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# Digital Transformation and Sustainable Accounting: The Role of AI, Blockchain, and Data Analytics in the Green Economy

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**Abstract:** In this study, we investigate how three major digital technologies, including Artificial Intelligence (AI), Data Analytics, and Blockchain Technology, influence sustainable accounting practices, especially in enhancing the transparency, accuracy, and efficiency of sustainability reporting. The increased relevance of sustainability and environmental responsibility has raised the pressure for more transparent and accountable sustainability reporting systems. In reaction, digital technologies are being embraced to facilitate sustainable accounting practices in the new green economy. Data was gathered using a quantitative research design, which consisted of a structured survey of accounting and sustainability professionals, and obtained 102 valid responses. Descriptive statistics, correlation, and multiple regression methods were used to analyze the data in SPSS. The findings indicate that Blockchain Technology and Data Analytics have considerable positive impacts on sustainable accounting practice, improved ESG data management, accurate reporting, and transparency. Artificial Intelligence, in its turn, has no statistically significant direct effect, which is likely to imply that its influence can be contingent on the organizational preparedness, digital infrastructure, and the supply of skilled professionals. The study adds to the growing body of literature about digital transformation in sustainability accounting by empirically comparing the impact of various digital technologies in a single analytical context. The results have significant managerial and policy implications to organizations and regulators interested in enhancing the sustainability reporting framework, and hastening the shift toward a more transparent, more digitally-enabled green economy.

**Keywords:** Digital transformation; Blockchain technology; Data analytics; Artificial intelligence; ESG reporting; Sustainable accounting; Green economy.

## 1. Introduction

Green economy shift in the world has greatly risen the need to have transparent and reliable sustainability reporting systems. Governments, investors and stakeholders are all asking organisations to reveal their impacts on the environment and show responsibility as far as climate change, carbon emissions and the wider sustainability objectives are concerned. Consequently, sustainable accounting practises have now become a decisive element of the contemporary corporate governance and environmental management. Over the past few years, the digital technologies have become formidable facilitators of sustainability reporting and environmental accounting. Artificial Intelligence (AI), blockchain technologies, and data analytics are new innovations that provide organisations with the opportunities to gather, analyse, and verify environmental information more precisely and efficiently (Martínez-Peláez et al., 2023). These technologies enable companies to handle big amounts of information pertaining to sustainability, automate environmental reporting, and enhance the transparency of environmental reporting. Digital transformation is thus transforming the accounting profession and transform the meaning of how organisations they measure and communicate their environmental performance. They are able to use the combination of innovative digital instruments with accounting systems and improve decision-making, increase environmental responsibility, and uphold more comprehensive sustainable development.

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Although the use of digital technologies in the sustainability reporting has grown and remains significant, organisations are still faced with a number of challenges in incorporating these digital technologies into the accounting systems. A significant problem is associated with the absence of standard approaches to sustainability reporting, leading to the lack of consistency in environmental information among the industries and jurisdiction. Also, the global digital skills gap poses a considerable challenge to the successful introduction of such advanced technologies as AI and blockchain into sustainability reporting. Most of the organisations do not have employees possessing the technical skills needed to use digital tools to analyse and report environmental data (Early, 2024). Besides, implementing digital technologies within the current accounting infrastructures may be complicated and costly. The rest of the challenges involve the issues of data security, technological compatibility, and internal resistance to the digital transformation. These obstacles restrict the capacity of organisations to utilise digital tools to the full extent in enhancing environmental accounting and sustainability reporting practises. The increased focus on environmental sustainability has escalated the pressure on companies to disclose sustainability in a transparent, reliable, and standardised manner. Regulators, investors, and the society are putting pressure on firms to show their responsibility to the environment by enhancing strong accounting and reporting practises (Crossley et al., 2021).

Digital technologies allow to offer considerable opportunities in order to cope with these challenges, to make balancing the environmental data more precise and sustainability reporting process more efficient. The usage of AI and data analytics technologies may facilitate the analysis of complicated environmental data, whereas blockchain can increase a disclosure of sustainability in terms of transparency and traceability. It is hence important in the comprehension of how these digital tools can be used to make accounting practises sustainable so that organisations may enhance their environmental responsibility and make the business practises aligned with the world-sustainability objectives.

The purpose of the study is to explore the potential of digital technologies as a way of improving sustainable accounting in the green economy. In particular, the research aims at:

- Determine the digital technologies that are already in use in sustainable accounting.
- Examine the role of digital tools in sustainability reporting accuracy, transparency, and efficiency.
- Analyse the contribution of accounting professionals to the adoption of digital technologies in the sustainability practise.
- Research the main issues and opportunities of introducing digital technologies in sustainable accounting systems.

**Main Research Question**

What is the role of digital technologies in sustainable accounting in the green economy?

**Sub-Questions**

- What are the current digital tools applied in sustainable accounting practises?
- What impact do these tools have on the accuracy and transparency of sustainability reporting?
- What is the role of the accounting professionals in the introduction of the digital technologies in sustainability reporting systems?
- What are the challenges and opportunities of using digital technologies in sustainable accounting?

This research adds to the available body of literature on digital transformation, sustainability accounting, and green economy development in a number of aspects; First, it contributes to the theoretical knowledge of how new digital technologies affect the practise of sustainability reporting. Although the literature on digital transformation in the accounting field has already been conducted, there has been little research specifically on the topic concerning the use of AI, blockchain, and data analytics in a sustainable accounting platform. Second, the research has practical implications to organisations that aim to improve environmental transparency by digital innovation. The results can provide an insight to accountants, managers, and policy-makers on how digital tools can be properly implemented to enhance the sustainability reporting frameworks. Lastly, the study can be used in policy discourses by offering an understanding of the importance of digital capabilities and digital training programmes that allow organisations to take full advantage of digital technologies to meet sustainability goals in the green economy.

The rest of the paper shall be structured as follows. Section 2 provides a review of the available literature concerning the digital transformation and sustainable accounting practises. Section 3 provides the theoretical framework and formulates the study hypotheses. Section 4 presents the data analysis and research methodology. Section 5 contains the empirical results and their conclusions about the practise of accounting and sustainability reporting. Lastly, the paper ends with a conclusion and suggestions on how the study can be further developed.

## 2. Theoretical Framework

There are various theoretical perspectives that can be used to explain the integration of digital technologies into the sustainability of the accounting practises. Specifically, the ideas of the Resource-Based View (RBV) and Dynamic

Capabilities Theory as well as the Technology Acceptance Model (TAM) offer a solid theoretical framework of interpreting the process through which organisations should adopt and utilise digital technologies to improve sustainability reporting.

**Resource-Based View (RBV)**

According to the Resource-Based View, there are valuable, rare, inimitable, and non-substitutable resources that are developed by firms to attain a competitive advantage (Barney, 1991). The digital technologies, including Artificial Intelligence (AI), blockchain, and data analytics, are considered strategic organisational resources that effectively increase the ability of firms to use sustainability information, based on the sustainable accounting context. These technologies allow collecting, processing, and analysing a significant amount of environmental data, which enhance the accuracy and reliability of sustainability reporting. Indicatively, AI algorithms are capable of analysing the environmental indicators and identifying anomalies in the sustainability-related data, and the blockchain technology can be used to improve the level of transparency by establishing unchangeable records of environmental transactions and green investments. According to the RBV, organisations that manage to incorporate digital tools in their accounting systems will be able to create a high-quality sustainability reporting capacity and strategic benefits in the new green economy.

**Dynamic Capabilities Theory**

Although RBV underlines the significance of valuable resources, Dynamic Capabilities Theory stresses on the capacity of the firm to integrate, develop, and redesign resources whenever responding to the fast-changing environment (Teece, 2007). Considering the principles of sustainability accounting, digital transformation necessitates the organisation to continually modify its technological infrastructure, organisational processes, and the capabilities of employees. Digital tools like AI and complex data analytics will help companies track environmental performance in real-time so that companies react to environmental risks and regulations promptly. Blockchain can also enhance the sustainability reporting through enhancing better traceability and validation of environmental data. As a result, companies that have good online capabilities are in a better position to introduce sustainability factors in their accounting systems and enable long-term environmental policies.

**Technology Acceptance Model (TAM)**

The Technology Acceptance Model (TAM) is the model that describes the process of adopting new technologies depending on two major factors that are perceived usefulness and perceived ease of use (Davis, 1989). Considering sustainable accounting, accountants and sustainability professionals need to view digital tools as being useful and available to them so that they can incorporate them into their reporting. As an example, AI-based analytics tools can contribute to the efficiency of sustainability reporting to a considerable extent by automating the work with data processing. Likewise, blockchain technologies may ease the process of environmental transactions checking and enhance stakeholder confidence in the disclosure of sustainability. Nevertheless, once users feel that these technologies are not simple or easy to use, their adoption might not be as high. Combined with RBV, Dynamic Capabilities Theory, and TAM, these theories offer a rich theoretical spectrum on how digital technologies can impact sustainable accounting practises in the green economy.

## 3. Development of literature Review and Hypotheses

**Digital Transformation of Accounting**

The digital transformation has radically changed the accounting behaviour by bringing new advanced technologies into the accounting profession that are making these practises more efficient, precise, and transparent in reporting financial information. Artificial intelligence, blockchain, and data analytics are technologies that allow organisations to automate their accounting operations and enhance the capacity to make decisions (Martinez-Pelaz et al., 2023). According to current literature, it is believed that a digital accounting system can be very helpful in improving the quality of reported financial data both because of the possibility of minimising human error and because of the high level of reliability of the financial information (Phornlaphatrachakorn and Kalasindhu, 2021). With the digitization of accounting systems, organisations are in a stronger position of handling complicated datasets associated with environmental and social performance.

**First, Artificial Intelligence and Sustainability Reporting**

One of the most disruptive technologies in the area of sustainability accounting has become Artificial Intelligence. The AI systems are able to process vast amount of environmental data and recognise patterns involving carbon emission, resource use and environmental risk management. Bibri et al. (2024; Roy et al., 2025) suggest that AI-powered platforms can help organisations handle sustainability data more efficiently and produce predictive analytics that can aid in making environmental decisions. Sustainability reporting can also be automated by AI and thereby relieving the accounting professionals of administration costs and enhancing the accuracy of reporting. Artificial intelligence increases the data processing power and helps organisations to handle extensive datasets in the environment. Artificial intelligence technologies can be used to automate sustainability reporting efforts and enhance the precision of environmental reporting.

**H1: Adoption of Artificial Intelligence has a positive effect on the sustainable accounting practises.**

**Second, Blockchain Technology and ESG reporting**

The blockchain technology has received significant interests due to its functionality in promoting transparency and traceability in financial and environmental reporting systems. Blockchain offers sustainability data an opportunity to remain indelible and unalterable once developed through the development of decentralised records. A number of reports emphasise the use of blockchain in the monitoring of green bonds, carbon credits, and investments of an environmentally friendly nature (Ojukwu et al., 2024). Indicatively, environmental transactions have been verified through blockchain platforms to ensure that the funds provided to green initiatives are utilised accordingly. Such increased transparency has the potential to increase the stakeholder confidence in the sustainability disclosure, and corporate accountability. The blockchain technology can enhance transparency and accountability in the sustainability reporting because environmental data cannot be changed and manipulated.

**H2: Adoption of blockchain technology has a positive impact on sustainable accounting practises.**

**Third, Data Analytics and ESG Reporting**

Data analytics is also important in the analysis of environmental, social, and governance (ESG) information. The sophisticated analytics tools can help organisations to derive valuable observations on sustainability data, allowing firms to understand the current environmental performance and where improvements can be made. One of the studies reveals that data analytics enhances the sustainability reporting quality as it allows companies to handle the complicated environmental data and produce more precise disclosures (Di Vaio et al., 2021). In addition, analytics can help to monitor the environmental performance in real-time, and organisations are able to respond to sustainability issues swiftly. Data analytics can be useful to extract valuable insights on sustainability data to enhance the quality of environmental decision-making and the quality of reporting.

**H3: Data analytics capability has a positive effect on sustainable accounting practises.**

Although various pieces of research have been conducted to analyse the digital transformation and sustainability, a few gaps exist in the literature review of the adoption of digital technologies in the context of sustainable accounting. First, there are previous studies that usually focus on specific technologies separately, including artificial intelligence, blockchain, or data analytics, without analysing their interconnected impacts or relative impact on the accounting systems aimed at sustainability. This disjointed presentation does not fully inform us of the interaction of various digital instruments in affecting the quality of sustainability reporting and environmental responsibility which can be considered one of the objectives of SDG17. Second, a significant portion of the literature is conducted on macro-level indicators of the digital economy or the national-level green growth, instead of looking at the organisational-level accounting processes in which sustainability information is created, managed, and reported. This leads to the fact that the direct impact of digital technologies on the practise of sustainable accounting and ESG reporting mechanisms in firms has little empirical evidence. Third, even though digital technologies are generally known as possible enablers of sustainability, there is still little empirical research on their implementation in the accounting and reporting systems, especially in regard to sustainability accounting in digital environments. Specifically, empirical studies that compare the comparative roles of Artificial Intelligence, Data Analytics, and Blockchain Technology in enhancing the transparency, efficiency, and accuracy of sustainability reporting are scarce. Lastly, the professional contribution of accountants and sustainability practitioners to the integrative process of digital tools in the accounting systems has been mostly neglected in the past. Knowledge of how accounting practitioners embrace and employ digital technologies is critical in converting technological opportunities into successful sustainability measures. To fill these gaps, the current research offers the empirical evidence regarding the effects of the adoption of AI, Data Analytics, and Blockchain Technology on the sustainable accounting practises in a green economy. The study, through the analysis of the synergistic impacts of these technologies in one analytical framework, adds to the literature on digital transformation in sustainability accounting and offers new perspectives on how organisations can use digital innovations to improve environmental accountability and the quality of sustainability reporting (Roy et al., 2025; Al-Habashneh et al., 2025).

## 4. Research Methodology

The research design used in this study is a quantitative, explanatory research design to explore the impact of the adoption of digital tools, which include Artificial Intelligence (AI), Data Analytics, and Blockchain Technology, on Sustainable Accounting Practises (SAP) within the green economy. A cross-sectional survey was also used to obtain the perception of the accounting professionals and organisational practises regarding sustainability reporting. This type of methodology is appropriate since the objective of the study is to test hypothesised relationships with help of measurable indicators and statistical inference. The target group includes the accounting and sustainability professionals in the organisations that implement sustainability reporting and/or environment oriented accounting practises. These respondents are a suitable unit of analysis, as they are directly exposed to accounting systems, reporting demands, and the new digital technology and thus in a position to assess the levels of adoption, perceived usefulness as well

as reporting results. N = 102 valid responses were retrieved from professionals in various institutions. Since SAP is modelled as a three-predictor model (AI, Data Analytics, Blockchain), this sample size suffices OLS regression and suffices PLS-SEM (which is designed to be used when the model is more exploratory or prediction-oriented and with smaller sample sizes) so long as measurement quality is established (reliability/validity) and bootstrapping is applied to test significance. The questionnaire operationalizes four latent constructs; AI Adoption, Data Analytics Capability, Blockchain Adoption, and Sustainable Accounting Practises. The measurement scale that was used to measure items was a 5-point Likert scale (1 = strongly disagree and 5 = strongly agree). Constructs were formulated to measure an adoption/usage as well as sustainability-reporting consequences of accuracy, transparency, and efficiency.

**Table 1:** Variable measurement

| Construct | Definition | Measurement (sample indicators) | Scale |
|---|---|---|---|
| **AI Adoption (AI)** | Extent to which AI is used to support sustainability accounting/reporting tasks | Automation, anomaly detection, forecasting, reporting support | 5-point Likert |
| **Data Analytics Capability (DA)** | Organizational capability to collect, process, and analyze ESG/sustainability data for reporting | ESG data integration, analytics dashboards, decision support, reporting accuracy | 5-point Likert |
| **Blockchain Adoption (BC)** | Use of blockchain for traceability, verification, and transparency of sustainability information | Immutable records, audit trail, traceability of green transactions, reliability | 5-point Likert |
| **Sustainable Accounting Practices (SAP)** | Degree to which accounting integrates environmental/social dimensions into reporting and decision processes | ESG disclosure quality, transparency, reporting efficiency, internal sustainability accounting use | 5-point Likert |

## 5. Empirical Results and Discussion

### 5.1 Sample profile

The number of valid responses analysed was 102. The sample size was dominated by women (61.8%), most of the age was 26-35 years (49.0%), and most of them had high education (Master of degree: 49.0%). The work experience was also quite high with the highest percentage being 8 years (28.4%) experience and most people having a work experience over 4 years. This profile indicates that the sample is appropriate to assess the use of digital tools in the sustainability accounting settings.

**Table 2:** Respondent demographics (N = 102)

| Category | Group | Frequency | Percent |
|---|---|---|---|
| **Age** | 18–25 | 38 | 37.3 |
| | 26–35 | 50 | 49.0 |
| | 36–45 | 14 | 13.7 |
| **Education** | Bachelor's | 38 | 37.3 |
| | Master's | 50 | 49.0 |
| | PhD | 14 | 13.7 |
| **Gender** | Male | 38 | 37.3 |
| | Female | 63 | 61.8 |
| | Other | 1 | 1.0 |
| **Experience** | 1–3 years | 20 | 19.6 |
| | 4–5 years | 26 | 25.5 |
| | 6–7 years | 19 | 18.6 |
| | 8 years | 29 | 28.4 |
| | 10+ years | 8 | 7.8 |

### 5.2 Descriptive insights on digital tools and sustainable accounting

On the whole, the respondents expressed positive views on digital tools in sustainable accounting. The descriptive trends show especially high levels of consensus in the areas of the use of data analytics and AI to aid reporting efficiency, whereas the views on blockchain were more favourable but more reserved in nature (more neutral answers), which implies that blockchain is perceived as useful but not something ubiquitous and universal in all environments.

#### 5.2.1 Artificial Intelligence

The respondents admitted that AI helps to pursue green economy objectives and enhance efficiency and transparency in the sphere of accounting. The highest concurrence was realised on the concept that AI is a major catalyst of green economic efficiency (Mean = 4.14, SD = 0.821).

**Table 3:** Descriptive statistics: Artificial Intelligence (AI) items

| Item | Mean | SD | Overall interpretation |
|---|---|---|---|
| AI is a major catalyst of green economic efficiency | 4.14 | 0.821 | Agree |
| Efficiency, accuracy, and transparency can be improve by AI in sustainable accounting | 3.77 | 0.878 | Agree |
| Ethical considerations are required for AI in sustainable accounting | 3.59 | 0.958 | Agree |

Although AI is taken as positive, the greater focus on ethical issues and a relatively larger variance implies that there is heterogeneity in the preparedness, governance, and skill levels among organisations.

### 5.2.2 Data Analytics

The agreement and the relative lower variability in data analytics were consistently high, which suggests that the perceived usefulness in the management of ESG data was high, and the reporting was accurate.

**Table 4:** Descriptive statistics: Data Analytics (DA) items

| Item | Mean | SD | Overall interpretation |
|---|---|---|---|
| With data analytics data management and reporting accuracy can be enhanced | 4.08 | 0.685 | Agree |
| With data analytics ESG data management and reporting can be enhanced | 4.00 | 0.796 | Agree |
| Sustainability software are required for data analytics to ensure accountability | 4.14 | 0.821 | Agree |

The SDs are low to moderate, which reflects consistency among the respondents that sustainability reporting quality is centred on the analytics capability.

### 5.2.3 Blockchain Technology

Blockchain received a positive score but was rated higher in neutrality, which aligns with technologies that could be seen as both advantageous but still in older stages of diffusion in most accounting settings.

**Table 5:** Descriptive statistics: Blockchain Technology (BC) items

| Item | Mean | SD | Overall interpretation |
|---|---|---|---|
| Blockchain enhances transparency and ensures sustainable accounting | 3.37 | 0.954 | Agree |
| Blockchain is one of the best tools for environmental monitoring | 3.36 | 0.952 | Agree |
| Blockchain lowers transaction costs and supports sustainability | 3.37 | 0.954 | Agree |

The results of the average score 3.36–3.37 imply a medium level of agreement. The trend is frequently observed when organisations have realised value but have obstacles adopting them like the cost of implementation, interoperability, regulation, or restricted use cases.

### 5.2.4 Sustainable Accounting Practices

There was a high agreement that digital tools provide opportunities to develop environmental objectives (Mean = 4.07, SD = 0.893), and the same was moderate regarding conceptual grounding and good use.

**Table 6:** Descriptive statistics: Sustainable Accounting Practices (SAP) items

| Item | Mean | SD | Overall interpretation |
|---|---|---|---|
| Digital tools provide opportunities to advance environmental goals | 4.07 | 0.893 | Agree |
| SAP integrates environmental and social factors into accounting | 3.54 | 0.941 | Agree |
| Effective use of digital tools enhances SAP | 3.37 | 0.954 | Agree |

### 5.3 Correlation analysis:

The Pearson correlation analysis shows that there are strong positive correlations between core study variables, which supports that greater adoption/capability of digital tools co-exists with greater sustainable practises in accounting.

**Table 7:** Correlation matrix (Pearson r, N = 102)

| Variables | AI | DA | BC | SAP |
|---|---|---|---|---|
| **Artificial Intelligence (AI)** | 1 | | | |
| **Data Analytics (DA)** | .739** | 1 | | |
| **Blockchain (BC)** | .678** | .364** | 1 | |
| **Sustainable Accounting Practices (SAP)** | .726** | .562** | .837** | 1 |

**Note:** All correlations were found to be p <.01 (as reported).

The highest correlation is recorded between blockchain and SAP (r =.837), which is also in tandem with the regression findings that blockchain appears to be the most powerful predictor.

### 5.4 Regression analysis (hypothesis testing)

Sustainable Accounting Practises (SAP) were used as the dependent variable and AI, Data Analytics, and Blockchain as predictors were put through multiple regression.

#### 5.4.1 Model fit

The model has a high explanatory power: R = .882, $R^2$ =.778, Adjusted $R^2$ =.771, which means that the three predictors can explain approximately 77.8% of the variance of SAP.

**Table 8:** Regression model summary

| R | $R^2$ | Adjusted $R^2$ | Std. Error of Estimate |
|---|---|---|---|
| .882 | .778 | .771 | .35150 |

#### 5.4.2 Coefficient estimates

Blockchain and Data analytics are statistically significant predictors with AI not being significant.

**Table 9:** Regression coefficients (DV = SAP)

| Predictor | B | Std. Error | Beta | t | p-value |
|---|---|---|---|---|---|
| Constant | .297 | .217 | — | 1.370 | .174 |
| Artificial Intelligence (AI) | .049 | .095 | .048 | .520 | .604 |
| Data Analytics (DA) | .281 | .077 | .269 | 3.658 | .000 |
| Blockchain Technology (BC) | .603 | .058 | .706 | 10.472 | .000 |

- The greatest impact on SAP is with blockchain (β =.706, p <.001), meaning traceability, verification, and transparency mechanisms are very influential in determining the outcome of sustainable accounting.
- The correlation between data analytics (β =.269, p <.001) and SAP is positive, which is in line with the perspective that analytics enhances the management of ESG data, accuracy of reporting, and the usefulness of decisions.
- AI (β = .048, p = .604) is not significant. Notably, this does not imply irrelevance of AI, but only indicates that the added value of AI could be indirect, dependent on ability and integration or only just evolving in the context sampled.

In order to convert adoption into accounting results, AI might need additional enablers (data governance maturity, system integration, digital skills, and ethical/controls infrastructure). This is consistent with the descriptive results that ethical considerations are salient, and more dispersed in the case of AI.

### 5.5 Hypotheses results

**Table 10:** Hypotheses testing summary

| Hypothesis | Path | Result | Evidence |
|---|---|---|---|
| **H1** | Blockchain → SAP | **Supported** | β = .706, p < .001 |
| **H2** | Data Analytics → SAP | **Supported** | β = .269, p < .001 |
| **H3** | AI → SAP | **Not supported** | β = .048, p = .604 |

### 5.6 Discussion of findings:

**RQ1: What are the current digital tools applied in sustainable accounting practises?**

Results show that AI, Data Analytics, and Blockchain are identified and utilised as the primary digital technology that contributes to the accounting-related sustainability. The level of operational reliance currently held by the respondents, as indicated by their descriptive scores, is highest on analytics and blockchain, where the AI adoption is seen in a positive manner, but not always converted into sustainable accounting performance.

**RQ2: What impact do these tools have on the accuracy and transparency of sustainability reporting?**

The findings are quite convincing and suggest that digital tools can positively influence the quality of sustainability reporting, specifically by means of:

- Blockchain, that provides transparency and auditability (the greatest impact on SAP), and
- Data analytics, enhancing ESG measurement, data integration and accuracy.

**RQ3: What is the role of the accounting professionals in the introduction of the digital technologies in sustainability reporting systems?**

The evidence suggests that accountants do not consider technology passively; instead, they are the actors of implementation and governance, especially when it comes to determining the reporting processes, how to justify ESG metrics, and how to make sure they are aligned with the sustainability objectives. The greater predictive power of blockchain and analytics implies that accountants can now focus on the tools that can to a greater extent be mapped to assurance, traceability, and reporting control.

**RQ4: What are the challenges and opportunities of using digital technologies in sustainable accounting?**

The trend of AI positive descriptive, non-significant regression, is in itself a significant finding: it indicates that the benefits AI can bring may be conditional on the overcoming of such barriers as: digital skills gaps, integration with accounting systems, governance and ethical control requirements, and availability/quality of ESG data.

## 6. Conclusion

This paper has explored the role of the main digital technologies in developing sustainable accounting practises, including Artificial Intelligence (AI), Data Analytics, and Blockchain Technology, in the framework of a green economy. Based on survey evidence of accounting professionals (N=102) and hypothesis testing through regression analysis, the study can give empirical evidence of which digital technologies are currently determining sustainability-oriented accounting results and where implementation gaps exist.

On the whole, the results prove that digital transformation is directly connected with more sustainable accounting. Specifically, the Blockchain Technology became the most significant predictor, which means that the tools that enhance traceability, auditability, and transparency are vital to the sustainability reporting and environmental responsibility. Data Analytics proved to be a highly significant positive factor as well, which is why it is justified to conclude that the capability to gather, synthesise, and analyse ESG data is the core to enhance the accuracy, consistency, and usefulness of reporting. In contrast, AI was not significant in the regression model. It should not be inferred that AI is useless, but it suggests that the effect of AI may be conditional upon complementary conditions in the organisation, including maturity in data governance, alignment with accounting processes, access to digital skills, etc., before its application yields sustainable accounting practise improvements.

This research adds to the sustainability accounting and digital transformation literature because it provides comparative evidence on three technologies within a single model. Notably, it also emphasises the fact that although organisations can have positive expectations of AI, those technologies that have the most clearly visible measurable accounting results on the current front are those focused on directly empowering measurement capacity (analytics) and verification processes (blockchain). This difference can be of value to both researchers and practitioners by explaining their importance regarding the strongest links of the digital investments to the instances of the instant enhancement of sustainable accounting processes.

### Practical Implications

The results of this paper have significant implications to managers, accounting and sustainability practitioners who aim to improve sustainable accounting practise via digital transformation. Since organisations are under increasing pressure by regulators, investors, and other involved stakeholders to enhance transparency in their sustainability reporting, the strategic use of digital technologies may become a pivotal phenomenon to enhance environmental responsibility and the quality of reporting.

First, the organisations must focus on building capabilities of data analytics in order to enhance both quality and reliability of sustainability data. Data analytics solutions will help companies to aggregate and manipulate large amounts of environmental, social, and governance (ESG) data, enabling companies to discern patterns and track environmental performance and create more precise sustainability reports. With the help of innovative data analytics platforms, companies are able to facilitate the efficiency of the sustainability reporting procedures and contribute to the process of making decisions regarding the environmental management based on the utilisation of the data. Second, the high empirical impact of blockchain technology accentuates its possibility to achieve high efficiency in enhancing transparency and traceability in the sustainability reporting systems. Blockchain systems enable organisations to establish unalterable and verifiable logs of environmental transactions, including carbon emissions data and green finance investments and sustainable supply chain operations. It is thus possible to enhance stakeholder trust in sustainability disclosures and mitigate the risks of greenwashing by imposing blockchain technologies to make sustainability information transparent and auditable. Third, even though artificial intelligence (AI) did not prove to have a statistically significant direct effect on sustainable accounting practises when used in the regression analysis, it is not negligible as a strategic capability to organisations. The AI technologies can be used to automatize the process of data collection, increase the predictive analysis of the environment, and assist in making smart decisions on sustainability management. Nonetheless, AI performance relies on other related organisational investments, such as digital infrastructure, human resources, and ethical governance systems. Managers are thus advised to take a long-term view of the AI implementation, workforce training, system integration, and responsible AI governance. Lastly, companies ought to invest in long-term professional development and digital skills training of the accounting and sustainability experts. With the accounting profession changing to adapt to the digital transformation, professionals in the field should learn to use data analytics, digital reporting, and sustainability measurement tools. Development of such capabilities will enable organisations to incorporate sustainability reporting processes into the digital technologies efficiently and enhance the quality of sustainable accounting practises generally.

### Policy Implications

The results of the current study also have significant ramifications to policy-makers, regulators, and standard-setting organisations that need to encourage sustainable economic growth, as well as enhance the level of transparency of sustainability reports.

To begin with, the policymakers are to promote the adoption of digital technologies in sustainability reporting systems by creating the standardised digital reporting principles. To improve the consistency, comparability and credibility of sustainability disclosures within organisations

and industries, it will be prudent to establish interoperable reporting standards that incorporate digital technologies with requirements of ESG reporting. Second, the government and other regulatory entities ought to support programmes that would help in closing the digital skills gap in the accounting and sustainability fields. Professional training, professional certification, and industry-university-regulatory institution collaborations can be used to provide professionals with digital skills necessary to efficiently use the new technology e.g. AI, data analytics, and blockchain in sustainability reporting. Third, the regulatory bodies must consider the creation of digital governance systems that facilitate the responsible implementation of high-technology in sustainability reporting. As an illustration, verification systems with blockchain technology could be incorporated within environmental monitoring systems to facilitate credibility of green financial programmes, reporting of carbon emission, and sustainable supply chain practises. Lastly, policymakers are advised to integrate the digital transformation plans with the national sustainability agendas. Governments can ensure the switch towards a more transparent, accountable and digitally enabled green economy by encouraging investments on digital infrastructure and innovation on sustainability reporting technologies.

**Limitations and Future Research**

Although the current study offers useful information about the impact of digital technologies on sustainable accounting practises, it is important to mention a number of limitations.

In the first place, the empirical study is grounded on the cross-sectional survey design that does not permit determining causal connexions between digital technology use and sustainable accounting achievements. Longitudinal research designs could be used in future studies to research the impact of adopting digital technologies on sustainability reporting practise in the long term. Second, the current research paper is more concerned with the immediate impact of the digital technologies on sustainable accounting practises. Future research can expand on this paradigm to consider the possible mediating variables, including sustainability reporting quality, digital governance maturity, or ESG data management system, which could be the reasons why digital technologies can be converted into better sustainability results. Third, the study might be taken further by exploring moderating variables that might exist between digital technologies and sustainable accounting practises. Such variables as the digital skills, regulatory pressure, the size of an organisation, the nature of an industry, and the sustainability reporting experience can be of much importance in determining the effectiveness of digital technologies in sustainability accounting. Lastly, this paper will address one particular group of accounting professionals. Future studies can expand the analytical scope of the study by comparing various organisational settings, such as small and medium-sized organisations (SMEs), multinational organisations, and governmental organisations to gain greater insight into how availability of resources and institutional settings affect digital transformation of sustainability accounting.

To sum up, the current paper shows that digital technologies are becoming the key factor in the development of sustainable accounting in the green economy. Based on the empirical evidence, blockchain technology and data analytics are the most measurable contributions to the current state of transparency, accuracy, and efficiency in sustainability reporting systems. Artificial intelligence, in its turn, seems to be a new feature whose future success will be predetermined by the readiness of an organisation, the data infrastructure, and the acquisition of the necessary digital skills. This study offers practical implications to organisations that aim to improve the sustainability reporting processes and the use of digital technologies in improving their environmental accountability by explaining the unique contribution of various digital technologies. Meanwhile, the paper emphasises the significance of coordination among organisations, policymakers, and professional institutions in order to deal with technological, regulatory, and skills-related issues related to digital transformation. In the end, the incorporation of digital technologies into the context of sustainable accounting systems may facilitate the creation of more open and credible sustainability reporting systems, which can further ensure the greater scope, i.e. the creation of more responsible, data-driven and sustainable green economy.

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**Appendix: Table A1. Measurement Instrument (Questionnaire Items)**

**Section A: Demographic Information**

| Variable | Category | Options |
|---|---|---|
| Gender | Respondent gender | Male / Female |
| Age | Respondent age group | 18–25 years / 26–35 years / 36–45 years |
| Education | Highest educational qualification | Bachelor's Degree / Master's Degree / PhD |

| Variable | Category | Options |
|---|---|---|
| Working Experience | Years of professional experience | 1–3 years / 4–5 years / 6–7 years / 8 years / 10 years and above |

**Section B: Digital Tools and Sustainable Accounting Practices**

**Scale:** 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

| No. | Construct | Measurement Item | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|
| **Artificial Intelligence (AI)** | | | | | | | |
| 1 | Artificial Intelligence | AI is a significant driver of green economic efficiency. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 2 | Artificial Intelligence | AI improves efficiency, accuracy, and transparency in sustainable accounting practices. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 3 | Artificial Intelligence | The use of AI in sustainable accounting requires ethical considerations and governance mechanisms. | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Data Analytics** | | | | | | | |
| 4 | Data Analytics | Data analytics enhances data management and reporting accuracy in sustainable accounting practices. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 5 | Data Analytics | Data analytics improves ESG data management and sustainability reporting. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 6 | Data Analytics | Data analytics requires specialized sustainability software to ensure environmental accountability. | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Blockchain Technology** | | | | | | | |
| 7 | Blockchain Technology | Blockchain technology enhances transparency in sustainable accounting practices. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 8 | Blockchain Technology | Blockchain technology supports environmental monitoring and sustainability tracking. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 9 | Blockchain Technology | Blockchain technology reduces transaction costs and improves sustainability reporting. | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Sustainable Accounting Practices (Dependent Variable)** | | | | | | | |
| 10 | Sustainable Accounting | The integration of digital tools into accounting provides opportunities to advance environmental goals in the green economy. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 11 | Sustainable Accounting | Sustainable accounting practices incorporate environmental and social factors into financial systems. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 12 | Sustainable Accounting | The effective use of digital tools enhances sustainable accounting practices. | ☐ | ☐ | ☐ | ☐ | ☐ |