Leveraging AI in ESG Reporting and Assurance: What Sustainable Strategic Accountants Should Know

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Abstract

This article discusses Artificial Intelligence (AI)'s emerging role in Environmental, Social, and Governance (ESG) reporting and assurance that Sustainable Strategic Accountants (SSAs) should know and prepare to engage in AI-driven ESG accounting practices. It explores an overall ESG reporting and assurance process, key activities in each process, the current state of AI integration into ESG reporting and assurance processes, and the associated benefits and challenges. The paper also considers ethical issues surrounding AI in ESG reporting and assurance. The author draws on a literature review in accounting and related fields to discuss the ESG reporting and assurance process and the use of AI in the ESG accounting domain. Additionally, the author offers reasons why SSAs must know these issues and how to prepare to engage in the AI-driven ESG accounting domain. The key takeaways from the article are as follows. Integrating AI into ESG reporting and assurance enhances accuracy, efficiency, and transparency, enabling better decision-making on corporate ESG performance. Yet, challenges like algorithm bias and opaque processes of AI models must be addressed. Accounting professionals, particularly SSAs, should understand AI's strengths and limitations, collaborate with data experts, and ensure AI tools align with ESG standards and regulations.

Keywords: ESG Reporting; ESG Assurance; AI in ESG Reporting, AI in ESG Assurance, Sustainable Strategic Accountants

การใช้ประโยชน์จากปัญญาประดิษฐ์ในการรายงานและการให้ความเชื่อมั่นด้านสิ่งแวดล้อม สังคม และธรรมาภิบาล (ESG): สิ่งที่นักบัญชีเชิงกลยุทธ์เพื่อความยั่งยืนควรรู้

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บทคัดย่อ

บทความนี้กล่าวถึงบทบาทที่เกิดขึ้นใหม่ของปัญญาประดิษฐ์ (AI) ในการรายงานและการให้ความเชื่อมั่นด้านสิ่งแวดล้อม สังคม และธรรมาภิบาล (ESG) ซึ่งนักบัญชีเชิงกลยุทธ์เพื่อความยั่งยืน (Sustainable Strategic Accountants: SSAs) ควรทราบและเตรียมพร้อมในการมีส่วนร่วมกับการปฏิบัติงานด้านการบัญชี ESG ที่ขับเคลื่อนด้วย AI โดยบทความนี้อธิบายภาพรวมของกระบวนการรายงานและการให้ความเชื่อมั่นด้าน ESG กิจกรรมหลักในแต่ละกระบวนการ สถานะปัจจุบันของการบูรณาการ AI เข้ากับกระบวนการรายงานและการให้ความเชื่อมั่นด้าน ESG รวมถึงประโยชน์ที่ได้รับและความท้าทายที่เกี่ยวข้อง นอกจากนี้ บทความยังพิจารณาประเด็นจริยธรรมที่เกี่ยวข้องกับ AI ในการรายงานและการให้ความเชื่อมั่นด้าน ESG โดยผู้เขียนได้ทบทวนวรรณกรรมในสาขาการบัญชีและสาขาที่เกี่ยวข้องเพื่ออภิปรายเกี่ยวกับกระบวนการรายงานและการให้ความเชื่อมั่นด้าน ESG และการใช้ AI ในขอบเขตงานด้านการบัญชี ESG นอกจากนี้ผู้เขียนได้นำเสนอมุมมองว่าเหตุใดนักบัญชี SSAs จึงต้องทราบประเด็นเหล่านี้และวิธีการเตรียมพร้อมเพื่อมีส่วนร่วมในการปฏิบัติงานบัญชี ESG ที่ขับเคลื่อนด้วย AI โดยสรุปประเด็นสำคัญจากบทความมีดังนี้ การบูรณาการ AI เข้ากับการรายงานและการให้ความเชื่อมั่นด้าน ESG ช่วยเพิ่มความแม่นยำ ประสิทธิภาพ และความโปร่งใส ซึ่งส่งผลให้การตัดสินใจเกี่ยวกับผลการดำเนินงานด้าน ESG ของบริษัทดีขึ้น อย่างไรก็ตาม ความท้าทาย เช่น อคติของอัลกอริทึมและกระบวนการที่ไม่โปร่งใสของแบบจำลอง AI เป็นประเด็นที่ต้องพิจารณาและคำนึงถึงในการใช้งาน AI นอกจากนี้ผู้ประกอบวิชาชีพด้านการบัญชี โดยเฉพาะนักบัญชี SSAs ควรเข้าใจจุดแข็งและข้อจำกัดของ AI ให้ความร่วมมือในการทำงานร่วมกับผู้เชี่ยวชาญด้านข้อมูล และให้ความเชื่อมั่นว่าการใช้เครื่องมือ AI สอดคล้องกับมาตรฐานและข้อบังคับด้าน ESG

คำสำคัญ: การรายงาน ESG; การให้ความเชื่อมั่นด้าน ESG; AI ในการรายงาน ESG; AI ในการให้ความเชื่อมั่นด้าน ESG; นักบัญชีเชิงกลยุทธ์เพื่อความยั่งยืน

1. INTRODUCTION

In response to investors' demand for environmental, social, and governance (ESG) data in addition to traditional financial data, the majority of large corporations worldwide now voluntarily share ESG information based on voluntary standards set by multiple standard-setting bodies (Appelbaum et al., 2024; Kaplan & Ramanna, 2021). Using data from the United States in 2020, 76% of S&P 500 firms issued an ESG report, and 46% of these reports included ESG assurance, a significant increase from 38% of ESG reports and 16% of reports that included ESG assurance in 2010 (Gipper et al., 2024).

ESG is defined as a firm's obligation to improve social welfare and equitable and sustainable long-term wealth for stakeholders (Mohammad & Wasiuzzaman, 2021). The Environmental (E) component of ESG focuses on managing environmental factors such as climate, natural resource scarcity, pollution, and waste. The Social (S) component refers to social factors such as labor and supply chain, employee health and safety, and diversity. The Governance (G) component refers to the company's corporate governance, such as the structure and diversity of the directors, executive compensation, and political contributions (Raghavan, 2022). In industry practice, ESG, sustainability, and Corporate Social Responsibility (CSR) reporting are sometimes used interchangeably.

ESG accounting practices generally refer to the measurement, reporting, and assurance of an organization's performance related to ESG factors. While most accounting standards traditionally focus on financial information, ESG accounting expands the scope to include nonfinancial metrics. Specifically, environmental or green accounting involves integrating environmental costs into a company's financial statements, such as resource use and pollution costs (Trisnawati et al., 2022). Although companies face challenges in measuring and disclosing environmental aspects, environmental accounting practices positively affect a firm's performance by enhancing transparency and accountability (Shoeb et al., 2022; Trisnawati et al., 2022). Social responsibility reporting involves disclosing information related to a company's social impact, such as labor practices and community engagement. Firms that effectively report on social responsibility can attract a broader customer base and gain a competitive advantage in the market (Harif & Natasha, 2024). Governance in ESG accounting refers to the disclosure of corporate governance practices. Effective governance requires integrating ESG factors into financial accounting practices, which can guide green investment and support sustainable development strategies (Huang, 2024). Integrating these nonfinancial factors into traditional accounting frameworks is a central challenge in developing comprehensive ESG accounting practices. It leads to more demand for independent assurance in ESG reporting, highlighting the increasing demand for greater transparency and credibility in ESG disclosures.

Previous research suggests that investors favor good ESG firms while poorly disclosed ESG indicates idiosyncratic risks (Mohammad & Wasiuzzaman, 2021). Lack of ESG disclosure by firms can result in bad investments that may result in environmental pollution or discrimination against employees. Another study suggests that ESG disclosure, as measured by ESG disclosure score, has a positive association with firm performance (Mohammad & Wasiuzzaman, 2021). Therefore, integrating ESG into

a firm's investment decision will assist investors in making decisions based on overall performance rather than only on financial performance. As discussed by Mohammad and Wasiuzzaman (2021), ESG-compliant firms are found to have better governance, focus more on sustainable development, have less earnings volatility, and have access to lower-cost funds. Thus, these findings support more responsible business practices as firms with better ESG disclosures tend to perform better. Previous research highlights the importance of nonfinancial disclosures as a key indicator that firms should consider in evaluating their long-term sustainability.

Artificial Intelligence (AI) is essential in enhancing the ESG reporting and assurance process in many aspects. For example, AI is integrated into the ESG process for ESG data collection, validation, and processing, automating ESG reporting and auditing tasks, conducting ESG data analytics and visualizations, managing ESG risks, detecting anomalies, and enabling real-time monitoring (Chen, 2024; Kokina et al., 2025). The AI-driven ESG process is an enabler that improves the completeness and accuracy of ESG reports and assurance services.

Sustainable Strategic Accountants (SSAs) — as I define in this article — are forward-thinking accounting professionals who integrate advanced analytical capabilities, digital proficiency, sustainability principles, and strategic financial insight. Their role goes beyond traditional accounting functions, embracing a broader value-creation mindset. SSAs are equipped to support organizations in aligning financial performance with long-term, non-financial objectives such as environmental stewardship, social responsibility, and ethical governance. By combining these competencies, SSAs contribute to building resilient, future-ready business models.

Because corporations and assurance service providers are leveraging and integrating various AI systems into their ESG process, SSAs who are involved in both the ESG reporting process as the preparer and ESG assurance process as the auditee must understand AI, ESG reporting, ESG assurance, AI integration into the ESG accounting domain, implementation challenges, and ethical AI usage. Therefore, this article discusses AI's emerging role in ESG reporting and ESG assurance that SSAs should know and prepare to engage in AI-driven ESG accounting practices. Specifically, it explores an overall ESG reporting and assurance process, key activities in each process, the current state of AI integration into ESG reporting and assurance processes, and the associated benefits and challenges. The paper also considers ethical issues surrounding AI in ESG reporting and assurance. Furthermore, the author discusses why and how SSAs should prepare to leverage AI in ESG accounting.

2. ESG Reporting and Assurance

This section discusses the definitions and overall process of ESG reporting and ESG assurance separately based on the accounting and related literature review.

2.1 ESG Reporting

ESG reporting refers to the disclosure of firm performance in three key dimensions: environment, social, and governance. As discussed earlier, this is due to an increasing demand from investors, advocates, and other stakeholders for corporations to take on responsibilities beyond maximizing shareholder value in financial areas. Many firms are adopting ESG reporting to meet the information demanded by stakeholders and show their commitment to ESG risk management (Raghavan, 2022). The purpose of ESG reporting is to provide transparency of a company's overall sustainability and ethical practices in the three key areas (Kaplan & Ramanna, 2021). The ESG report documents a company's ESG performance and usually includes qualitative discussions and quantitative metrics. However, these reports vary in format, content, and audience across different firms and industries because these reports have not been audited (Raghavan, 2022; Rouen et al., 2022).

The ESG reporting process involves several key steps, each designed to ensure that ESG metrics are accurately captured, reported, and utilized to enhance stakeholder engagement and corporate reputation. The ESG reporting process for organizations typically consists of the following key steps. The first step is to define the scope and objectives of the report. This step involves identifying and selecting ESG metrics material for the organization and its stakeholders, including qualitative and quantitative indicators that reflect the company's performance in the ESG areas (Raghavan, 2022). Once the scope and objectives are defined, the next step is to collect, measure, and analyze the relevant ESG data. This step is critical for ensuring the accuracy and reliability of the reported information. Companies must establish robust data collection systems that capture relevant ESG information from various sources, including internal records, surveys, and third-party providers (Dasinapa, 2024). Collecting ESG reports involves hand-collecting available reports from firms' websites and conducting extensive searches of archived data for older reports (Rouen et al., 2022). Environmental measurement focuses on greenhouse gas (GHG) emissions, which are critical for effective ESG reporting. The GHG protocol classifies emissions into Scopes 1, 2, and 3. Scope 1 is the easiest to measure, while Scope 3 involves complex supply chains and is the hardest to quantify. Relative to environmental metrics, the social impact is more complicated due to the lack of consensus on what constitutes societal performance. However, some standard key components are labor practices and employee welfare measures. Governance is considered a process rather than an outcome and, thus, is difficult to measure directly. Most companies often measure inputs such as board diversity or compliance for this dimension (Kaplan & Ramanna, 2021).

Third, companies select from various reporting frameworks to guide their reporting process. Voluntary reporting frameworks and guidance have been adopted, but currently, there are no global disclosure standards for ESG reports (Raghavan, 2022). To provide guidelines on ESG corporate disclosure, several organizations issued voluntary ESG and sustainability reporting standards, such as the Sustainability Accounting Standard Board (SASB) and the Global Reporting Initiative (GRI) (Christensen et al., 2021). SASB is an organization that developed sustainability accounting standards for public companies. The SASB standards are designed for mandatory SEC filings and have become the most adopted voluntary standards for ESG issues in the United States (Rouen et al., 2022). Similarly, GRI provides guidance for ESG reporting. Following the merger of SASB and GRI, the new organization was consolidated into the IFRS Foundation in 2022, with SASB standards as the starting point for developing IFRS's Sustainability Disclosure Standards (Rouen et al., 2022)

Fourth, to enhance the credibility of the ESG report, organizations often engage third-party assurance providers to verify the accuracy of the reported data. There are different levels of assurance, ranging from limited to reasonable assurance. Limited assurance involves a high-level review of the data, while reasonable assurance involves a more detailed and rigorous verification process (Zampone & Guidi, 2024). Fifth, the reporting and disclosure step presents the collected and verified ESG data clearly and transparently. The report should be comprehensive yet concise and include qualitative and quantitative information. ESG reports typically include sections such as an overview of the organization's ESG strategy, a discussion of material ESG issues, and a presentation of key performance indicators. The report may include case studies and examples to illustrate the organization's ESG initiatives and achievements (Abeysekera, 2022). Finally, ESG reporting is an ongoing process that requires continuous improvement and monitoring. Organizations should regularly review and update their ESG reporting process to align with their strategic objectives and stakeholder expectations (Abeysekera, 2022).

Despite the increasing ESG disclosure trend, there are several issues related to ESG data quality due to the lack of clear ESG policies, skills, and robust systems to collect and manage ESG data to comply with ESG assurance requirements (Appelbaum et al., 2024). ESG reporting also faces challenges as it is too broad and vague when measuring each component. It leads to selective reporting and greenwashing, in which firms highlight favorable metrics and ignore less favorable ones. The lack of a universal ESG reporting framework resulted in inconsistent reporting practices among firms (Kaplan & Ramanna, 2021). Therefore, Kaplan and Ramanna (2001) proposed that ESG reporting should focus on outcome-based metrics rather than inputs and processes. For environmental reporting, firms should focus on dimensions with broad agreement on preferred outcomes, such as reducing greenhouse gas emissions. For societal reporting, firms should concentrate on areas with clear positive or negative social consequences, such as employee health and safety and eliminating child labor. The study also suggested that the governance component be integrated into financial, environmental, and social reporting as it is a process leading to outcomes in those areas.

Figure 1 presents an overview of the ESG reporting process.

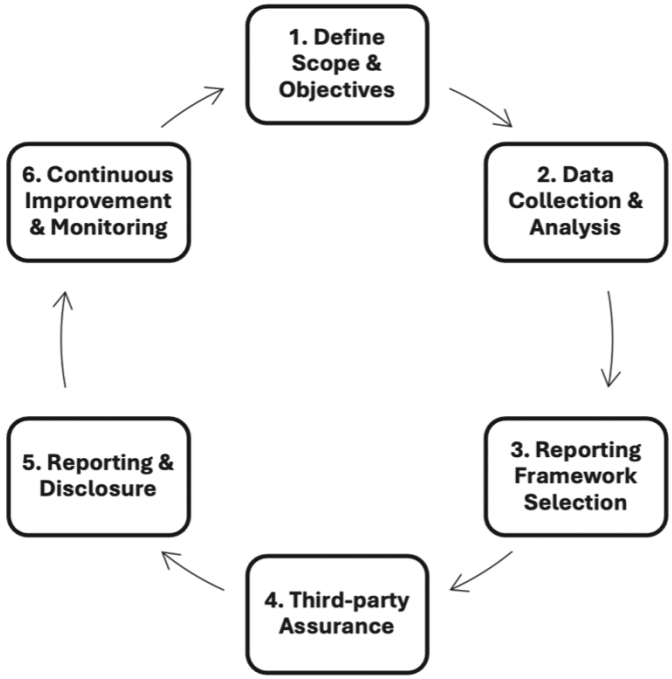

Figure 1: ESG Reporting Process Overview

2.2 ESG Assurance

ESG assurance refers to the process through which companies engage third parties to provide independent evaluation and validation of their ESG disclosures. Reputation concerns primarily drive ESG assurance, as companies aim to demonstrate their commitment to sustainable practices and gain credibility with investors, customers, and other stakeholders (Li et al., 2024). As discussed earlier, ESG, CSR, and Sustainability reports are closely related. Like ESG assurance, CSR assurance services are critical in enhancing CSR reports' credibility and reliability (Cohen & Simnett, 2015). Sustainability assurance also enhances the credibility of sustainability reports (Farooq & De Villiers, 2019). The market for sustainability assurance services is relatively new and mainly unregulated, with various types of assurance providers, such as major accounting firms and other service providers. The methods and standards used in the process also evolve in this field (Cohen & Simnett, 2015; Farooq & De Villiers, 2019). Compared to financial audits, ESG assurance is still in its early stages. The assurance of ESG reports involves a wide range of subject matters. Assurance providers must employ appropriate techniques to handle the diverse types of information, which can be quantitative and qualitative (Li et al., 2024).

The ESG assurance process is a comprehensive approach that ensures the credibility and transparency of an organization's ESG disclosures. This process involves several key steps and activities, each contributing to the overall reliability and trustworthiness of the ESG reports. The first step is planning and scoping the ESG assurance. This step involves understanding the organization's ESG context, including its industry, regulatory environment, and specific ESG risks and opportunities. The audit scope is determined based on the materiality of ESG issues, stakeholder expectations, and the organization's strategic objectives (Olorunyomi et al., 2021). The next step is to identify ESG risks and evaluate internal controls. In this step, auditors assess the potential risks associated with the organization's ESG activities that could affect the accuracy and completeness of ESG disclosures. The effectiveness of the organization's internal controls over ESG data collection and reporting is then evaluated to identify any weaknesses that could affect the reliability of the information (Eulerich et al., 2022; Ramadhan et al., 2023).

Third, auditors gather ESG data from various sources within the organization and ensure that data is comprehensive and aligns with the defined scope of the audit. The data is then verified for accuracy and consistency using advanced technologies to enhance data integrity and reduce the risk of errors (Olorunyomi et al., 2021). Fourth, auditors analyze the organization's ESG performance and assess the organization's compliance with relevant ESG reporting standards and frameworks to ensure that disclosures meet regulatory and stakeholder expectations (Rawat, 2025). Fifth, an assurance report is prepared, outlining the audit findings, conclusions, and any recommendations for improvement. The report is communicated to the organization's management and stakeholders. Auditors engage with stakeholders to discuss the assurance findings and address concerns or questions (Ramadhan et al., 2023). The last step is to provide feedback to the organization on areas for improvement, helping to enhance future ESG reporting and assurance activities (Eulerich et al., 2022).

O'Dwyer and Owen (2005) analyzed assurance statements in ESG and sustainability reports and highlighted significant findings and concerns about ESG assurance services. For example, accountants and assurance providers use different approaches. Accountants tend to adopt a more conservative and limited approach, thus providing low assurance levels. On the other hand, assurance providers take a more evaluative approach, therefore offering higher assurance levels. However, the assurance providers' focus on guiding companies' strategic moves may compromise their independence. In the context of O'Dwyer and Owen's (2005) analysis, the terms "low assurance levels" and "high assurance levels" refer specifically to the credibility and reliability of the information presented in ESG and sustainability reports. The study also raised concerns about the independence of the assurance process, especially for significant management control over the assurance activities (O'Dwyer & Owen, 2005).

Several international standards and guidelines have been developed for ESG assurance, as Li et al. (2024) and Michelon et al. (2019) discussed. The International Standard on Assurance Engagements (ISAE3000) provides principles and procedures for nonfinancial assurance engagements. The AA1000

Assurance Standard (AA1000AS) focuses on inclusivity, materiality, responsiveness, and impact from stakeholders' perspectives. The Global Reporting Initiative (GRI) offers guidelines for ESG reporting but does not specify how ESG assurance should be conducted. In terms of level of assurance, ESG assurance can be conducted at two levels: (1) reasonable assurance and (2) limited assurance (Li et al., 2024).

ESG assurance benefits firms by ensuring data reliability and identifying weaknesses in their sustainability practices. It also helps firms gain support from ESG-conscious consumers who support responsible business practices (Li et al., 2024). Nevertheless, the ESG and sustainability assurance process faces challenges due to the immature reporting standards and inadequate internal systems within firms, leading to difficulties detecting errors before reporting. Another challenge arises from the nature of ESG information, which includes both quantitative and qualitative data. Its intrinsic variability calls for a range of assurance and verification approaches. Despite these challenges, ESG assurance providers remain relatively protected, as ESG reporting — in many jurisdictions — is still largely voluntary and faces less regulatory scrutiny and litigation risk than traditional financial audits (Li et al., 2024; Michelon et al., 2019).

Figure 2 presents an overview of the ESG assurance process.

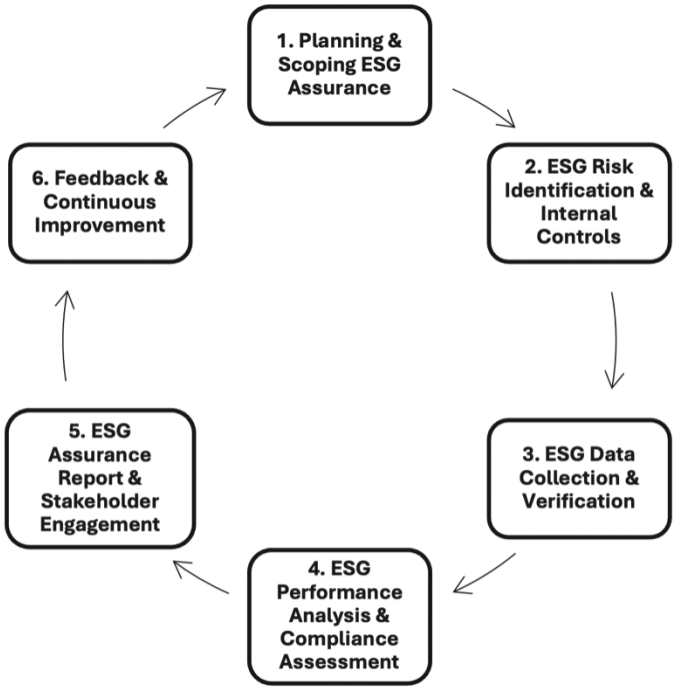

Figure 2: ESG Assurance Process Overview

3. The Role of AI in ESG Reporting and Assurance

This section discusses how AI is leveraged for ESG reporting and assurance and the benefits of adopting AI technologies in this domain.

3.1 AI in ESG Reporting

AI plays a vital role in enhancing the ESG reporting process. For example, AI technology improves data collection and processing, improving the completeness and accuracy of ESG reports that stakeholders can rely on for decision-making. AI can also perform an in-depth analysis and identify potential risks and quality of ESG data. In addition, AI improves the visualization of ESG performance and thus makes ESG reports more understandable. AI in ESG reporting enhances transparency and credibility through automated data validation processes. Lastly, AI helps identify and manage ESG risks in real-time, resulting in the reliability of ESG disclosures (Chen, 2024).

SSAs should understand and prepare to get involved in applying AI to ESG reporting for several reasons. For example, SSAs possess data analysis, financial reporting, and assurance knowledge and skills. Their expertise is crucial for ensuring data quality, accuracy, and reliability within AI-driven ESG systems. Their understanding of the auditing principles also allows them to assure the reliability and integrity of AI-generated insights. In addition, AI can automate many tasks in ESG reporting, freeing up SSAs to focus on higher-level analysis. By integrating AI into their workflows, SSAs can streamline data collection, analysis, and reporting processes, improving efficiency and reducing costs. AI algorithms can identify complex patterns and correlations within ESG data that might be missed by human analysts, allowing SSAs to gain deeper insights into ESG performance and inform strategic decision-making. AI can facilitate more transparent and comprehensive ESG reporting, enhancing stakeholder communication. Therefore, leveraging AI allows SSAs to provide stakeholders with clear, concise, and data-driven ESG information.

To gain more practical insights into how AI technologies are leveraged and integrated into ESG reporting, I draw on the ESG and sustainability literature for the following examples. One use case of AI-driven ESG is for voluntary corporate carbon reporting, which refers to the practice where companies voluntarily disclose their greenhouse gas (GHG) emissions and related environmental data (Frost et al., 2023). Machine learning models are used to predict the level of voluntary carbon reporting by analyzing large datasets to identify patterns and relationships that might not be obvious. These AI models outperform the traditional logistic regression model and help understand which factors are most influential in determining whether a company will engage in voluntary carbon reporting (Frost et al., 2023). Another related use case is the adoption of AI in the ESG rating industry. ESG raters are essential in assessing firms' ESG reporting process and providing metrics that guide sustainable investment (Giri & Chaparro, 2024). In this industry, ESG raters extensively use Natural Language Processing (NLP) to streamline data collection, processing, and analysis. This technology facilitates processing large volumes of unstructured data, which is crucial for accurate ESG assessments. This

involves using NLP technologies to automate extracting and interpreting relevant information from corporate reports and news articles. NLP applications in the ESG context include Name Entity Recognition, Sentiment Analysis, and Text Classification Algorithms. These tools help identify and categorize relevant entities, assess the sentiment of textual data, and classify documents based on their content. Therefore, integrating these AI technologies in ESG ratings enhances reliability and transparency and reduces potential biases in these ratings (Giri & Chaparro, 2024).

From the accounting perspective, SSAs can leverage AI in various aspects of ESG reporting to streamline their workflows, improve accuracy, and enhance communication with stakeholders. One practical application of AI in ESG reporting is using natural language processing to automate the collection and analysis of unstructured data from various sources, such as sustainability reports, media articles, and social media. This can help accountants quickly identify and extract relevant information, reducing the time and effort required to gather the necessary data. Another way AI can benefit the ESG reporting process is by improving the accuracy and consistency of data analysis. AI algorithms can detect patterns, identify anomalies, and generate insights from large datasets more efficiently than manual review (Le Guyader, 2019). This can be useful for accountants responsible for verifying the integrity and reliability of ESG data.

Furthermore, AI can enhance the communication and presentation of ESG information. AI can automate the generation of ESG reports, reducing the time and resources required for manual report preparation. This also ensures consistency in reporting formats and reduces the risk of errors. Intelligent data visualization tools can transform complex ESG data into easy-to-understand reports, dashboards, and visualizations, enabling accountants to effectively communicate their findings to stakeholders (Qing & Jin, 2023). Finally, AI can analyze stakeholder sentiment and preferences, allowing organizations to effectively tailor their ESG communications and address specific concerns (Li et al., 2024).

Figure 3 summarizes AI's role in ESG reporting.

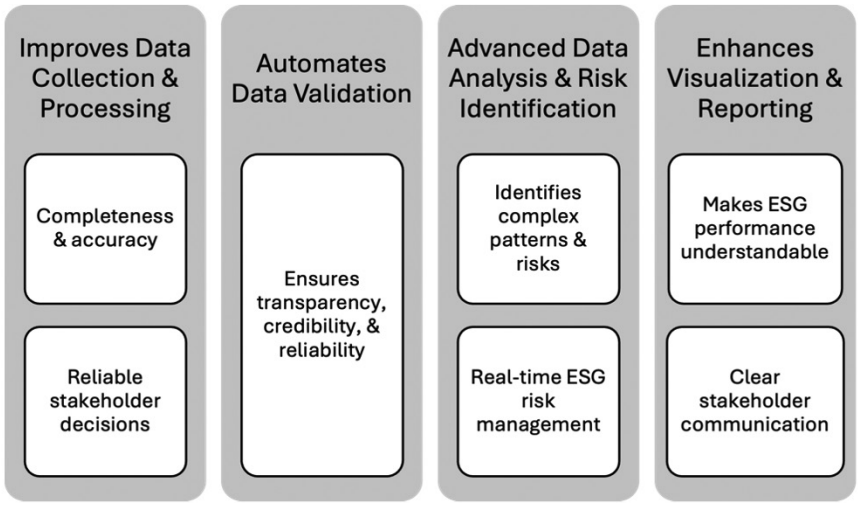

Figure 3: Summary of AI's Role in ESG Reporting

3.2 AI in ESG Assurance

The auditing literature discussed the role of AI in auditing in many aspects. For example, Robotic Process Automation (RPA) automates structured and repetitive tasks traditionally performed manually in auditing. AI also extracts and validates vast amounts of raw data used in auditing, such as payment transaction data, for further substantive testing. Large accounting firms use machine learning models to analyze data and identify anomalies for further forensic investigation. Accounting firms also use NLP to analyze contracts and financial reports to understand the context and extract relevant details for further analyses (Kokina & Davenport, 2017). To summarize, the application of AI in auditing is primarily used for tasks such as identifying anomalies, detecting potential fraud, matching related transactions, reviewing contracts and leases, and performing benchmarking. These tasks leverage machine learning for pattern recognition and Optical Character Recognition (OCR) for document review (Kokina et al., 2025).

As more organizations adopt AI in ESG reporting, auditors have also leveraged more AI in the ESG assurance process. Therefore, SSAs and auditors, the key stakeholders in both ESG reporting and assurance processes, should be knowledgeable about the applications of AI in the ESG assurance process. By automating data collection and analysis, AI can reduce the risk of human error and bias, improving data integrity and transparency. This increased transparency and led to more efficient and reliable ESG assurance processes. In addition, AI algorithms can quickly identify patterns and anomalies in large datasets, helping SSAs and auditors detect potential misstatements or omissions in ESG disclosures. AI can also identify potential ESG risks and opportunities so that SSAs and auditors can provide feedback and recommendations to organizations to address these issues and improve their overall ESG performance proactively. Furthermore, SSAs who understand AI's capabilities in ESG

assurance can help organizations meet regulatory requirements and demonstrate their commitment to sustainability. Specifically, accounting professionals with a solid understanding of AI and its applications in ESG assurance can effectively evaluate the accuracy and integrity of AI-generated ESG data, ensuring that the information provided to stakeholders is reliable and trustworthy.

Similar to the benefit of AI integration within ESG reporting, several AI models are leveraged in the ESG assurance domain to enhance the accuracy and reliability of corporate ESG reports. One notable use case of technologies in ESG assurance is discussed by Gu, Dai, and Vasarhelyi (2023). Specifically, the study introduced an innovative method to improve ESG assurance by incorporating the concept of Audit 4.0 into the ESG domain. The approach aims to improve the efficiency, effectiveness, and accuracy of ESG assurance. The Audit 4.0-based ESG assurance leverages several emerging technologies to provide real-time and continuous assurance. This involves using sensors and the Internet of Things (IoT) to detect abnormal activities as they occur. AI is utilized in Audit 4.0-based ESG assurance to collect and transmit data to a cloud where continuous ESG assurance models perform anomaly detection and automatically generate high-risk reports for relevant parties. Another example of AI application in ESG assurance is using satellite images to capture real-time audit evidence to examine greenhouse gas emission disclosures. AI is also integrated with IoT devices to report environmental data such as air and water quality (Gu et al., 2023). Overall, the study suggests that AI plays a role in ESG assurance by providing objective, real-time evidence to improve the quality of the ESG reporting process.

A recent study by Li, Kim, Dai, and Vasarhelyi (2024) proposed an AI-based-ESG assurance based on the three-layer paradigm to illustrate the use of AI in ESG data collection and processing for assurance purposes. Specifically, the technology layer focuses on technologies and tools for processing ESG data, such as OCR to convert unstructured data and NLP to analyze unstructured text data and extract insights. The application layer uses technologies to collect and analyze ESG data, such as web crawlers to extract nonfinancial data from web pages. IoT devices are used to collect real-time ESG data for continuous monitoring. The data layer helps process and validate ESG data. AI can improve ESG reporting by automating reporting processes, benchmarking performance, providing real-time monitoring, improving data quality, and ensuring regulatory compliance.

Overall, the application of AI in auditing leads to improved audit quality and lower audit fees. Specifically, AI helps improve the selection of outliers for further examination, testing entire populations, confirmation automation, and performing analytical procedures (Kokina et al., 2025). The consequences are that AI is transforming auditing, including ESG assurance, and allowing human auditors to focus more on complex and judgment-based tasks (Kokina & Davenport, 2017). Despite potential benefits from AI in ESG assurance, some challenges include data format consistency across clients, transparency and explainability of AI, AI bias, data privacy, reliability, and the fear of auditor overreliance on AI (Kokina et al., 2025).

Figure 4 summarizes AI's role in ESG assurance.

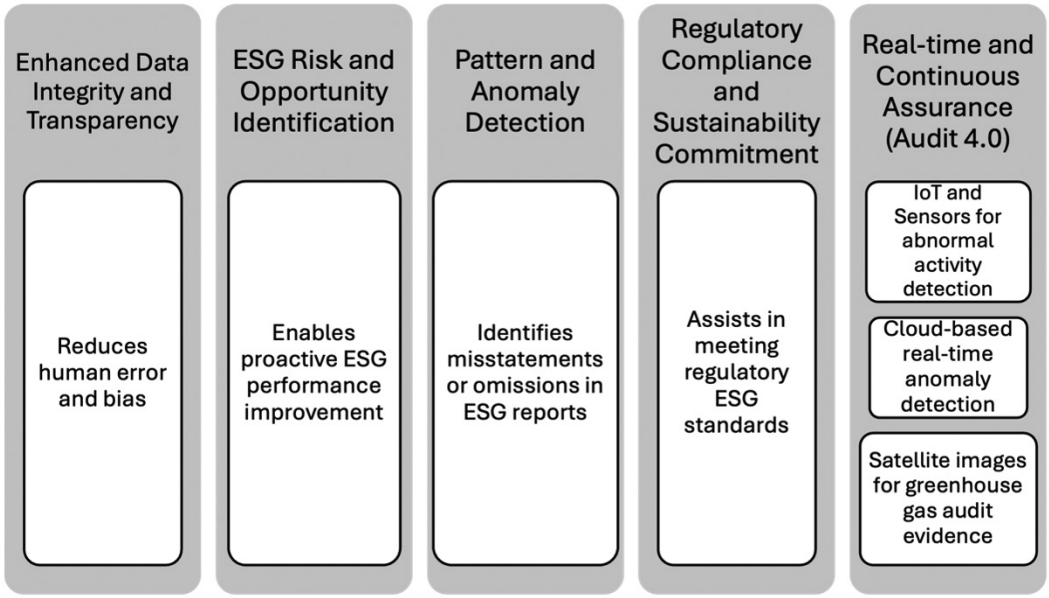

Figure 4: Summary of AI's Role in ESG Assurance

4. Challenges and Ethical Considerations of AI in ESG Reporting and Assurance

As the use of AI in the ESG reporting and assurance processes continues to evolve, SSAs and other accounting professionals must address the associated challenges and ethical considerations.

Several challenges of AI in the ESG process are noted in the literature that are relevant to the accounting profession as follows (Burnaev et al., 2023; Chopra et al., 2024; Li et al., 2024; Thomas et al., 2024). First, there is a significant concern over ESG data privacy and the credibility of data collected by AI technologies. Second, a large volume of data collected from various sources by AI makes it labor-intensive to make timely decisions in addressing ESG issues. Third, not all types of data collected by AI are of high quality or relevant to ESG issues and thus require further data selection and processing. Fourth, AI models face methodological challenges due to the lack of standardized ESG metrics and accounting standards, which lead to inconsistencies in the ESG reporting and assurance process. Fifth, the emergence of new AI tools presents a new challenge to the ESG reporting and assurance process of their impact on the ESG domain.

AI in ESG reporting also faces behavioral challenges due to the diverse methods used by ESG rating providers, which lead to inconsistent evaluations and scores. Finally, while AI addresses ESG challenges, it poses other risks, such as generating fake news and computational resource requirements. These challenges underscore the complexity of integrating AI into the ESG process and the need for ongoing research and careful management to maximize benefits while mitigating risks (Burnaev et al., 2023; Chopra et al., 2024; Li et al., 2024; Thomas et al., 2024).

Developing trustworthy and responsible AI frameworks ensures that AI technologies are implemented ethically and safely across various sectors. International frameworks and standards have been established to guide AI systems' ethical development and deployment. These include

the Organisation for Economic Co-operation and Development (OECD) AI Principles, the European Union (EU) AI Act, and the National Institute of Standards and Technology (NIST) AI Risk Management Framework (RMF). Each framework provides a unique approach to addressing the ethical, legal, and social challenges AI technologies pose. The OECD AI Principles emphasize the importance of inclusive, sustainable, and human-centered AI systems, ensuring that AI technologies contribute to economic growth and societal well-being (Ashraf & Mustafa, 2024). The EU AI Act is a comprehensive framework for governing AI systems within the European Union. It aims to ensure that AI technologies are used safely and transparently and respect fundamental rights (Ukoh & Adetunji, 2025). The NIST AI RMF provides guidelines for managing risks associated with AI systems. It focuses on enhancing the trustworthiness of AI technologies by addressing issues such as fairness, transparency, and accountability (Ashraf & Mustafa, 2024).

Overall, SSAs and auditors are encouraged to consider ethical issues. This includes the ethical considerations of AI in the ESG reporting and assurance process, as summarized below (Ayling & Chapman, 2022; Lim, 2024; Palumbo et al., 2024). First, there is an ethical concern about bias and unfairness of AI systems based on the trained data and algorithms that can lead to incomparable and discriminatory outcomes. Second, a concern about the lack of transparency of AI models may reduce the reliability of decisions made based on these models. Third, potentially misusing AI's predictive models can lead to data privacy violations and other unintended consequences. Fourth, ethics washing is risky in the AI-based ESG process. ESG assessment procedures are implemented more as a formality based on a checklist rather than a real effort to address ethical concerns. Fifth, due to the unstandardized ESG metrics used by organizations, assessing AI's ethical adherence in ESG reporting is challenging. Lastly, the existence of multiple frameworks and standards governing AI tool usage can lead to inconsistencies in ESG reporting and accountability challenges. These points underscore the need for further research and development of objective metrics to ensure that AI systems used in ESG reporting are ethically sound and aligned with human values (Ayling & Chapman, 2022; Lim, 2024; Palumbo et al., 2024).

Table 1 summarizes AI benefits, applications, challenges, and ethical considerations in leveraging AI for ESG reporting and assurance.

Table 1 Summary of AI Benefits, Applications, and Challenges in ESG Reporting and Assurance

Category	Key Points
Benefits	• Enhances data accuracy, completeness, and reliability in ESG reporting. • Improves transparency, credibility, and real-time ESG risk management. • Streamlines data collection and processing, reducing manual workload and costs. • Identifies complex patterns and anomalies that humans may miss. • Enhances visualization and communication of ESG information to stakeholders. • Supports proactive risk and opportunity identification through continuous monitoring and assurance processes.
Applications	• Adoption of Natural Language Processing (NLP) for automated data extraction and interpretation in ESG ratings and reporting. • Implementation of Robotic Process Automation (RPA) and Optical Character Recognition (OCR) in auditing processes. • Integration of Internet of Things (IoT) and satellite imagery for real-time ESG assurance. • Application of Audit 4.0 for continuous ESG data collection and monitoring. • Automating stakeholder sentiment analysis for targeted ESG communication.
Challenges & Ethical Considerations	**Technical & Methodological Challenges:** • Data privacy, consistency, and quality issues due to large, diverse datasets. • Lack of standardized ESG metrics, causing inconsistency and methodological difficulties. • Computational resource constraints and difficulty managing new AI tools. **Behavioral & Ethical Concerns:** • Potential biases and unfairness in AI models leading to discriminatory outcomes. • Transparency and explainability issues affecting stakeholder trust. • Risk of AI misuse, privacy violations, and ethics washing. • Divergent international frameworks causing inconsistency in ESG reporting standards and accountability.

5. Preparing for Leveraging AI in ESG Reporting and Assurance

This section explores the necessary preparations for SSAs and other accounting professionals and academia to integrate AI in ESG reporting and assurance. Specifically, to fully leverage AI in ESG reporting and assurance, SSAs must consider several steps as follows. First, SSAs must understand relevant ESG standards and frameworks to guide AI's development, implementation, and governance in ESG reporting and assurance. Second, SSAs must understand AI concepts and techniques relevant to ESG reporting and assurance. This includes data analytics, machine learning, and AI auditing. SSAs and their organizations must invest in education and training programs for SSAs to effectively utilize AI tools in the ESG domain and address ethical considerations. Professional certifications and training programs can help SSAs acquire the necessary skills and knowledge. In addition to AI knowledge, SSAs must build digital literacy, which includes data management tools, software platforms, and digital reporting frameworks. Next, SSAs must collaborate with other stakeholders in the AI-driven ESG domain, such as technology developers and regulators, to address challenges and enhance the benefits of AI usage in ESG. Collaboration and knowledge sharing among accounting and auditing professionals are crucial for adopting AI in ESG assurance.

Furthermore, SSAs should support human-AI collaboration in which AI enhances human capabilities rather than replace human judgment with AI. Staying informed of the latest developments in AI and ESG is essential. Therefore, SSAs should consider reviewing industry publications, attending conferences, and engaging with professional networks to gain insights into emerging trends and best practices. Lastly, understanding the ethical implications of AI in ESG assurance is necessary for all accounting professionals and academia. This includes addressing potential algorithm biases, ensuring data privacy, and promoting responsible AI usage.

6. Conclusion

In conclusion, integrating AI within the ESG domain enhances the accuracy, efficiency, effectiveness, and transparency of the ESG reporting and assurance process. AI-driven ESG reporting and assurance can help firms and stakeholders make more informed decisions about corporate ESG performance. However, AI users need to address the challenges of AI algorithm bias, the black box process of the AI model, and other ethical considerations to ensure the long-term sustainability of the AI-based ESG approach.

As for the accounting profession, SSAs must understand the capabilities and limitations of AI technologies and the potential risks and challenges associated with AI implementation. In addition, SSAs should be aware of the importance of the transparency and accountability of the AI-based ESG approach. SSAs must collaborate closely with professionals from other fields, such as data scientists and IT professionals, to develop a more comprehensive framework for the AI-driven ESG process. To be specific, SSAs should actively engage in the development and implementation of AI tools used in the ESG reporting and assurance process by contributing their expertise in financial

reporting, data analysis, auditing, and risk management to help design and test the AI systems to ensure they are aligned with ESG accounting practices and regulations. Furthermore, SSAs should stay informed about regulatory updates and emerging technologies and acquire relevant knowledge and skills for competitive advantage.

This article does not provide an exhaustive discussion on the role of AI in ESG reporting and assurance, nor does it cover every aspect that SSAs should consider when leveraging AI tools in the ESG accounting domain. Nonetheless, the author hopes these insights will raise awareness and spark interest among SSAs, other accounting professionals, and academia in adopting AI and other emerging technologies to enhance ESG reporting and assurance—especially as standards and frameworks continue to evolve in response to technological advancements.

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