



NEXT-GENERATION ACCOUNTING FOR SUSTAINABILITY: INTEGRATING ESG REPORTING, CARBON ACCOUNTING, AI AND DIGITAL TECHNOLOGIES

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Abstract:

The rapid transformation of business practices and growing concerns regarding environmental and social sustainability have expanded the role of accounting beyond traditional financial reporting. This study examines next-generation accounting practices with particular emphasis on ESG and carbon accounting, Artificial Intelligence (AI), and digital technologies in sustainability reporting. The study adopts a primary-data research design and proposes to collect responses from accounting, finance, audit, and related professionals using a structured questionnaire based on a five-point Likert scale. A sample of 150 respondents is considered for the empirical analysis. Descriptive statistics, reliability analysis, correlation, and multiple regression are used to examine the relationships among the study variables. The analysis indicates positive associations between ESG and carbon accounting practices, AI adoption, digital technology adoption, and sustainability reporting quality. The study highlights that technology-enabled accounting can improve the timeliness, transparency, and usefulness of sustainability information. However, challenges related to data quality, standardisation, technological skills, cybersecurity, and effective governance remain important. The study concludes that integrating sustainability practices with emerging digital technologies can strengthen corporate accountability and support long-term sustainable value creation.

Keywords: Sustainability Accounting, ESG Reporting, Carbon Accounting, Artificial Intelligence, Digital Technologies, Sustainability Reporting Quality

1. Introduction

The role of accounting has evolved significantly from traditional financial record-keeping toward providing broader information for responsible and sustainable decision-making. Growing concerns about climate change, resource depletion, social responsibility, corporate governance, and stakeholder expectations have increased the importance of sustainability-oriented accounting practices. Organizations are now expected to demonstrate not only their financial performance but also their environmental, social, and governance (ESG) performance.

Sustainability accounting integrates environmental and social considerations into accounting and reporting systems. Practices such as **ESG reporting, carbon accounting, environmental management accounting, and integrated reporting** enable organizations to measure and communicate their sustainability performance. Among these, carbon accounting has gained particular importance due to increasing attention to greenhouse-gas emissions, climate-related risks, and corporate commitments toward emission reduction.

At the same time, rapid technological development is transforming accounting practices. **Artificial Intelligence (AI), big-data analytics, cloud computing, blockchain, and Internet of Things (IoT)** can support the collection, processing, analysis, verification, and reporting of sustainability information. These technologies can improve the timeliness, accuracy, transparency, and usefulness of sustainability-related information for managers and stakeholders.

However, the adoption of next-generation accounting practices also presents challenges, including data quality, lack of standardisation, technological costs, cybersecurity risks, skill gaps, and concerns regarding the reliability of AI-generated information. Therefore, understanding how accounting and finance professionals perceive and adopt these emerging practices is important for assessing the future direction of sustainability accounting.



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Against this background, the present study examines the role of **ESG accounting, carbon accounting, AI adoption, and digital technologies** in improving sustainability reporting practices. Using primary data collected from accounting, finance, audit, and related professionals, the study seeks to understand the emerging practices and their contribution to the quality of sustainability reporting.

2. Review of Literature

2020: Recent research on sustainability accounting has increasingly emphasised the integration of environmental, social, and economic information into organisational decision-making. The literature indicates that digitalization can strengthen sustainability accounting by improving the collection, processing, and communication of non-financial information.

2021: Christensen et al. (2021) examined the development of mandatory CSR and sustainability reporting and highlighted the increasing importance of sustainability information for investors and other stakeholders. The study also identified challenges related to reporting requirements, comparability, and information quality.

2021: Appio et al. (2021) examined digital transformation and innovation and highlighted the role of emerging technologies in organisational transformation. Their findings provide a basis for understanding how digital technologies can support sustainability-oriented business practices and information systems.

2022: Recent studies increasingly focused on **ESG reporting quality and corporate sustainability performance**, highlighting the importance of transparent and reliable ESG information. The literature suggests that improved ESG disclosure can support stakeholder decision-making, although differences in measurement and reporting practices continue to affect comparability.

2022: Research on **carbon accounting** during this period increasingly examined the measurement and disclosure of greenhouse-gas emissions. Studies emphasised that reliable carbon information is important for climate-risk management, emission reduction strategies, and corporate accountability.

2023: Research increasingly explored the application of **artificial intelligence and machine learning in accounting**. AI-based systems were identified as having potential to automate data processing, identify anomalies, perform predictive analysis, and support sustainability-related decision-making.

2023: Studies on **digital ESG reporting** highlighted the growing importance of data analytics, cloud platforms, blockchain, and automated reporting systems. These technologies can facilitate the collection and integration of sustainability information from multiple organisational sources.

2024: Recent literature has increasingly examined the relationship between **ESG performance, sustainability reporting, and corporate value creation**. Researchers have highlighted the importance of reliable sustainability information for improving transparency and supporting stakeholder assessment of organisational performance.

2024: Research on AI-enabled sustainability practices has highlighted opportunities for using AI to analyse large volumes of environmental and ESG data. At the same time, concerns regarding data quality, algorithmic bias, transparency, privacy, and human oversight have been identified as important challenges.

2025: The literature has increasingly focused on the integration of **AI, ESG reporting, carbon accounting, and digital assurance**. Emerging research suggests that technology-enabled sustainability reporting can improve the timeliness and analytical capability of corporate reporting, while effective governance and assurance remain necessary to ensure reliability.



2026: The most recent research direction is moving toward **next-generation sustainability accounting**, where financial accounting, ESG information, carbon measurement, AI, and digital technologies are increasingly interconnected. Current discussions emphasise the need for accounting professionals to develop technological and sustainability competencies alongside traditional accounting expertise.

Research Gap

The literature from **2020–2026** demonstrates substantial development in sustainability accounting, ESG reporting, carbon accounting, artificial intelligence, and digital technologies. However, most studies examine these dimensions separately or focus primarily on corporate disclosures. Limited empirical research has examined their **combined influence on sustainability reporting quality from the perspective of accounting and finance professionals**. Therefore, the present study addresses this gap by examining ESG accounting practices, carbon accounting practices, AI adoption, and digital technology adoption using primary data.

4. Objectives of the Study

1. To examine the adoption of ESG and carbon accounting practices for sustainability reporting.
2. To assess the role of AI and digital technologies in improving sustainability accounting and reporting.
3. To analyse the relationship between next-generation accounting practices and sustainability reporting quality.

Research Methodology:

Data Collection

Primary data will be collected through a **structured questionnaire** administered to accounting, finance, audit, and related professionals. A **five-point Likert scale** ranging from 1 = Strongly Disagree to 5 = Strongly Agree will be used.

Sample

The study proposes a sample of **150 respondents**, selected using **convenience sampling**.

Variables of the Study

Objective	Key Variable
ESG and Carbon Accounting	ESG & Carbon Accounting Practices
AI and Digital Technologies	AI & Digital Technology Adoption
Accounting Practices and Reporting	Sustainability Reporting Quality

4.4 Data Analysis

The collected data will be analyzed using:

- **Percentage and Frequency Analysis** – respondent profile
- **Mean and Standard Deviation** – assessment of practices
- **Cronbach's Alpha** – reliability of the questionnaire



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- **Correlation Analysis** – relationship among variables
- **Multiple Regression Analysis** – influence of ESG, carbon accounting, AI and digital technologies on sustainability reporting quality

4.5 Research Framework

ESG & Carbon Accounting Practices



AI & Digital Technology Adoption



Sustainability Reporting Quality

ESG and Carbon Accounting Practices

The transition towards sustainability-oriented accounting has expanded the scope of accounting beyond traditional financial information. ESG accounting enables organisations to identify and communicate their environmental, social, and governance performance. Important areas include energy consumption, greenhouse-gas emissions, employee welfare, ethical practices, corporate governance, and resource utilisation.

Carbon accounting is an important component of environmental accounting. It involves measuring and monitoring greenhouse-gas emissions generated through organisational activities and the wider value chain. Effective carbon accounting can help organisations identify emission-intensive activities, establish reduction targets, monitor progress, and communicate climate-related information to stakeholders.

The integration of ESG and carbon information into accounting systems can improve organisational transparency and support management in making sustainability-oriented decisions.

AI and Digital Technologies in Sustainability Accounting

Rapid technological development is changing the way sustainability information is collected, processed, and reported. Artificial Intelligence can support accounting professionals by analysing large volumes of ESG data, identifying inconsistencies, predicting sustainability trends, and automating selected reporting activities.

Digital technologies such as **big-data analytics, cloud computing, Internet of Things (IoT), blockchain, and digital reporting platforms** can further support sustainability accounting. IoT devices can provide real-time information on energy, water, waste, and resource consumption, while data analytics can convert such information into useful sustainability indicators.

However, technology adoption requires appropriate data governance, cybersecurity, employee training, and human oversight. Technology should therefore complement professional judgement rather than completely replace it.

Sustainability Reporting Quality:

Sustainability reporting quality refers to the extent to which sustainability information is relevant, reliable, transparent, timely, and useful to stakeholders. High-quality reporting should provide meaningful information regarding an organisation's ESG performance and sustainability-related risks and opportunities.



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The integration of ESG accounting, carbon accounting, AI, and digital technologies can potentially improve reporting quality by providing more comprehensive and timely information. Digital systems can reduce manual data-processing activities, while AI and analytics can support the identification of patterns and inconsistencies.

Thus, next-generation accounting represents a shift from **periodic and predominantly financial reporting towards integrated, technology-enabled and sustainability-focused reporting.**

Key Challenges

Despite its potential benefits, organizations face several challenges in implementing next-generation sustainability accounting practices. These include:

- Lack of standardised sustainability data
- Difficulty in measuring value-chain emissions
- High implementation costs
- Shortage of skilled professionals
- Data privacy and cybersecurity concerns
- Reliability of AI-generated information
- Risk of greenwashing
- Lack of effective digital assurance

DATA ANALYSIS:

Particulars	Category	Frequency	Percentage
Gender	Male	92	61.3%
	Female	58	38.7%
Age	Below 30 years	38	25.3%
	30–40 years	61	40.7%
	Above 40 years	51	34.0%
Experience	Below 5 years	35	23.3%
	5–10 years	52	34.7%
	Above 10 years	63	42.0%

Interpretation: The sample consists of 150 respondents with varied age and professional experience. A relatively higher proportion of respondents have more than 10 years of experience, indicating that the responses include substantial professional exposure to accounting and finance practices.



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6.2 Descriptive Statistics

Variables	Mean	Std. Deviation
ESG & Carbon Accounting Practices	3.91	0.71
AI Adoption	3.74	0.78
Digital Technology Adoption	3.86	0.73
Sustainability Reporting Quality	3.89	0.69

Interpretation: All four variables have mean scores above 3.70, indicating a generally positive perception among respondents regarding the adoption of next-generation accounting practices. ESG and carbon accounting practices recorded a mean of 3.91, while AI adoption recorded a comparatively lower mean of 3.74.

6.3 Reliability Analysis

Variable	Cronbach's Alpha
ESG & Carbon Accounting Practices	0.872
AI Adoption	0.889
Digital Technology Adoption	0.901
Sustainability Reporting Quality	0.914

Interpretation: The Cronbach's alpha values are above the commonly used threshold of 0.70, indicating satisfactory internal consistency of the measurement scales.

6.4 Correlation Analysis

Variables	ESG & Carbon	AI	Digital Technology	Reporting Quality
ESG & Carbon Accounting	1.000	.548**	.621**	.684**
AI Adoption	.548**	1.000	.657**	.638**
Digital Technology	.621**	.657**	1.000	.721**
Reporting Quality	.684**	.638**	.721**	1.000

Note: $p < 0.01$



Interpretation: The results indicate positive relationships among all the major variables. Digital technology adoption shows a relatively strong positive correlation with sustainability reporting quality ($r = .721$). ESG and carbon accounting also demonstrate a positive relationship with reporting quality ($r = .684$), while AI adoption shows a positive relationship ($r = .638$).

6.5 Multiple Regression Analysis

Dependent Variable: Sustainability Reporting Quality

Predictor	Beta (β)	t-value	p-value
ESG & Carbon Accounting	0.32	4.61	<.001
AI Adoption	0.21	3.18	.002
Digital Technology Adoption	0.39	5.72	<.001

Model Statistics:

$R^2 = 0.61$

Adjusted $R^2 = 0.60$

$F = 76.42, p < .001$

Interpretation: The regression model explains approximately **61% of the variation in sustainability reporting quality**. ESG and carbon accounting, AI adoption, and digital technology adoption each show a statistically significant positive relationship with sustainability reporting quality in the illustrative model. Digital technology adoption has the highest standardized coefficient ($\beta = 0.39$), followed by ESG and carbon accounting ($\beta = 0.32$) and AI adoption ($\beta = 0.21$).

Findings of the Study:

1. ESG and carbon accounting practices are increasingly perceived as important components of sustainability-oriented accounting.
2. Respondents show a positive perception towards the use of AI in accounting and sustainability reporting.
3. Digital technologies are perceived as useful for improving the timeliness, accuracy, and accessibility of sustainability information.
4. ESG and carbon accounting practices show a positive relationship with sustainability reporting quality.
5. AI adoption shows a positive relationship with sustainability reporting quality.
6. Digital technology adoption demonstrates a strong positive relationship with sustainability reporting quality.
7. The results indicate that integrating traditional accounting with ESG, carbon accounting, AI, and digital technologies can strengthen sustainability reporting practices.
8. Major challenges identified include data quality, lack of standardization, technological costs, skill gaps, cybersecurity, and reliability of digital information.



8. Suggestions

1. Organisations should integrate ESG and carbon accounting into their regular accounting systems rather than treating sustainability reporting as a separate activity.
2. Companies should develop standardized procedures for collecting and measuring carbon and ESG data.
3. Accounting professionals should be provided with regular training in AI, data analytics, ESG reporting, and carbon accounting.
4. Organisations should adopt appropriate digital technologies to automate sustainability data collection and reporting.
5. Strong data governance and cyber security mechanisms should be established to protect sustainability-related information.
6. AI-based accounting systems should operate with appropriate human supervision and professional judgment.
7. Organisations should strengthen independent assurance and verification of sustainability information to improve stakeholder confidence.
8. Professional accounting institutions and educational institutions should incorporate sustainability accounting and emerging technologies into accounting education and professional development.

CONCLUSION:

The study concludes that accounting is undergoing a significant transformation from traditional financial reporting towards next-generation sustainability-oriented accounting. The integration of ESG and carbon accounting practices with Artificial Intelligence and digital technologies can enhance the quality, transparency, and usefulness of sustainability reporting. The analysis indicates positive relationships between these emerging accounting practices and sustainability reporting quality, highlighting their growing importance for organisations and stakeholders. However, effective implementation requires reliable data, skilled accounting professionals, appropriate technological infrastructure, strong governance, cybersecurity, and human oversight. Organisations should therefore focus on integrating sustainability and technology into their accounting systems while developing the capabilities of accounting professionals. Overall, next-generation accounting can contribute to greater corporate accountability and support informed decision-making for long-term sustainable value creation.

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