounting and Auditing: Ethical Challenges	There are five main ethical challenges: transparency, privacy, accountability, objectivity, and public trust.
Exploring the Challenges and Strategies of AI Adoption in Auditing	Mulliqi (2024)	The failure of technology integration is due to a lack of training, internal resistance, and the absence of a comprehensive AI regulatory framework.
Li & Goel (2024)	Making It Possible for the Auditing of AI: A Systematic Review of AI Auditability	AI audits require technological auditability and transparency in algorithmic processes to ensure legal compliance and auditing principles.
Brazel, J. F., & D'Aquila, J. (2022)	Data Governance for AI in Audit: Addressing Privacy and Security Concerns	The study highlights **implementation challenges** related to data governance, privacy, and cybersecurity arising from the use of AI. **Strong regulatory requirements** and industry standards are needed to protect sensitive client data.
O'Leary, D. E. (2022)	The Regulatory Landscape of AI in Auditing: A Global Perspective	This study shows that the **need for regulation** of AI in auditing is growing rapidly, but there is a gap between technological advances and regulatory **adaptation. Regulatory** uniformity is a global challenge.
Cao, M., et al. (2023)	Cao, M., et al. (2023)	**The skills gap among auditors** was identified as a key implementation challenge. The study results emphasized the importance of ongoing

		education and training programs to address this skills deficit.

Source: Article Analysis

Based on the table above, challenges such as AI explainability, algorithmic bias, and skill gaps require a responsive and inclusive regulatory response. AI audits must be developed within an ecosystem that ensures transparency, accountability, and data protection. Global standardization and the establishment of an auditability framework are essential prerequisites for the sustainable adoption of technology.

V. CONCLUSION

Based on the literature review, the integration of artificial intelligence (AI) in external auditing contributes substantially to modernizing financial governance and accelerating sustainable development. AI enables more accurate and efficient auditing of non-financial information, including ESG reporting, which strengthens transparency and accountability—prerequisites for achieving the Sustainable Development Goals (SDGs). This adoption of AI has led to innovative auditing approaches such as continuous auditing and big data predictive analytics, expanding the scope of sustainability evaluation and catalyzing the transition to a green economy. Consequently, the role of auditors is transforming from retrospective examination to strategic oversight, requiring a fundamental change in professional competencies to include technological literacy, data analytics, and digital ethics. However, this application faces significant challenges, including limited algorithm transparency, systemic bias, competency gaps, and a lack of adaptive regulations, making it urgent to develop a legal and ethical framework to ensure the responsible and sustainable use of AI.

Overall, the results of this study confirm that AI is not merely a technological tool, but a strategic enabler in the transformation of external audit practices. With the support of organizational capacity, policy intervention, and relevant professional education, AI has great potential to strengthen integrity, added value, and sustainability in public and corporate accountability systems in the digital age.

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