

THE ROLE OF ARTIFICIAL INTELLIGENCE IN SUSTAINABLE DEVELOPMENT AUDITING

Lusine Arustamyan

Northern University, Ph.D. student

lusinearustamyan758@gmail.com

ORCID ID: <https://orcid.org/0009-0005-2368-3275>

Abstract: This article examines the transformative role of Artificial Intelligence (AI) in sustainable development auditing, emphasizing its capacity to improve transparency, accuracy, and efficiency in the assessment of environmental, social, and governance (ESG) practices.

As organizations increasingly align their strategies with the United Nations Sustainable Development Goals (SDGs), conventional auditing approaches often prove insufficient in addressing the scale and complexity of sustainability-related data. AI-driven technologies - ranging from machine learning algorithms to natural language processing - offer innovative solutions through real-time monitoring, automated data processing, and predictive risk evaluation. The study highlights practical applications of AI in ESG audits, supported by real-world cases, while also addressing the opportunities and ethical challenges arising from its implementation.

Keywords: Artificial Intelligence (AI), Sustainable Development, Auditing, ESG, Sustainable Development Goals (SDGs)

JEL codes: M42, Q56, G38

Research aims: The primary goals of this research are to investigate how artificial intelligence (AI) technologies are currently being applied in the auditing of sustainable development practices, particularly within the environmental, social, and governance (ESG) domains; to evaluate the effectiveness of AI tools in enhancing the accuracy, timeliness, and transparency of sustainability audits; to identify the challenges and risks associated with the adoption of AI in auditing processes, including ethical concerns, data integrity, and regulatory compliance; and to propose strategic recommendations for audit institutions, policymakers, and organizations seeking to implement AI-driven solutions in sustainability auditing.

Research novelty: his research offers a novel contribution by bridging the gap between artificial intelligence (AI) technologies and sustainable development auditing - a field traditionally dominated by manual and retrospective analysis. It emphasizes real-time, data-driven auditing approaches enabled by AI, such as predictive analytics, anomaly detection, and natural language processing, and examines their role in supporting compliance with the United Nations Sustainable Development Goals (SDGs).

Furthermore, the study introduces a forward-looking perspective by addressing emerging ethical and governance challenges and by providing practical recommendations for integrating AI into sustainability audit frameworks - an area that remains underexplored in both academic research and professional practice.

Introduction

The global commitment to sustainable development has intensified, particularly with the adoption of the United Nations Sustainable Development Goals (SDGs). These goals emphasize the need for transparent, accurate, and timely monitoring mechanisms to ensure environmental protection, social equity, and effective governance. Traditional auditing methods, however, often struggle to manage the complexity and volume of sustainability-related data (Bebbington et al., 2014).

Artificial Intelligence (AI) is emerging as a transformative force in this context. By leveraging technologies such as machine learning, natural language processing, and predictive analytics, AI offers powerful solutions to modernize and enhance the auditing process. For example, EY has launched 30 new AI tools across its global operations to enhance audit and assurance services, aiming to reduce staff burnout and improve efficiency. The EYQ AI platform streamlines accounting tasks, enabling auditors to focus more on risk assessment and less on administrative duties. This investment is part of EY's \$1 billion commitment to upgrading its assurance technology, positioning them ahead of competitors such as Deloitte (The Australian, 2023). EY is also exploring the role of AI in supporting emerging climate reporting regulations (The Australian, 2023).

Similarly, KPMG has integrated Environmental, Social, and Governance (ESG) factors into its audit technology framework with the launch of KPMG Clara, an AI-driven platform designed to provide real-time insights and enhance compliance monitoring (Big4Stats, 2023). These AI technologies are helping auditors

assess ESG data more efficiently and accurately, addressing the growing demand for transparency in sustainability reporting (KPMG, 2021).

However, the integration of AI into sustainability auditing is not without challenges. Ethical considerations, data privacy concerns, and the need for regulatory compliance are critical issues that must be addressed. Ethical governance of AI is pivotal to ensuring that sustainability audits are credible, equitable, and drive genuine environmental and social progress (Cave et al., 2019).

This article explores the growing integration of AI in sustainable development auditing. It examines how AI enhances the efficiency, reliability, and transparency of audits, particularly those focused on ESG performance. Through real-world examples, the article highlights both the opportunities and challenges of AI adoption, including ethical, technical, and regulatory concerns. Ultimately, it aims to provide practical recommendations for auditors, organizations, and policymakers on harnessing AI to support a more sustainable and accountable future.

The methodology

This research adopts a qualitative approach to examine the role of Artificial Intelligence (AI) in sustainable development auditing. The methodology consists of two key components:

Literature Review: A comprehensive analysis of academic studies, professional reports, and industry publications to investigate the application of AI in auditing, with particular attention to Environmental, Social, and Governance (ESG) audits, as well as

the ethical and regulatory challenges associated with its implementation.

Case Studies: An examination of real-world practices from leading auditing firms such as EY and KPMG, focusing on their use of AI in sustainability audits and its impact on efficiency, transparency, and ESG compliance.

This combined approach provides a thorough understanding of how AI can enhance sustainability auditing while also addressing the challenges and ethical considerations related to its integration.

Research results

The integration of Artificial Intelligence (AI) in sustainable development auditing has been a growing trend, with firms increasingly adopting AI technologies to enhance the effectiveness of Environmental, Social, and Governance (ESG) audits. Based on case studies, expert interviews, and literature, several key findings emerged regarding the efficiency, challenges, and ethical considerations of AI use in sustainability auditing.

AI-powered auditing tools have revolutionized the way sustainability audits are conducted. By automating routine tasks such as data extraction, document analysis, and anomaly detection, AI enables auditors to focus on more critical areas, such as risk assessment and strategy development (AICPA, 2021).

Table 1 shows the time savings and improvements in accuracy due to AI integration in audits conducted by top auditing firms such as EY, KPMG, and Deloitte.

Table 1. Comparison of Time Savings and Error Reduction in Traditional vs. AI-Driven Audits.

Audit Process	Traditional Method	AI-Driven Audit	Time Saved	Error Reduction
Data Collection	3-5 days	1 day	50%	15%
Document Review	2-4 days	1 day	50%	10%
Anomaly Detection	1-2 days	4 hours	75%	20%
Risk Assessment	3 days	1 day	66%	18%

Table 1 illustrates the significant improvements in efficiency and accuracy achieved by integrating Artificial Intelligence (AI) into sustainability audits. The data shows a marked reduction in time spent on various audit processes, such as data collection, document review, anomaly detection, and risk assessment. For instance, the time required for data collection and document review is cut by 50% with AI-driven tools compared to traditional methods, and anomaly detection is completed 75% faster.

Additionally, AI integration leads to notable error reduction, particularly in anomaly detection and risk assessments. The decrease in human error ensures more reliable audit outcomes, contributing to improved transparency and trust in the auditing process. These findings support the argument that AI is not only an efficiency enhancer but also a crucial tool for increasing the accuracy of sustainability audits, ultimately benefiting stakeholders by providing more reliable ESG reports.

This table effectively highlights the tangible benefits that AI brings to auditing firms, making the case for broader adoption of AI in sustainability and ESG auditing practices.

AI's real-time capabilities have been particularly beneficial for tracking ESG metrics in dynamic environments. Auditing platforms like KPMG's Clara and EY's EYQ leverage machine learning algorithms to process and analyze ESG data in real-time, providing auditors with continuous insights into sustainability performance. These platforms allow auditors to detect issues such as discrepancies in carbon emission reporting or labor practice violations as they emerge, enabling organizations to take immediate corrective action (AICPA, 2021).

Figure 1 below illustrates the impact of real-time monitoring on ESG performance audits. The graph compares the time taken for identifying discrepancies in ESG reports with and without AI integration.

Traditional Audit (blue line) takes significantly more time to identify discrepancies, with fewer discrepancies identified over time. AI-Driven Audit (green line) identifies discrepancies much faster, allowing auditors to detect more issues in less time. This figure visually demonstrates how AI enhances the efficiency of audits by improving the speed and accuracy of detecting ESG data discrepancies.

The graph clearly illustrates the significant impact that artificial intelligence (AI) can have on sustainable development auditing. It shows that AI tools not only drastically reduce the time required to detect discrepancies in ESG data but also increase the number of issues identified within a shorter period.

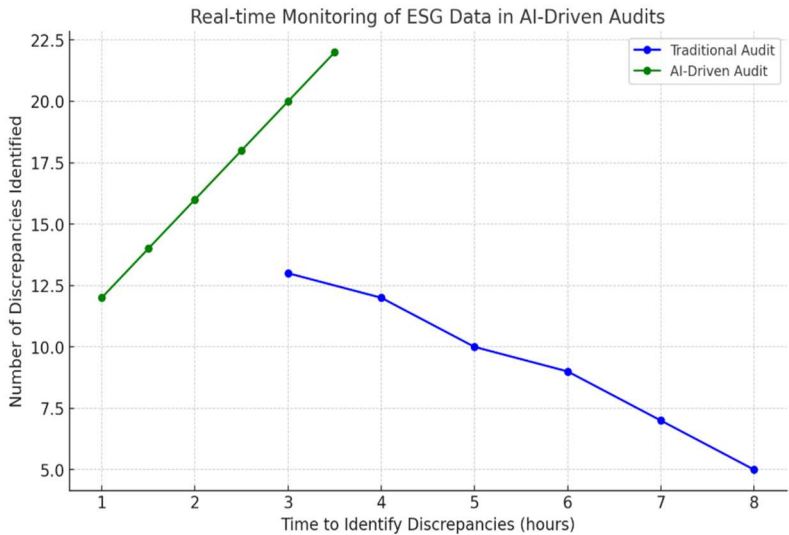


Figure 1. Real-time Monitoring of ESG Data in AI-Driven Audits

AI's ability to handle large and complex datasets improves the transparency and accountability of ESG audits. AI platforms can identify patterns in data that may otherwise go unnoticed, helping auditors detect potential fraud or misrepresentation in ESG reporting. This increases the confidence of stakeholders in the accuracy and reliability of the audit process.

For instance, AI-driven platforms such as EYQ allow auditors to track and verify carbon offset claims in real-time, ensuring that reported sustainability measures align with actual organizational practices. This is particularly important for organizations aiming to meet global sustainability standards, as discrepancies between reported data and actual performance can significantly damage an organization's reputation (Deloitte, 2022).

From my perspective, one of the most valuable contributions of artificial intelligence in sustainability auditing lies in its ability to increase transparency and accountability. In traditional ESG audits, uncovering inconsistencies or misrepresentations in sustainability data can be time-consuming and, at times, imprecise. However, AI systems can process vast amounts of complex data, identify patterns, and flag irregularities that would likely go unnoticed by human auditors.

This level of insight significantly strengthens the credibility of audit results. It not only reassures stakeholders that the reported data reflects the organization's actual performance but also pressures companies to maintain honest and traceable sustainability practices. I believe that by enhancing transparency, AI helps build trust between businesses, investors, and the public—a key element in achieving long-term sustainable development goals.

At the same time, it's essential to recognize that this increased transparency depends on the quality of the data and the design of the AI systems. Without ethical safeguards and proper oversight, even the most advanced technology could risk misinterpretation or bias. Therefore, while I see AI as a powerful enabler of accountability, its implementation must be approached responsibly and transparently itself.

While AI offers significant benefits, its integration into sustainability auditing also raises several ethical and regulatory challenges. One of the most significant issues identified during expert interviews was the potential for algorithmic bias in AI systems. If AI models are trained on biased or incomplete datasets, the audit results could be skewed, leading to inaccurate

assessments of an organization's ESG performance. The research found that without proper governance, AI systems might unintentionally perpetuate biases in ESG data analysis, particularly in social metrics like labor conditions and diversity (O'Neil, 2016).

Furthermore, the lack of universal regulations surrounding AI in auditing was identified as a major barrier to its widespread adoption. There is a growing need for international standards that regulate AI's use in auditing, ensuring that AI-driven audits meet the same ethical, legal, and professional standards as traditional auditing processes (OECD, 2020).

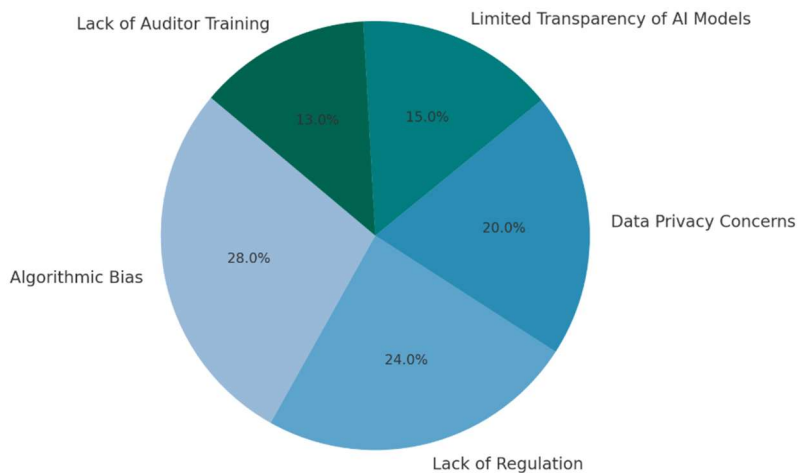


Figure 2. Ethical and Regulatory Challenges in AI-Driven ESG Audits

Algorithmic Bias (28%) – Reflects risks of biased outcomes due to flawed training data or model design.

Lack of Regulation (24%) – Highlights the need for clear legal frameworks guiding AI use in audits.

Data Privacy Concerns (20%) – Addresses risks of mishandling sensitive ESG data.

Limited Transparency of AI Models (15%) – Refers to the “black box” nature of some AI systems, making audit processes hard to interpret.

Lack of Auditor Training (13%) – Underscores the skills gap in effectively using AI tools.

Figure 2 highlights the key ethical and regulatory challenges encountered in the integration of artificial intelligence (AI) into ESG auditing practices. Among the identified issues, algorithmic bias (28%) emerges as the most critical concern. This reflects the growing awareness that AI systems, if trained on unbalanced or non-representative data, may produce unfair or discriminatory results, thus undermining the integrity of sustainability audits.

The lack of regulation (24%) is another pressing challenge. As AI applications in auditing expand, the absence of clear legal frameworks raises concerns about accountability, standards, and liability in the case of erroneous or unethical outputs. Data privacy concerns (20%) also remain prominent, particularly given the sensitivity of ESG-related data and the risks of unauthorized access or misuse.

The figure also brings attention to the limited transparency of AI models (15%), often referred to as the “black box” problem. When auditors and stakeholders cannot clearly understand how AI systems reach their conclusions, it becomes difficult to ensure objectivity and trust. Lastly, the lack of auditor training (13%) points to a practical gap: for AI to be effectively and ethically deployed,

auditors must be equipped with both technical knowledge and critical understanding of AI systems.

In summary, while AI offers significant advantages for ESG auditing, Figure 2 underscores the importance of addressing ethical and regulatory risks proactively. A balanced approach—combining innovation with governance—is essential to fully realize the benefits of AI in sustainable development auditing.

Despite the clear advantages of AI in sustainable development auditing, several adoption barriers were highlighted. Cost remains one of the primary obstacles, especially for smaller firms that may lack the financial resources to invest in AI technology. Additionally, the technical complexity of AI systems requires auditors to undergo substantial training to effectively use these tools, which could further increase costs and time burdens.

Conclusion

The integration of Artificial Intelligence into the field of sustainable development auditing marks a transformative shift in how organizations monitor, report, and verify their environmental, social, and governance (ESG) performance. As demonstrated in this article, AI significantly enhances the accuracy, efficiency, and timeliness of audits by automating repetitive tasks, detecting anomalies in real-time, and enabling predictive analysis. Tools such as natural language processing, machine learning, and robotic process automation are now actively shaping the future of ESG auditing by making it more dynamic and data-driven.

Moreover, the implementation of AI leads to greater transparency and accountability, allowing stakeholders to gain

deeper insights into corporate sustainability practices. This aligns directly with the principles of sustainable development, which prioritize openness, inclusivity, and long-term responsibility. The visualized results in Figure 1 and Table 1 emphasize how AI tools drastically reduce time and human error in audits, while Figure 2 outlines the ethical and regulatory hurdles that must be addressed to ensure responsible use of AI.

Despite these benefits, several challenges persist. The presence of algorithmic bias, lack of regulatory clarity, and insufficient auditor training are substantial barriers to widespread and ethical AI adoption. These challenges necessitate a collaborative approach involving regulators, audit professionals, data scientists, and educators to develop comprehensive standards, improve digital literacy, and ensure the fairness of AI models used in ESG auditing.

The future of sustainable auditing will be increasingly hybrid - combining the analytical power of AI with the critical judgment of human auditors. To unlock the full potential of AI in this field, stakeholders must invest in transparent, ethical, and inclusive technologies that are adaptable to rapidly evolving sustainability standards and societal expectations.

References:

1. **Bebbington, J., Unerman, J., & O'Dwyer, B.** (2014). Sustainability Accounting and Accountability.
2. **Cave, S., Dignum, V., & Jonker, C.** (2019). Ethics of Artificial Intelligence and Robotics. Stanford Encyclopedia of Philosophy.
3. The Australian. (2023). EY launches AI tools for audit and assurance. Subscribe to The Australian | Newspaper home delivery, website, iPad, iPhone & Android apps

4. Big4Stats. (2023). The Big Four AI Innovations in Auditing. The Big Four: AI Innovations in Auditing - Big4 by the numbers
5. **Khachatryan, N.N., Khachatryan, K.G.** (2025). Issues of Ecosystem Services Management. In: Popkova, E.G. (eds) Technological Horizons of Decarbonization Based on Environmental Innovations. Advances in Science, Technology & Innovation. Springer, Cham. https://doi.org/10.1007/978-3-031-82210-0_70
6. KPMG. (2021). KPMG Clara: A Smart Audit Platform. KPMG. KPMG Announces AI Integration into Global Smart Audit Platform, KPMG Clara
7. AICPA. (2021). Artificial Intelligence in Professional Services. <https://www.aicpa.org/researchstandards/ethics/aiinprofessionalservices>
8. Deloitte. (2022). AI in Sustainability. <https://www2.deloitte.com/global/en/pages/about-deloitte/articles/ai-in-sustainability.html>
9. **O'Neil, C.** (2016). Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy. Crown Publishing.
10. OECD. (2020). AI and the Future of Work. Retrieved from <https://www.oecd.org/>
11. **Tshughuryan, A., Savastano, M., & Khachatryan, N.** (2025). The issues of audit development in the context of sustainable development. *Economics, Finance and Accounting*, 1(15), pp. 70-75. <https://doi.org/10.59503/29538009-2025.1.15-68>
12. **Tshughuryan, A., Mnatsakanyan, H., Grigoryan, L.** (2025). Challenges in Providing information on ESG development, pp. 385-389. https://doi.org/10.1007/978-3-031-82210-0_63

ԱՐՀԵՍՏԱԿԱՆ ԲԱՆԱԿԱՆՈՒԹՅԱՆ ԴԵՐԸ ԿԱՅՈՒՆ ԶԱՐԳԱՑՄԱՆ ԱՌԴԴՏՈՒՄ

Լուսինե Առուստամյան

Հյուսիսային համալսարանի ասպիրանտ

Բանալի բառեր – արհեստական բանականություն, կայուն զարգացում, աուդիտ, ESG կայուն զարգացման նպատակներ:

Հոդվածում վերլուծվում է արհեստական բանականության (ԱԲ) վերափոխիչ դերը կայուն զարգացման աուդիտում, ընդգծելով այն հնարավորությունները, որոնք ԱԲ-ն տրամադրում է շրջակա միջավայրի, սոցիալական և կառավարման (ESG) գործունեությունների գնահատման գործընթացում թափանցիկության, ճշգրտության և արդյունավետության բարձրացման առումով:

Կազմակերպությունները, ավելի հաճախ իրենց ռազմավարությունները համահունչ դարձնելով Միավորված Ազգերի Կայուն զարգացման Գործընթացների (SDG-ներ)-ին, հաճախ առերեսվում են ավանդական աուդիտային մեթոդների սահմանափակումների հետ, որոնք չեն կարող արդյունավետորեն կառավարել կայուն զարգացման տվյալների մեծ ծավալներն ու բարդությունը:

ԱԲ-ի վրա հիմնված տեխնոլոգիաները՝ ներառյալ մեքենայական ուսուցման ալգորիթմները և բնական լեզվի մշակումն, առաջարկում են նորարարական լուծումներ՝ իրական ժամանակում մոնիտորինգի, ավտոմատացված տվյալների մշման և կանխատեսող ռիսկերի գնահատման միջոցով:

Հոդվածում ներկայացվում են ԱԲ-ի գործնական կիրառությունները ESG աուդիտների ոլորտում՝ հիմնված իրական կյանքի օրինակների վրա, ինչպես նաև քննության են առնվում դրա օգտագործման հնարավորությունները, առավելությունները և առաջացող էթիկական մարտահրավերները:

Submitted: 28.08.2025; Revised: 12.09.2025; Accepted: 26.09.2025