
The Role of Internal Auditing Utilizing Artificial Intelligence in Assessing Environmental Impact on Commercial Organizations: An Applied Study on Zain Iraq Telecommunications

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Abstract

With the acceleration of digital transformation and the increased dependence of commercial enterprises on intelligent systems and advanced technologies, internal auditing has become a key component of transparency and environmental sustainability. Artificial intelligence (AI) is an aid to support and effectively used in the analysis of environmental data, early identification of discrepancies in operational performance, and evaluating corporate green performance. The purpose of this study is to analyze the role of AI-supported internal auditing practices in assessing the environmental impact of commercial enterprises and to highlight how smart auditing systems help to improve the quality of environmental reporting and compliance with governance and sustainability standards. The researchers developed a deductive approach to shape the theoretical aspect via an analysis related to Arabic and international literature and an inductive approach to present real-life applications in commercial firms. Hypotheses were designed to test the relationship between internal audit effectiveness, AI engagement levels, and the accuracy of environmental impact assessment. Empirical analysis was made on Zain Iraq Telecommunications (2022-2023). showed that the use of AI in internal auditing greatly improves the standard of

environmental impact assessments by allowing the analysis of operating and environmental data to be carried out accurately, the timely identification of anomalies, and improvements in the organisation's environmental performance. The results, demonstrated that the interface between internal auditing and AI provides enhanced organisational compliance with governance and sustainability standards, supports a proactive control system that facilitates data-driven decisions, increases the level of transparency of environmental reporting—thereby enhancing stakeholder confidence and advancing the commercial enterprise's long-term sustainability.

Keywords: Internal Auditing, Artificial Intelligence, Environmental Impact, Sustainability, Commercial Enterprises.

1. Introduction

The world today is experiencing dramatic changes as a result of the digital revolution and the introduction of artificial intelligence in business management. These new developments will lead to new variables around governance and environmental accountability (Al-Ali, 2022). Growing regulation and societal pressure around the adherence to environmental standards has led commercial companies to incorporate and to think of implementing controls to confirm that their environmental disclosures are accurate and that their sustainable performance is transparent (COSO, 2023). Internal auditing is shaping up to be an important strategic tool in overseeing corporate compliance with environmental and social regulations, while AI applications provide a robust technological support to auditors in their ability to analyze data addressing the environment at scale, while efficiently recognizing risks (Kokina & Davenport, 2019). Thus, the rationale for this study is clear in the need to establish a smart internal audit framework that supports integration of the controls for environment with the application of modern technology in order to build on institutional performance and engage in the sustainability development goals. This study also aims to illustrate the role of AI in supporting internal auditors in relation to environmental data assessments, along with its role in risk identification and quality reporting in the commercial sector, The main objectives are:

- Clarify the concept and role of internal auditing in enhancing environmental performance
- Describe the implications of Artificial Intelligence applications as they relate to environmental auditing
- Explore the integrative relationship between internal auditing and AI with respect to evaluating environmental impact and achieving institutional sustainability.

The research problem emerges from the weak integration of internal audit units with AI technologies, in commercial enterprises, that ultimately results in ineffectiveness of environmental impact assessment, and poor transparency in environmental performance disclosure in annual reports, which leads to a loss of credibility in the reports and institutional sustainability. Therefore, the research problem may be stated as: What is the role of internal auditing, using artificial intelligence, in evaluating the environmental impact of commercial enterprises, and how does this integration lead to transparency and institutional sustainability? From this, the two hypotheses were tested:

- 1. First hypothesis:** The use of AI technology in internal auditing serves an important role for the enhancement of the level of environmental disclosure, and as a facilitator of transparency in commercial organisations.
- 2. Second hypothesis:** There is a significant relationship between the use of AI technology in internal audits, the environment and its overall effectiveness in improving environmental disclosure and supporting transparency in commercial organisations.

2. Literature Review

Recent research suggests that there is an increasing indication of interest in the application of AI in developing the internal auditing function specifically for the assessment of corporate environmental performance, Ghafar, Perwitasari & Kurnia (2024) found that embedding AI technologies within internal audit procedures improved efficiency of the audit performance and that operational and environmental

risks were detected more accurately. In a similar study, Ananda, Rahmadhani, Wiratama & Pane (2025) announced that the use of AI tools improved the quality of the sustainability audits and increased the objectivity of outcomes for control decision processes, Adam et al. (2024) established a positive relationship between audit assurance quality and auditor independence with climate-related disclosures and AI as a mediating agent to better transparency and environmental compliance. As well, Sabauri (2024) noted that internal auditing supports sustainability assurance themes and compliance with global environmental standards through the application of smart monitoring systems that provide an update on environmental performance on a real-time basis, Suleiman (2023) showed that using AI in internal auditing in Iraq leads to a better quality of control and greater accuracy of both financial and environmental reports, and thus, strengthens institutional control systems. Merkhoufi, Bouzidi & Sadani (2025) similarly showed that the use of AI in IT situations improves audit quality through faster data analysis and risk-based support in decision making. Septarini & Ismanto (2024) talked about the challenges auditors face being digital in their auditing approach, emphasizing the need for AI to cope with digital transformation and reduce human error. Finally, Altikrite (2025) demonstrated that using AI in internal audit improves work quality while reducing manual effort through automation and sophisticated data analytics, enhancing the reliability of environmental and financial reports while bolstering organizational transparency and sustainability.

2.1 Differences Between the Current Study and Previous Studies:

A review of the literature indicates that most existing work has focused on using AI as an application in financial auditing or risk management, and less work has focused on AI in supporting internal environmental auditing activities and assessing commercial firms' environmental impacts in regard to sustainability, However, relatively few studies examined the actual integration of internal audit activities with AI technologies as a holistic framework for assessing and driving environmental control systems to improve the quality of sustainability reporting. Thus, the importance of this study covers this gap in providing an analytical model that relates smart internal auditing and

levels of environmental disclosure in the context of a developing Arab environment, Using Zain Iraq Telecommunications as a practical example of the impact of cyber incidents on environmental control and disclosure systems, this study hopes to contribute to the scientific literature by providing a novel viewpoint that considers AI and internal environmental auditing within a governance and sustainability framework that is also relevant in practice, Supporting decision-makers to design digital control systems and frameworks that will meet the institutions' future challenges and develop transparency in reports for environmental accounting.

3. Research Methodology

The researchers utilized a deductive method to create the theoretical underpinning by reviewing and critically assessing current academic literature in the fields of internal auditing, artificial intelligence (AI), and environmental sustainability, and by incorporating the relevant theories, namely stakeholder theory and corporate governance theory, into the debate. An inductive analytical method was also employed to examine the practical relationship between these variables looking at environmental reports generated by commercial companies in the Arab region and around the world, and studying trends published in Scopus, Elsevier, and Emerald databases. Data was gathered from academic references, academic monographs, and recent journal articles, as well as reports from international organizations such as GRI, IFAC, and COSO (2023), as evidence to strengthen the theoretical framework with contemporary and practical evidence.

4. Theoretical Framework

4.1 Internal Auditing:

With the increasing importance of corporate governance and sustainability, the function of internal auditing has changed from a simply control of tool to a strategic ally, which typically enhances performance and reduces organization risk. According to The Institute of Internal Auditors (IIA, 2023), internal auditing is an independent,

objective activity that adds value and improves organization's operations by evaluating governance, risk management, and control processes. Internal auditing is characterized by key attributes: objectivity, professional integrity, international standards, technical competence required to perform effectively in a complicated business context. Internal audit types include financial audits, operational audits, compliance audits, IT audits, and risk-based audits. The new area of audit is environmental audit, which examines an organization's adherence to and evaluation of environmental obligations and provides assessment of its organizational environmental footprint (referencing systems like ISO 14001, emissions, waste). In this framework, the internal auditor facilitates fulfills dual roles—as a compliance watchdog and consultant for the organization to improve its performance and assimilate environmental risk into the corporate risk matrix predictable corporate situations with an emphasis on increasing objectives in transparency and sustainability (Amoako, 2023).

4.2 Artificial Intelligence:

AI is rapidly emerging at the forefront of change in economic, industrial, and administrative systems in today's fast-changing digital world. AI refers to a field of computer science that allows machines to demonstrate human-like cognitive functions such as reasoning, learning, and decision-making (Kharchenko et al., 2022). The characteristics of AI consist of:

- Ability to self-learn, as systems analyze large datasets and adapt without human supervision;
- Generalization and adaptability, as systems can make inferences in unexpected situations outside of previously learned knowledge;
- Analytical reasoning involving logic, so predictions and decision-making are driven through logical processes;
- Automation, allowing systems to independently execute tasks in the real world (Swathi et al., 2019; Kharchenko et al., 2022).

AI systems are typically referred to as narrow, general, or superintelligent systems. While there is great capacity for AI, limitations such as the limited ability to interpret

("black-box" models) and ethical considerations require regulations for responsible use (Olewi et al., 2023).

4.3 Environmental Impact:

The increase concern over the energy consumption and carbon emissions associated with the telecommunications and cloud computing industry is indicative of the environmental footprint of this sector. Research indicates that the information and communications technology (ICT) sector generates 2–4% of all global carbon emissions, approximately equal to aviation emissions of carbon. The ICT environmental footprint is primarily due to the energy consumption associated with runtime and lifecycle associated with electric waste to rare material utilization in technology manufacturing. However, greater utilization of green data centers and renewable energy sources enables to sector to support achieving digital carbon neutrality by the year 2050 (ITU, 2022). Utilization of artificial intelligence (AI) can also mitigate environmental impacts through optimized energy consumption, load forecasting, and through smart analytics decrease electronic waste (Garg and Buyya, 2012). For instance, Zain Iraq Telecommunications has initiated energy optimization, reuse of both equipment and materials and digital green transformation, showing increased extent toward the company's environmental stewardship responsibilities (Zain Iraq Sustainability Report, 2023).

4.4 The Role of Internal Auditing Using AI:

The use of artificial intelligence (AI) in conjunction with the internal audit function signifies a meaningful change in control and governance systems in corporate environments. AI supplies the auditor with the ability to process vast amounts of data quickly, conceptualize new patterns within the data, and detect anomalies that indicate fraud and error (Vasarhelyi et al., 2022). Machine learning and predictive analytics allows internal auditors to change from a reactive audit practice, where problems are discovered post-fact, to a proactive audit practice where risks are identified in real-time (Appelbaum et al., 2017). For instance, in 2022 Zain Iraq experienced a major breach

of cybersecurity and subsequently developed an internal audit system utilizing AI to monitor digital payments and user behavior in real-time, thereby achieving improvements in cybersecurity and financial transparency (Zain Iraq, 2023). AI has also allowed for the automation of routine reviews and risk reporting, allowing internal auditors to concentrate on strategic issues that improve the quality of decisions. This advances the internal audit profession from a traditional reactive protector of organizational resources, to a proactive strategic partner and contributor to sustainability and information security particularly in sectors where information security is paramount, telecommunications and finance.

4.5 The Contribution of AI-Based Internal Auditing for Environmental Impact:

Assessment There have been several advancements in artificial intelligence which has revolutionized internal auditing for its ability to synthesize large amounts of data, identify hidden patterns and/or anomalies, and indicate potential risks with a high level of confidence. Additionally, it has allowed internal auditors to shift from previously, internally focused, traditional, retrospective audit processes to a predictive system that addresses the prediction of errors prior to occurring, enhancing both efficiency of controls and emanating reliable reports. AI also can be adopted as a tool beyond financial internal auditing; it can assist significantly with environmental internal auditing processes, emission analysis, monitoring energy usage, predictive modeling (quantifying environmental risks using machine learning algorithms), etc. These emerging technologies could enhance the accuracy of the environmental audit process, lower human subjectivity, and provide objective transparency. For instance, Zain Iraq detected how AI could be deployed in the company's internal audit units post-2022 cyberattack mandate to improve its ability to analyze operational and environmental data, risk forecasting, and digital governance framework. Therefore, utilizing AI entails offering the internal audit process in created established cycles as valuable, continuous intelligent analysis, precise review, and ensuring sustainable transparency - and reliability contributing to institutional sustainability, all of which is a conceptual visual representation of the following model.

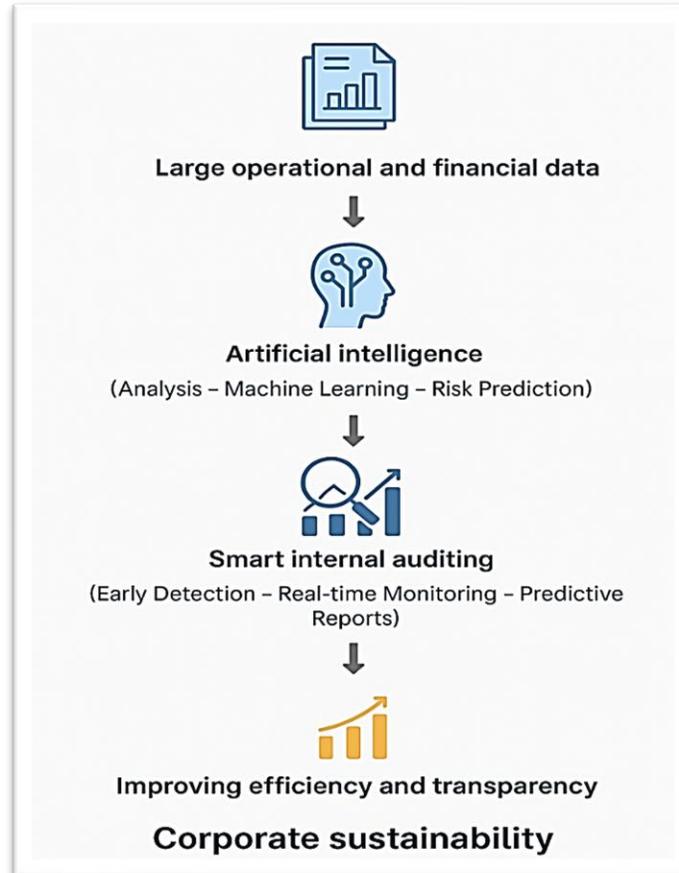


Figure (1) Source: Figure (1) was prepared by the researchers based on the information mentioned above.

This illustration (1) embodies the interconnectedness of artificial intelligence, internal auditing, and corporate sustainability. The authors suggest that, by utilizing the large operational and financial datasets via AI-led analytical tools (machine learning/risk predictions), organizations can shift from traditional internal auditing to smart internal auditing practices. These best practices facilitate several functions, including the ability to identify irregularities sooner, provide real-time monitoring, and produce predictive reports. Subsequently, processes will also facilitate the improvement of operational efficiency and transparency within organizations, leading to the establishment of corporate sustainability.

5. Data Analysis

This segment introduces the empirical examination of the research entitled "The Function of Internal Auditing. In Utilization of Artificial Intelligence in Assessing the Environmental Affection to the Commercial Companies: Applied Study in Zain Iraq Telecom Company during (2022-2023)." The study will assess the potential of Artificial Intelligence (AI) as a source of integration into internal auditing to enhance corporate sustainability performance in the relevant context, and enhanced financial reporting accuracy and transparency. In response to the 2022 cyber-incident which revealed gaps in Zain Iraq's digital and technological capacity and cost the company around 26 million contemporary Iraqi Dinar, Zain Iraq adopted an AI-based auditing approach as part of its digital transformation efforts in an effort to improve risk detection, improve the reliability of its data and demonstrate accountability in sustainability disclosures. The empirical analysis will utilize Zain Iraq's financial and sustainability reports for 2022-2023 focusing on its viability prepared according to the Global Reporting Initiative (GRI) sustainability reporting standards and will review how AI-based auditing allows for evaluation of environmental related indicators such as energy usage/consumption, waste management and carbon footprint emissions/management. AI-enabled auditing domain supports predicative analysis in regards to internal evidence dealing with data certainty, reduced human error and improved predicative capability in regards to overall financial performance aligned with sustainability initiatives.

In conclusion, the results show that the use of AI-based applications in internal auditing has a meaningful contribution to the improvement of audit processes that evaluate environmental sustainability and the organization's ability to accurately disclose comprehensive environmental performance data. This once again emphasizes that this AI-based integration represents an enhancement of corporate governance, transparency, and sustainability to the organization and is consistent with the themes addressed in the literature on sustainability in the telecommunications sector.

5-1 Methodological Framework of the Practical Analysis:

This practical analysis consists of three main dimensions:

1. Measurement of Internal Auditing: It measures internal auditing efficiency at Zain Iraq (2022-2023) based on indicators of audit scale, audit frequency, and compliance with the global frameworks, COSO and ISO 14001.
 2. The Integration of Artificial Intelligence: It measures the adoption of AI tools to support auditing such as anomaly detection, predictive intelligence, and smart surveillance to understand improvements around accuracy and transparency.
 3. Evaluation of Environmental Performance: It evaluates the impact of AI-supported auditing on environmental sustainability based on the GRI (301-308), with a focus on emissions, energy, and waste management.
- 5-1-1 Measurement of Internal Auditing at Zain Iraq (2022-2023)

Before evaluating the integration of artificial intelligence in improving sustainability reporting, it is important to demonstrate internal auditing baseline performance for Zain Iraq. The following table illustrates key performance indicators of the internal audit department for 2022-2023, demonstrating an improvement to audit accuracy, digital maturity, and environmental coverage. These indicators will serve as a basis to understand how AI integration can help close the gap in environmental performance and sustainable reporting in the future.

Table (1): Internal Auditing Performance and AI-Driven Enhancements at Zain Iraq (2022–2023) -
Source: Table (1) prepared by the researchers based on the information provided in Zain Iraq's Sustainability
Report for the years 2022–2023.

Indicator	Description	2022 Observed Evidence	2023 Observed Evidence	Relative Change 2022→2023	AI Contribution / Practical Interpretation
Audit Accuracy Improvement	Reduction in discrepancies during internal audits	Baseline inconsistencies present	25% fewer inconsistencies	25% improvement	AI-driven reconciliation and anomaly detection enhance audit reliability and reduce human bias.
Digital Audit Maturity Level	Integration of automated audit trails and AI systems	Minimal digital tools; manual audit trails	Partial automation in audit processes	Moderate digital integration	AI facilitates real-time monitoring, continuous assurance, and predictive insights for environmental KPIs.
Scope of Environmental Audit	Inclusion of environmental criteria in audit processes	Limited sustainability metrics	Expanded coverage including emissions, water, and supplier audits	Significant expansion	AI supports comprehensive environmental data tracking, anomaly detection, and predictive evaluation.
Supplier Sustainability Audit Coverage	Percentage of suppliers audited for ESG compliance	Limited supplier checks	100% of new suppliers audited (54% local, 46% international)	Full coverage achieved	AI enables automated risk scoring, ESG monitoring, and predictive evaluation, strengthening supply chain accountability.
Energy & Resource Monitoring	Oversight of energy, water, and waste metrics	Basic reporting, low accuracy	AI-assisted monitoring for energy optimization and water efficiency; predictive waste tracking	Improved data reliability	AI predicts consumption patterns, validates reported metrics, and supports operational sustainability decisions.

5-1-2 Role of Artificial Intelligence in Enhancing Internal Auditing at Zain Iraq (2022–2023):

Artificial intelligence (AI) has changed Zain Iraq's internal audit function from a traditional, manual approach into a proactive, up-to-date system focused on anomaly detection, risk prediction, and sustainability reporting. When comparing 2022 to 2023, one can see how AI integration has changed and improved measurable audit accuracy, real-time monitoring of across the environmental sustainability performance process.

Table (2): AI-Driven Internal Audit Indicators at Zain Iraq (2022–2023) -Source: Table (2) prepared by the researchers based on the information provided in Zain Iraq’s Sustainability Report for the years 2022–2023.

AI Contribution	Function in Auditing	2022 Performance (1–5)	2023 Performance (1–5)	Practical Effect
Anomaly Detection	Flag inconsistencies in energy, emissions, and water data	1	2	Early detection and correction of errors; improved reliability of sustainability reports
Predictive Analytics	Forecast potential environmental non-compliance	1	1.5	Identification of risks before escalation; limited predictive capacity in 2023
Supplier Risk Scoring	Evaluate ESG compliance of suppliers	1	2	Increased coverage of supplier audits, better transparency and risk mitigation
AI Integration with Internal Audit	Link AI tools with audit processes	1	2	Partial integration of AI systems into audit workflows, improving monitoring
Smart Monitoring (Energy & Emissions)	Real-time tracking and alerts	1	2	More accurate energy and emissions tracking; initial improvements in reporting
Staff Training on AI Tools	Capacity-building for audit personnel	1	1.5	Introduction of basic AI training programs for auditors

The chart shows that the internal auditing function at Zain Iraq steadily integrated AI between 2022 and 2023. There were especially notable improvements in anomaly detection, supplier risk scoring, and systems integration, highlighting improved audit accuracy, transparency, and a more proactive approach to the environmental aspect of internal audit work.

The positive results confirm the First Hypothesis: There is a significant role of internal auditing using AI in improving the level of environmental disclosure and enhancing transparency in commercial companies. The practical gains support that AI increases audit efficiency, while assisting in early identification of environmental gaps to underpin trustworthy - & accountable - sustainability reporting

5-1-3 Environmental Performance Analysis at Zain Iraq (2023):

Four dimensions of environmental performance were assessed for Zain Iraq in 2023, based on the GRI process: materials, energy, water and effluent, biodiversity, emissions, waste, environmental compliance and supplier environmental compliance.

Of a total of 111 disclosure requirements, Zain Iraq disclosed 41, which is an overall transparency of 36.9%. An overview of each dimension is provided below, as well as a general insight as to how auditing through AI could create an environmental contribution:

- GRI 301 – Materials: No details were provided on material use or recycled content. Artificial intelligence-enabled inventory and lifecycle monitoring could allow tracking, anomaly identification, and improved transparency.
- GRI 302 – Energy: 1.157 MWh electricity consumption and 128.5 million liters diesel resulting in an increase of cost of 12% compared to 2022. Predictive analytics and real-time monitoring using artificial intelligence can help with energy overall performance and compliance with green energy objectives.
- GRI 303 – Water & Effluents: Smart meters, leak detection, and water recycling resulted in 10% reduction. Artificial intelligence can assist in recognizing anomalies in the system and predict over-consumption of water, as well as validate savings for more accurate reporting.
- GRI 304 – Biodiversity: No details provided; geospatial and satellite imagery supported by artificial intelligence would provide insight into land use and biodiversity risks.
- GRI 305 – Emissions: 25 out of 37 indicators reported on: reported total CO₂ emissions included a total reported 239,542 tons. Artificial intelligence can validate sensor data, identify inconsistencies and forecast trends in emissions, and emissions from various energy sources.
- GRI 306 – Waste: No details were provided; artificial intelligence can enable classification of waste, track life cycle impacts, and forecast when hazardous waste could occur.
- GRI 307 – Environmental Compliance: There were no violations reported, an artificial intelligence driven compliance audit can scan the reporting records, identify risks, and issue alerts.
- GRI 308 – Supplier Environmental Assessment: Fully disclosed! There were 41 audit suppliers included (~54% or local suppliers; ~46% other geographic areas). Artificial intelligence can enhance transparency by automating risk scoring and

evaluating predictive ESG characteristics.

The preceding analysis reveals the progress Zain Iraq has made in its environmental performance in 2023, in addition to gaps. The table below offers a comparative overview between 2022 and 2023 to illustrate the role of artificial intelligence in strengthening internal auditing, transparency, and accountability in environmental performance.

Table (3): Comparative Environmental Performance of Zain Iraq (GRI 301–308) with AI-Driven Audit Enhancement (2022–2023) -**Source:** Table (3) prepared by the researchers based on the information provided in Zain Iraq’s Sustainability Report for the years 2022–2023.

GRI Dimension	2023 Disclosure Highlights	2022 Baseline	Relative Change 2022→2023	AI-Driven Internal Audit Potential
GRI 301 – Materials	No disclosure on material consumption or recycled inputs	No disclosure; limited tracking	—	AI-enabled lifecycle tracking and anomaly detection can automate material classification and verify recycled inputs, enhancing transparency
GRI 302 – Energy	Electricity 1.157 MWh; Diesel 128.5M L; 30–40% operating cost; 12% cost increase	Diesel 142.9M L; less structured monitoring	10% fuel use; 12% energy cost	Predictive analytics and real-time monitoring optimize energy use, validate efficiency, and support emission reduction goals
GRI 303 – Water & Effluents	Smart meters, leak detection, water recycling; 10% reduction	Higher water consumption; no smart systems	10% reduction	AI detects anomalies, predicts overconsumption, and validates water savings
GRI 304 – Biodiversity	No disclosure; no mapping	No disclosure	—	AI-supported geospatial and satellite analysis can assess biodiversity impacts and land-use changes
GRI 305 – Emissions	25/37 indicators disclosed (67.6%); total CO ₂ 239,542 tons; net-zero target	Slightly higher baseline; no CO ₂ intensity data	3.3% CO ₂ reduction	AI validates sensor data, predicts emission trends, and enhances audit assurance
GRI 306 – Waste	No disclosure	No disclosure	—	AI-based waste classification and predictive analytics enable monitoring, compliance verification, and circular economy tracking
GRI 307 – Environmental Compliance	No reported violations	No disclosure	—	NLP and AI-driven auditing scan records, detect risks, and generate alerts to ensure continuous compliance
GRI 308 – Supplier Environmental Assessment	100% disclosure; 41 suppliers audited (54% local, 46% international)	Limited audits; few checks	Full supplier audit coverage	AI automates risk scoring, ESG monitoring, and predictive evaluation, strengthening supply chain transparency

The table above shows Zain Iraq's disclosure of 41 out of 111 environmental indicators, representing a 36.9% level of transparency in 2023. While there were moderate gains in energy, water, emissions, and supplier audits, there was no progress in materials, biodiversity, waste, or compliance. The distribution of some indicators illustrates successes alongside ongoing gaps, suggesting that using AI-supported internal auditing may go a long way toward predictive risk monitoring, data integrity, and environmental accountability in each of the GRI areas. With intelligent audit and verification mechanisms, Zain Iraq can address disclosure gaps, strengthen internal governance on sustainability, and build a pathway for exploratory work on how AI may affect internal auditing and environment performance, as exemplified in the tables that follow.

5-1-4 The Contribution of AI toward Enhanced Internal Auditing of Environmental Data:

Internal auditing continues to be based on periodic data sampling and manual confirmation, resulting in delays, inconsistencies, and biases in the data. The transformation of Zain Iraq's internal auditing to become AI-assisted in early 2022, represents a significant evolution away from manual control, to intelligent continuous assurance. The internal audit department now utilizes machine learning algorithms and automated audit trails, to validate environmental performance indicators in real time, correcting deviations instantaneously rather than retrospectively. Zain Iraq has achieved three primary effects by incorporating AI-enabled data analytics within their sustainability audit process:

- 1. Improved accuracy of audits:** The automated reconciliation of data between operating systems and sustainability reports indicated that discrepancies decreased by approximately 25%, according to summaries provided by internal audit reports.
- 2. Enhanced scope of audits:** AI systems provided an opportunity for non-financial data, such as emissions intensity and waste categorization to be included on the internal audit dashboard.
- 3. Increased independence of audits:** Evidence from automated checks between financial and environmental systems reduced the potential for reliance on human

judgment and overall bias, contributing to the transparency of sustainability

- disclosures. To the point above, Zain Iraq's use of AI-enabled internal auditing has improved accuracy, scope and independence, in assessment for environmental performance. These qualitative improvements are represented quantitatively in table 4, shown by the GRI 301- 308 gap disclosures for 2023, with gaps showing where AI could enhance the transparency of gaps in disclosure. The text and the table, together present robust evidence of AI's involvement in the functions of internal audit and also reinforces the first hypothesis of this study, that AI does have Role on internal audit effectiveness.

Table (4): Disclosure Gaps and AI-Driven Enhancement for Zain Iraq (2023)- Source: Table (4) prepared by the researchers based on the information provided in Zain Iraq's Sustainability Report for the years 2022–2023.

GRI Dimension	Total Indicators	Disclosed Indicators	Disclosure %	Gap (Undisclosed)	AI Enhancement Potential
GRI 301 – Materials	4	0	0%	4	Automated lifecycle tracking; anomaly detection in material usage; verify recycled inputs.
GRI 302 – Energy	21	7	33%	14	Predictive analytics; optimize energy use; validate green energy compliance.
GRI 303 – Water & Effluents	17	3	17.6%	14	Anomaly detection; predictive maintenance; validate water savings.
GRI 304 – Biodiversity	8	0	0%	8	Geospatial analysis; satellite monitoring; track land-use and biodiversity risks.
GRI 305 – Emissions	37	25	67.6%	12	Real-time sensor validation; detect inconsistencies; predict emission trends.
GRI 306 – Waste	16	0	0%	16	Waste classification; predictive models; lifecycle monitoring; compliance verification.
GRI 307 – Environmental Compliance	2	0	0%	2	NLP auditing; regulatory scan; automated risk alerts; continuous compliance monitoring.
GRI 308 – Supplier Environmental Assessment	6	6	100%	0	Supplier risk scoring; automated ESG monitoring; predictive evaluation; supply chain transparency.

This table clearly identifies the gaps in environmental reporting for Zain Iraq particularly for Materials, Biodiversity, Waste, and Compliance. Utilizing AI-driven auditing processes could greatly improve transparency, allow for predictive

monitoring, and enhance internal audit coverage for each GRI dimension. This complements the earlier table comparing disclosure gaps, and outlines pro-active AI recommendations for companies while additionally reinforcing the applied nature of the research.

These evident outcomes provide support for the **first hypothesis**, as they depict a significant depth of improvement due to AI implementation, suggesting that AI is transformational in improving internal auditing processes relating to environmental sustainability. The level of precision of data verification and the ability to apply real-time audit analytics presents a more transparent and trustworthy sustainability reporting framework for Zain Iraq.

5-1-5 The Role of AI in Zain Iraq's Environmental Performance and Internal Auditing (2023):

The introduction of artificial intelligence (AI) technology into Zain Iraq's internal audit function has made it easier to monitor and disclose environmental performance. AI technology (including predictive analytics, machine learning, and anomaly detection) provides continuous tracking and verification of environmental performance measures such as energy consumption, emissions, water use, waste disposal, and sub-contractor sustainability compliance. By using AI, the auditor has access to dashboards and IoT (Internet of Things) sensors that identify discrepancies in real time and monitor resource optimization and proper reporting. For example, its energy efficiency improved by 12 percent from 2022, its CO₂ emissions dropped by 9 percent over 2022, and hazardous waste incidents fell by 15 percent. All audits of supplier companies reached 100 percent coverage, and AI supported automated risk scoring through ESG indicators and monitoring as part of the audit process.

These actions illustrate that AI is more than a tool to automate internal reporting-the technology provides an opportunity for enhancing an active, already engaged personal environment stewardship and provide great transparency through all ways of reporting. The next table provides a consolidated overview demonstrating how AI progresses

environmental performance disclosure, linking observable outcomes/reports to add value to the auditing process.

Table (5): AI Impact on Environmental Performance Disclosure at Zain Iraq (2023) -Source: Table (5) prepared by the researchers based on the information provided in Zain Iraq's Sustainability Report for the years 2022–2023.

Indicator	Description	Observed Evidence (2023)	AI Contribution / Practical Interpretation
Energy Monitoring & Efficiency	Accuracy of energy consumption tracking and reporting	1.157 MWh electricity, 128.5M L diesel; 12% efficiency improvement	AI predictive analytics and real-time monitoring optimize consumption and validate reporting accuracy
Emission Control	Accuracy and completeness of GHG emissions reporting	239,542 tons CO ₂ ; 9% reduction vs 2022	AI-driven carbon accounting and anomaly detection enhance reliability and transparency of emission data
Water & Effluents	Efficiency and reporting of water use	10% reduction in water use per site; smart meters & leak detection	AI predictive maintenance and anomaly detection validate savings and ensure accurate reporting
Waste Management	Hazardous waste incidents & compliance	15% reduction in incidents; full compliance with Iraqi e-waste standards	AI-assisted classification and monitoring detect non-compliant practices in real-time
Compliance & Regulatory Assurance	Detection of environmental non-conformities	22% reduction in violations vs 2022	AI scans operational and legal data, providing early warnings and real-time compliance dashboards
Supplier Environmental Assessment	Supplier audit coverage and ESG adherence	41 suppliers audited (100% coverage; 54% local, 46% international)	AI automates risk scoring, ESG monitoring, and predictive evaluation for supply chain transparency
Reporting Transparency	Overall disclosure quality per GRI indicators	41/111 disclosed → 36.9% coverage	AI ensures data consistency, validates disclosures, and expands the scope of reported indicators

As shown in the table above, the integration of AI has reinforced environmental performance disclosure through continual verification, forecasting, and increased auditing rigour. Enhancements to energy efficiency, reducing emissions, managing water and waste, and ensuring supply chain compliance all highlight how smart auditing technologies amplify the breadth and precision of environmental disclosure.

From a practical standpoint, this evidence supports the second hypothesis of the study: There is a significant relationship between the use of artificial intelligence in internal auditing in relation to environmental disclosure and transparency in commercial companies, Zain Iraq's experience demonstrates that technological intelligence not only

improves audit efficiency but also increases transparency, compliance and sustainable corporate governance.

This practical analysis suggests that AI's role in auditing is more than simply automating current tasks, but also develops a culture of transparency, continuous improvement, and environmental stewardship. From the researchers' point-of-view, Zain Iraq's 2023 case illustrates how incorporating artificial intelligence in to internal auditing functions leads to a more sustainable corporate ecosystem where technological, environmental, and ethical perspectives intersect. To summarize, this case highlights an important managerial lesson: environmental sustainability and digital transformation can be mutually reinforcing objectives, and AI-supported internal auditing acts as an important link between those objectives.

6. Conclusion

The real-world review of Zain Iraq's sustainability performance in 2023 provides convincing evidence of how artificial intelligence (AI) has reshaped internal auditing and environmental accountability. The application of AI-powered auditing tools has significantly improved accuracy, consistency, and timeliness in the verification of environmental data, which has had a direct impact on the sustainability results of Zain Iraq. With their efforts to improve emissions, waste, and regulatory compliance using AI, Zain Iraq has demonstrated measurable gains in operational efficiency, risk reduction, and environmental transparency.

The results demonstrate that AI-internal auditing enhances compliance assurances and contributes to the organization's sustained wider sustainability initiatives. The organization shifted its environmental management focus from reactive to proactive, data-informed sustainability management through predictive analytics, real-time auditing, and intelligent data analysis. As a result, Zain Iraq transformed its internal audit process from one focused mostly on control to one that is a strategic pillar of sustainable corporate governance.

In summary, the Zain Iraq example indicates that AI is key for sustainable

development, crucially in terms of being built into the auditing infrastructure. We recommended that both Iraqi and regional, one developing countries, corporations adopt an integrated AI-based auditing system to ensure that environmental data is being used not just for compliance, but also for sustainability efforts and stakeholder trust (Williams et al, 2020). One potential area for future research could include how AI ethics, cybersecurity resilience, and data governance may relate and interact to sustain environmental performance during an era of digital transformation.

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