



ARTIFICIAL INTELLIGENCE AS A CATALYST OR IMPEDIMENT TO SUSTAINABILITY REPORTING, AND THE SUSTAINABLE DEVELOPMENT GOALS

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ABSTRACT

The purpose of this paper was to examine whether Artificial Intelligence (AI) is a catalyst or impediment to sustainability reporting, and the Sustainable Development Goals (SDGs) based on the review of extant literature. Basically, AI has gained traction and importance in supporting sustainability reporting, and helping in the implementation and attainment of the 17 SDGs by 2030 and the African Union's Agenda by 2063. AI is redefining the efficiency, accuracy, and depth of corporate and sustainability reporting. New AI technologies are helping to transform sustainability reporting from a compliance-focused activity into a strategic value-creation tool, and from a retrospective exercise into a proactive, evidence-based accountability mechanism, improving ESG reporting and performance, and supporting sustainable business practices. Besides, AI-technologies are enablers of sustainable development and in the contexts of supporting net zero, climate change mitigation, renewable energy integration, and efficiency, intelligent transportation and mobility, waste management, and circular economy, among others. However, the core challenges and impediments of AI include the availability, quality, and privacy of data, bias and fairness of AI algorithms, high energy consumption of AI systems, bias, cost and implementation, governance issues and regulatory complexities, need for human oversight, lack of standardized metrics and frameworks, risk of greenwashing, discrimination of women and vulnerable persons, job



displacement among others. The paper concludes by highlighting the measures organizations and governments can take in order to realize the full potentials and benefits of AIs for sustainability reporting and the SDGs.

Keywords: *Artificial Intelligence, sustainability, sustainability reporting, SDGs, catalyst, impediments, challenges*

INTRODUCTION

Artificial Intelligence (AI) is commonly described as "the use of computational machinery to emulate capabilities inherent in humans, such as doing physical or mechanical tasks, thinking, and feeling" (Huang & Rust 2021). The introduction of AI is attributed to John McCarthy in 1956, during the early years of computer science. In the early twenty-first century, advances in technology have dominated, along with improved data quality and accessibility, transforming AI into a powerful tool capable of real-time learning and pattern identification. In today's rapidly evolving digital landscape, AI is no longer a futuristic concept but an active participant in reshaping professional practices. Within accounting and related disciplines, AI now performs tasks once reserved for humans, minimizing human error, accelerating decision-making, and streamlining processes with remarkable precision. The explosion of AI-related scholarship in recent years mirrors this swift technological ascent (Burström et

al., 2021; Kanbach et al., 2024; Mariani et al., 2022). The SDG Report of 2025 argues that advances in technology is a veritable potential to enhance human wellbeing and advance the SDGs (Sachs et al.,2025). Hence there is call on governments and policymakers in the common agenda to commit and collaborate with scholars and civil society to establish legal, regulatory, and ethical frameworks for AIs to direct innovations towards the common good. The AI helps to understand and prioritize our efforts to achieve the complex, dynamic and interconnected SDGs.

There is need for unprecedented collaboration to leverage the power of AI to achieve the SDG. Sabeena (2025) argues that governments are using AIs to achieve two main goals: improve efficiency and achieve financial gains across various sustainability sectors; integrate technology into business, achieve operational efficiency, achieve sustainability in all its forms, and help in holistic planning for social fairness, economic growth and environmental control. Galaz et al. (2021) and Olawade et al. (2024) posit that various AI-technologies such as robotics, internet of things,



and digital twins are increasingly being used for effective climate change mitigation action, robust farming practices, and Earth system modelling, augmented environmental monitoring, improved transparency in supply chains, tracking of illegal wildlife trade, and smart urban planning for sustainable development. They are used for resource allocation optimization, to enhance decision-making, and drive efficiency across various sectors, in order to enable a more sustainable and climate-resilient future. AI technologies have high impacts for sustainability in agriculture or farming, forestry and extraction of marine resources. Similarly, Regona et al. (2024) found that “AI can potentially transform the construction industry and contribute to the sustainability consideration processes in a more efficient and resilient ways. However, they argued that realization of the full potentials is hinged on addressing the ethical, data privacy and security concerns, and careful implementation and management.

The scoping review by Pimenow et al. (2025) using case studies from Africa, Asia, Europe and Latin America found that AI tools of machine/deep learning, IoT, large language models (LLMs) enhance an efficient, adaptive and sustainability of local and regional ecosystems. They find increasing

use of AIs in supporting local sustainable development in education, health and social inclusion, transforming local energy systems, assessing and management of ecosystems, carbon and environmental monitoring, assessing vulnerability, ecosystem change forecasting and sustainable agriculture. There are far-reaching impacts of AIs, observing its growing influence not only within traditional sectors but also in new and evolving domains (Larsson et al., 2019; Rantala et al., 2023). The widening scope of AI underscores the need to examine AI as a cross-cutting phenomenon that transcends industrial boundaries (Gupta et al., 2021). Simultaneously, the global push toward responsible and sustainable business practices have intensified. Stakeholders, ranging from investors to regulators, and the public are increasingly demanding that corporations to disclose the environmental and social footprints of their operations. As a result, sustainability reporting has evolved from being a mere compliance exercise to a strategic imperative, influencing both corporate reputation and investment decisions. Amidst this shifting landscape, AI stands out as a transformative enabler. From automating the gathering of environmental, social, and governance (ESG) data to producing predictive analytics that forecast sustainability outcomes, AI



has the potential to redefine the efficiency, accuracy, and depth of corporate reporting (Grewal et al., 2021). Yet, this promise and potential of AI is not without peril. The opaque nature of many AI systems, coupled with biases, data integrity issues, and governance limitations, raises critical questions about the transparency, inclusivity, and trustworthiness of AI-driven disclosures (Binns, 2018; Mittelstadt et al., 2016). Dhiman et al. (2024) reviewed AI and sustainability and found that despite the potentials of AI, concerns about its potential negative impacts such as high energy consumption and ethical challenges. Although, many researchers have examined the benefits and challenges of AI on sustainability, a research gap exists in relation to the impacts of AI on sustainable reporting and sustainable development goals (SDGs) that requires further investigation (Dhiman et al., 2024). Therefore, the purpose of this paper is to examine whether AI is a catalyst or impediment to sustainability reporting, and the SDGs. The rest of the paper is structured into six sections as follows. The immediate section presents the methodology adopted in the paper to select and analyze extant peer-reviewed literature and other materials on the subject matter and the various concepts of interest. Section three reviews the literature

on AI as a catalyst to sustainability reporting, and the SDGs, as well as the roles of AI's in reducing GHG emissions, climate change mitigation, and ensuring assurance in climate reporting. Section four dwells on prospects and pitfalls of the use of AI technologies such as the natural language processing, deep/machine learning, internet of things, and blockchains on sustainability reporting and the SDGs. Section five considers AI as an impediment and limitation to sustainability reporting and the SDGs, and the counter-arguments regarding AI's limitations in the sustainability contexts. Section six explores how to address challenges and limitations associated with AI's use and misuse in order to harness the benefits and potentials of AI in sustainability reporting and the SDGs. Section seven is the conclusion.

Materials and Methods

This paper employs the structured narrative literature reviews to synthesize recent academic and institutional researches on AI and sustainability reporting published between 2020 and 2025 (O'Connor et al., 2025). A narrative synthesis is particularly suited to this inquiry, given the interdisciplinary and largely conceptual nature of the topic, which draws on accounting, information systems, sustainability governance, and applied ethics



(Greenhalgh et al., 2018). The literature was sourced from established academic databases, including Scopus, Web of Science, and Google Scholar, alongside authoritative and institutional publications by organizations such as the European Commission, the United Nations, World Bank, World Economic Forum (WEF), and other leading sustainability organizations such as the SASB, GRI, ISSB among others. The research was guided by the current state of the literature on AI with regard to sustainability reporting and sustainable development.

The search terms combined key concepts such as artificial intelligence, sustainability reporting, ESG disclosure, ethical AI, climate reporting, impediments, challenges of AI, and digital governance. The studies were selected on the basis of their relevance to sustainability reporting, analytical robustness, and explicit engagement with the opportunities or limitations associated with AI adoption. The review adopted a thematic synthesis approach instead of statistical aggregation or meta-analysis. The literature review was organized into analytically coherent themes, including AI as a catalyst for sustainability reporting, ethical and technical constraints, comparative capabilities and constraints of AI technologies, governance and regulatory challenges and other

impediments, and practical implementation issues associated with the adoption of AI for sustainability. This approach supports theory development and critical reflection in a research area where empirical findings remain fragmented and rapidly evolving.

Artificial Intelligence (AI) as a Catalyst for Sustainability Reporting

New AI technologies are playing an increasingly critical role in transforming sustainability reporting from a compliance-focused activity into a strategic value-creation tool. By enabling real-time data collection, automated reporting, predictive analytics, and verifiable disclosures, these technologies are helping organizations to meet the growing demands of investors, regulators, and civil society for credible and forward-looking sustainability information (Bickley et al., 2024; Martini et al. 2024; Siddik et al. 2025). The latest AI's evolution, generative AI, has moved from mere computation to creativity, redefining how organizations converse with data, uncover meaning, and envision strategy and enhancing ESG reporting (Wu et al. 2025). The integration of advanced digital tools, such as AI, blockchain, Internet of Things (IoT), cloud computing, and big data analytics, has significantly enhanced the



accuracy, transparency, and timeliness of sustainability reporting. These technologies are not only transforming traditional corporate reporting frameworks but also enabling organizations to align their disclosures with globally recognized standards such as the GRI, SASB, and the IFRS Sustainability Disclosure Standards introduced by the International Sustainability Standards Board (ISSB).

The systematic review by Mustafa et al. (2025) provides “fresh insights on the roles of AIs in enhancing ethical, transparent and effective ESG disclosures”. They advocated for “stronger theoretical and practical frameworks to effectively leverage AI’s capabilities in sustainability reporting” (Alkaraan et al. 2024). Nishant et al. (2020) and Vinuesa et al. (2020) highlighted AI’s growing ability to transform sustainability reporting. By collecting information from IoT sensors, social media, and vast external databases, AI can link together insights that were once scattered and hard to access (Wamba et al., 2021). AI provides real-time intelligence for ESG reporting, turning static snapshots into living systems of accountability. Yang and Yang (2025) found that AI improves ESG performance through three pathways of “financing constraint alleviation, external oversight

enhancement, and information disclosure improvement”. Bickley et al. (2024) and Kar et al. (2022) noted that the synergy between AI and corporate sustainability is not just an academic curiosity but a frontier where technological intelligence meets moral responsibility; and where the future of responsible business is being written in real time. Correia and Água (2024) see the benefits from the use of AI for ESG reporting to include: “improved decision-making through better data quality, predictive insights into sustainability practices, and enhanced stakeholder engagement via dynamic reporting formats”. AI’s predictive capabilities allow companies to look beyond the rear-view mirror. It can model potential climate risks, forecast energy consumption, and simulate carbon emission patterns (Chatterjee et al., 2021), empowering organizations to anticipate rather than merely react. The predictive power of AI has also transformed sustainability from a backward-looking exercise into a forward-thinking discipline. AI is also redefining how sustainability narratives are written. Tools powered by AI can align company-specific data with global frameworks, such as the Global Reporting Initiative (GRI), Sustainability Accounting Standards Board (SASB), and the Task Force on Climate-related Financial



Disclosures (TCFD), to ensure both compliance and consistency (Lee et al., 2025). AI's influence stretches even further: it enhances auditability and combats greenwashing by detecting anomalies and inconsistencies in ESG data (De George et al., 2022). Embedded within regulatory technologies (RegTech), AI ensures that firms meet the fast-evolving demands of disclosure regimes, while blockchain integration reinforces data integrity by making sustainability claims verifiable and tamper-proof. Across production lines and global supply chains, predictive algorithms can balance supply and demand, cut waste, reduce emissions, and streamline logistics (Arinez et al., 2020; Singh et al., 2022).

It is no longer merely a compliance ritual but a living system of accountability, one that reflects how deeply an organization understands and interacts with the world it inhabits. The rise of digital technologies such as AI, blockchain, IoT, cloud computing, and big data analytics has turned sustainability reporting into an instrument of strategic foresight. These tools enable real-time monitoring, verifiable disclosures, and predictive insights that help businesses speak truthfully about their environmental and social impact while aligning with global standards such as GRI, SASB, and

the ISSB frameworks. The AI applications reduce waste, conserve natural resources, and minimize greenhouse gas emissions. Furthermore, AI is instrumental in strengthening environmental data collection, analysis, and reporting, which are central to measuring progress toward the ESDGs. AI tools, especially machine learning and natural language processing algorithms, are used to extract ESG data from various sources, including corporate sustainability reports, regulatory filings, and academic databases. This has been especially useful in advancing standardized reporting aligned with global frameworks such as GRI and TCFD (Deloitte, 2023). Through such automation, organizations can more effectively track their contributions to ESDGs and ensure accountability in their environmental impact.

AI could help redefine what it means for a company to be sustainable: not merely compliant or efficient, but genuinely intelligent in how it perceives, predicts, and protects the world it inhabits. In essence, AI is not just improving sustainability reporting; it is transforming it into a living, adaptive system that reflects both human values and technological foresight. It enables businesses not only to describe the present but to anticipate the future, forging a new covenant between innovation and accountability. Naveed et al. (2025)



examine the impact of adopting AI on the quality of corporate sustainability reporting of Chinese companies from 2015 to 2022 given the moderating roles of sustainability and specialist ESG committees. They found that AI adoption promotes overall sustainability reporting quantity and pillar-specific ESG disclosure quality with the sustainability committee playing a positively strategic role in the dynamic.

Artificial Intelligence as a Catalyst for Achieving the Sustainable Development Goals (SDGs) or the 2030 Agenda

Artificial Intelligence (AI) has evolved from a symbol of futuristic innovation into a driving force for present-day transformation, reshaping how humanity approaches one of its most urgent missions: achieving the SDG under the 2030 Agenda. Artificial Intelligence (AI) is a transformative force in the global pursuit of the United Nations SDGs, particularly the environmental-focused SDGs (commonly referred to as ESDGs). These include SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), SDG 14 (Life Below Water), and SDG 15 (Life on Land).

As the global community evaluates progress toward these goals, AI is increasingly being recognized as a powerful enabler capable of accelerating their implementation through enhanced data capabilities, decision-making, and monitoring frameworks. AI-enabled smart cities can reimagine urban life, advancing circular resource use, optimizing energy systems, and even anticipating catastrophic risks before they unfold (WEF, 2017).

According to Microsoft Corporation (2025), AI is the “latest and potentially most powerful general purpose technology offering an unprecedented opportunity to drive societal transformations we urgently need to achieve the world’s sustainability goals”. AI is an enabler of sustainability as it addresses the complexities of sustainability such as managing energy grids, improving resource use, and protecting the ecosystem from biodiversity loss; speeds up innovations to develop sustainability solutions and empowers sustainability workforce with tools and knowledge to deliver the sustainability solutions. AI is helping energy transition to net-zero and climate risk management. AI supports ESDG advancement through real-time environmental monitoring and predictive analytics. AI-powered systems utilize data from satellites, drones, and Internet of Things (IoT) devices to monitor



pollution levels, deforestation rates, water quality, and carbon emissions. These technologies enable early detection of environmental threats and provide actionable insights for policymakers and environmental regulators (Rolnick et al., 2022). For instance, AI algorithms trained on climate data can predict extreme weather events, allowing communities and governments to better prepare and respond to climate-related disasters, thereby advancing SDG 13 (Climate Action) and SDG 11 (Sustainable Cities).

AI also plays a pivotal role in enhancing sustainable resource management, particularly in agriculture, water use, and energy systems. Precision agriculture powered by AI helps farmers reduce water and fertilizer usage while maximizing yields, aligning with the goals of SDG 2 (Zero Hunger) and SDG 12 (Responsible Consumption and Production). Similarly, AI is applied to optimize energy consumption in buildings and smart grids, improving energy efficiency and supporting the achievement of SDG 7 (Affordable and Clean Energy). Specifically, AI supports the achievement of sustainable construction industry through the promotion of SDG 6,7,8,9,11,12,13,15 and 17 in the construction project phases of planning, design, construction, and operation and maintenance (Regona et al., 2024).

AI technologies are enablers of sustainable development in the context of climate change, support net zero, climate change mitigation, renewal energy integration and efficiency, intelligent transportation and mobility, waste management and circular economy. The technologies ensure a more reliable and efficient transition to low-carbon energy system and more sustainable and climate resilient future (Olawade et al.2024). According to Chen et al. (2021), smart AI manufacturing processes help to reduce energy consumption, waste, and carbon emissions by 30–50%. Also, Di Vaio et al. (2020) reported that AI helps to carbon footprints in Agribusiness. Common AI algorithms revolutionizing the construction industry include; data and predictive analyses, AI-driven automation, computer vision technology, early error detection, real-time analysis, robotics and autonomous machinery. According to Chen et al. (2022), key AIs used to promote SDGs in the construction industry include: environmental (energy optimization, material selection, waste management, renewable energy integration, environmental impact assessment, green building design), social (safety monitoring, labour optimization, training and development, community engagement, diversity and inclusion) and economic (project



planning, cost estimation, supply chain optimization, productivity monitoring, predictive maintenance, performance analysis).

AI is driving sustainable development in the African contexts. For instance, the integration of AI in urban planning and public transportation systems in Johannesburg, South Africa (Domingo et al.,2024); AI in water resource management in Africa and the United States (Olatunde et al.,2024), AI in the healthcare sector aiding diagnosis and patient management (Alshamrani,2022). Similarly, the African Union (AU) see the potentials of AI in the achievement of Agenda 2063 and the SDGs, as well as Africa's socio-economic transformation and cultural renaissance (AU,2024). Mienye et al. (2024) found that AI techniques are transforming various sectors and advancing significant sustainable development in areas crucial for economic growth, social equity, and environmental sustainability across Africa, despite the challenges. Gailhofer et al. (2021) found the deployment of AI would promote the goals of the EU green deal

.In developing countries such as Nigeria, and other sub-Saharan African nations, AI is being piloted to address data gaps that have long hindered environmental policy implementation. Projects focused on climate-smart agriculture, clean

energy distribution, and deforestation mapping illustrate the potential of AI to localize and scale ESG efforts. Although infrastructure and digital literacy challenges remain, AI is helping bridge the capacity divide by delivering data-driven solutions in remote or underserved areas (Adebayo & Ogunleye, 2021). For developing nations such as Nigeria and other countries across sub-Saharan Africa, AI is unlocking new opportunities to bridge historical data gap (Meinye et al.,2024). Whether through climate-smart agriculture, off-grid energy analytics, or forest mapping, AI is helping translate sustainability ambitions into localized, data-driven action (Adebayo & Ogunleye, 2021).

In regions where access to information and infrastructure remains uneven, AI is emerging as a quiet equalizer, empowering local communities to monitor, adapt, and innovate. Beyond systems and sensors, AI's most profound impact may lie in how it transforms environmental governance itself. By democratizing access to environmental data, AI fosters transparency and inclusion, key tenets of the 2030 Agenda. Citizen science platforms and AI-driven Chatbots allow individuals to report deforestation, illegal mining, or pollution events in real time, bringing environmental



accountability to the grassroots level. However, this technological awakening is not without paradox. The very systems designed to safeguard the planet consume vast computational energy. The algorithms that promise fairness can replicate bias if left unchecked. As the UN's 2023 SDG Progress Report warns, AI's environmental promise must be tempered by ethical vigilance, ensuring that digital intelligence serves humanity without widening the divides it seeks to close (UNs,2023).

Importantly, AI contributes to inclusive and participatory environmental governance, a principle that underpins the 2030 Agenda. By democratizing access to environmental information and enabling citizen science initiatives, AI-powered platforms empower communities to take part in environmental decision-making. For example, AI chatbots and open-source platforms allow local stakeholders to report pollution incidents or illegal deforestation, strengthening environmental enforcement mechanisms. Nevertheless, while AI presents immense opportunities, it also raises ethical and governance concerns. The environmental cost of training large language models, issues of data privacy, algorithmic bias, and the digital divide can exacerbate existing inequalities if not properly managed. The 2023 SDG Progress

Report warned that leveraging AI for sustainable development requires not only investment in digital infrastructure but also a commitment to ethical AI governance, inclusive data practices, and human-centered innovation (UNs, 2023). Of course, these advances bring challenges of their own. The sustainability of AI itself, its energy use, data requirements, and hardware waste, demands vigilant management. Likewise, achieving meaningful interoperability between data systems remains a crucial hurdle.

Ultimately, AI serves as both a catalyst and enabler of progress toward the 2030 SDG targets, through enhanced data intelligence, automation of sustainability reporting, and precision environmental interventions. In particular, AI stands at the epicenter of this transformation. As the global community progresses towards 2023, it has become increasingly clear that AI is not just a supporter of environmental goals but their accelerant. Through its unmatched capacity for data integration, pattern recognition, and predictive reasoning, AI is quietly weaving intelligence into the fabric of global sustainability governance. AI provides a technological pathway to accelerate the achievement of environmentally focused SDGs. However, the full potentials of AI can only be realized if its



deployment is inclusive, ethically governed, and aligned with the broader goals of sustainability, equity, and resilience.

AI's Role in Reducing GHG Emissions and Climate Change Mitigation

One of the most impactful contributions of AI to the climate change agenda lies in the measurement, reporting, and verification (MRV) of greenhouse gas (GHG) emissions. Accurate reporting of Scope 1 (direct), Scope 2 (indirect from energy), and Scope 3 (indirect from value chains) emissions is essential for companies to comply with sustainability standards such as the Task Force on Climate-related Financial Disclosures (TCFD) and IFRS S2 Climate-related Disclosures. Artificial Intelligence (AI) can significantly support climate change mitigation and adaptation reporting, a central area of the climate change agenda under SDG 13: Climate Action, by enhancing the quality, credibility, and timeliness of sustainability disclosures related to greenhouse gas (GHG) emissions and climate risk. However, traditional GHG reporting has been hampered by inconsistent data sources, estimation errors, and a lack of real-time information. AI addresses these challenges by enabling more precise, scalable, and

automated climate data management systems.

Machine learning algorithms can analyze large datasets from IoT sensors, satellite imagery, utility bills, transportation logs, and supply chain records to detect and estimate carbon emissions across facilities and operations. For instance, AI systems can track fuel consumption, manufacturing outputs, and electricity usage to calculate carbon footprints with a level of precision not achievable through manual methods (Rolnick et al., 2022). This real-time monitoring supports companies in updating their emissions inventories more frequently and aligning their reports with international benchmarks such as GRI 305 and the Science-Based Targets Initiative (SBTi). One of AI's greatest contributions lies in its ability to see the unseen. AI-powered satellites and IoT networks can track water quality, deforestation, pollution, and carbon emissions in real time, giving regulators and policymakers a living dashboard of the planet's health (Rolnick et al., 2022). By detecting anomalies before they spiral into crises, AI helps protect both ecosystems and economies. Smart energy grids infused with AI learn to distribute power where and when it's needed, optimizing consumption and reducing emissions, a step closer to the ideal of circular, regenerative economies. The power



of AI also extends into the invisible realm of data interpretation.

AI enhances the granularity and traceability of emission data, especially for Scope 3 emissions, which are often the most complex to quantify due to their dependence on third-party data. By leveraging natural language processing (NLP), AI can extract emissions-related disclosures from suppliers' sustainability reports, regulatory filings, and news articles. This supports a more complete picture of value-chain emissions, which is critical for comprehensive climate change disclosures. AI also facilitates the forecasting of emissions trends and the simulation of decarbonization scenarios. Predictive analytics tools allow companies to model how changes in production methods, energy sources, or logistics strategies would affect their carbon footprint over time. These simulations are vital for integrating climate risk into long-term business planning and for disclosing forward-looking statements in line with TCFD and ISSB requirements. Through the NLP, AI distills meaning from the noise, assembling sustainability dashboards that evolve as the world does (Deloitte,2023).

Companies no longer wait for quarterly updates; they can see, almost in real time, how their decisions ripple through the environment and society. Machine

learning goes further, uncovering trends hidden deep within data, anticipating climate risks, benchmarking corporate performance, and guiding strategy long before problems appear at the surface. In this digital ecosystem, blockchain adds a new dimension: trust. By recording ESG data on tamper-proof ledgers, it anchors sustainability claims in verifiable evidence (Tapscott & Tapscott,2020). Supply chains, once opaque, become transparent stories of accountability, where every ethical sourcing decision or carbon offset can be traced from origin to outcome. This level of integrity is redefining expectations in industries like mining, agriculture, and fashion, where stakeholder skepticism is highest and reputation is currency.

The measurement, reporting, and verification (MRV) of greenhouse gas (GHG) emissions has long been plagued by inconsistencies and lagging data. AI changes this narrative entirely. By analyzing streams of information from IoT sensors, satellite imagery, utility data, and transport logs, AI can estimate Scope 1, 2, and 3 emissions with unprecedented accuracy (Rolnick et al.,2022). Imagine algorithms that can detect shifts in fuel usage, model factory-level emissions, or read between the lines of supplier reports to fill missing data, offering a real-time pulse of



corporate carbon footprints. NLP-powered systems can scan global disclosures to trace indirect (Scope 3) emissions, long considered the most elusive component of climate accountability. The result is a level of transparency that turns compliance into foresight. Even more powerful are AI's predictive capabilities. Through scenario modeling, companies can simulate the long-term impact of new energy policies, production methods, or supply chain adjustments, testing decarbonization strategies before implementing them. The models assist firms in crafting forward-looking climate statements aligned with frameworks such as TCFD, ISSB, and the Science-Based Targets initiative (SBTI). In essence, AI is transforming sustainability from a static snapshot into a living dialogue between technology, ethics, and the environment. It enables companies not only to measure what matters but to imagine what is possible, to move from reporting footprints to reshaping them. If wielded wisely, with transparency, inclusivity, and ethical intent, AI can help build a future where sustainability is not just documented but dynamically achieved: a world where data becomes conscience, and intelligence becomes stewardship.

AI and Assurance of Sustainability Reporting

The call for strong ethical frameworks and independent assurance has never been louder. AI's transformative power highlights the relevance of AI for sustainable business models (SBMs) to meet SDGs, especially SDG 12 (Di Daio et al., 2022), and humanity's most urgent frontiers, climate change mitigation and adaptation, particularly under SDG 13 on climate action. Artificial Intelligence (AI) is quietly reshaping how assurance is delivered in climate-related financial disclosures. Audit firms now deploy AI systems to verify the internal consistency and external accuracy of emissions data presented in corporate sustainability reports. This digital shift has begun to restore trust in climate reporting by reducing manual verification errors, detecting data manipulation, and offering real-time anomaly alerts. As a result, investors, regulators, and other stakeholders can engage with ESG disclosures grounded in verifiable evidence rather than aspirational claims. By tightening the loop between data integrity and transparency, AI helps minimize the reputational and financial risks associated with greenwashing, a growing concern in the sustainability assurance landscape. AI's contribution to the climate change agenda, therefore,



extends beyond data automation; it redefines credibility. AI transforms sustainability reporting from a retrospective exercise into a proactive, evidence-based accountability mechanism through intelligent forecasting, continuous analytics, and precision-driven verification. Companies are now better equipped to anticipate regulatory scrutiny, adapt to evolving disclosure standards, and align their climate narratives with measurable progress.

1. The Prospects and Pitfalls of AI Technologies in Sustainability Reporting, and SDGs

Artificial Intelligence is quietly revolutionizing the sustainability landscape, transforming environmental, social, and governance (ESG) reporting from a slow, fragmented process into a living, intelligent system of accountability. Where spreadsheets and manual audits once struggled to keep pace with the speed of global change, AI now acts as both architect and interpreter, building real-time pictures of corporate impact and translating complexity into clarity. AI's strength lies in its ability to listen, to parse unstructured data scattered across financial statements, news feeds, social media, and regulatory filings. When paired with global cooperation, inclusive governance, and transparent reporting, AI has the

potential to turn the world's sustainability goals from aspirational targets into living, adaptive systems of planetary care. In this sense, AI is not just a catalyst for achieving the ESDGs; it is a mirror reflecting our collective capacity to harmonize intelligence, innovation, and integrity in pursuit of a resilient and regenerative world.

Artificial Intelligence (AI) technologies such as natural language processing (NLP), machine and deep learning (ML), block chain, IOT, big data and cloud computing are playing pivotal roles in automating data collection, classification, and analysis of environmental, social, and governance (ESG) metrics. AI-powered tools can extract relevant sustainability information from unstructured data sources such as financial statements, news reports, and regulatory filings using NLP. This enables organizations to generate real-time ESG dashboards and sustainability disclosures that are both timely and scalable (Deloitte,2023). NLP technologies excel at processing large volumes of qualitative information but often struggle with contextual interpretation, cultural nuance, and implicit social meanings embedded in sustainability narratives. NLP technologies can read, synthesize, and harmonize qualitative disclosures from across the



corporate world, lending comparability and coherence to what was once a fragmented reporting landscape (Yu et al., 2020). The challenges involved with the NLP include the issue of data quality, high cost of implementation, resources intensive, and high sensitive to inconsistent, non-structured corporate disclosures, inability to detect greenwashing, difficult to interpret complex, qualitative narratives, and false positive through over-estimation of alignment (Anaraki et al., 2025).

Furthermore, ML algorithms are used to predict environmental trends, assess climate-related risks, and benchmark corporate sustainability performance, thus informing strategic decision-making. They are particularly effective in identifying patterns and generating predictions, yet their performance is highly sensitive to data quality. Machine learning models forecast climate risks, carbon emissions, and resource consumption patterns (Chatterjee et al., 2021), enabling businesses to prepare rather than react. These models can even map supply chain vulnerabilities or estimate the financial materiality of environmental liabilities (Floridi & Cowls, 2019), allowing firms to balance risk with resilience. Machine learning models trained on

climate data can anticipate droughts, floods, and heatwaves, strengthening community resilience and advancing SDGs 11 and 13 on sustainable cities and climate action. Equally transformative is AI's role in resource stewardship. In agriculture, precision systems now guide farmers to use just enough water, fertilizer, and energy, maximizing yields while minimizing waste. In doing so, they bring SDG 2 (Zero Hunger), SDG 7 (Clean Energy), and SDG 12 (Responsible Consumption and Production) into sharper reach.

In the context of sustainability reporting, the deep learning and ML's weaknesses include incomplete or poorly standardized ESG datasets can introduce bias and compromise analytical reliability (Chatterjee et al., 2021), the problem of environmental footprint or the AI Green Paradox occurs where high energy consumption requires to train and run ML models offsets environmental goals or benefits. Other challenges of the ML models include; accounting for AI's unpredictable nature and the constant fluctuating human behavior or the variance bias shift (Nishant et al. 2020), explainability and transparency, and the black box problem, algorithmic bias and disinformation, lack of contextual understanding, scalability and high dimensionality of data; ethical and privacy risks, interpretability of



complex AI algorithms among others (Fan et al.,2023; Koundouri et al.2025; Mustafa et al.,2025). Fan et al. (2023) argue that only by addressing the challenges, and a responsible use DL/ML model use in sustainability would significantly contribute to a more sustainable future. Through NLP and ML, AI standardizes sustainability data in line with global frameworks such as GRI and TCFD (Deloitte, 2023), creating coherence in a field often clouded by inconsistent definitions and fragmented reporting.

Blockchain technology enhances trust and accountability in sustainability reporting by creating immutable records of ESG data. Through distributed ledger systems, companies can verify supply chain sustainability claims (e.g., ethical sourcing, carbon offsets) and ensure traceability of environmental footprints across production networks (Tapscott & Tapscott, 2020). This is particularly valuable in industries such as agriculture, mining, and fashion, where sustainability claims often face scrutiny from stakeholders and regulators. Although Blockchain-integrated AI systems help to improve data integrity and traceability, particularly within complex global supply chains, the technologies raise additional governance, scalability, and energy-consumption concerns, which must be carefully managed to ensure that

their use does not undermine broader sustainability objectives (Tapscott & Tapscott, 2020). The challenges of blockchain include high technical implementation cost, and high energy consumption for certain mechanisms like “Proof-of-work”, low transaction speeds, limited scalability for supply chain tracking, data privacy issues, and lack of standardized reporting (Boçe & Hoxha,2024; Mulligan et al.,2024).

Internet of Things (IoT) help in achieving of the UN SDGS (López-Vargas et al.,2020) devices facilitate real-time monitoring of environmental parameters such as energy consumption, water usage, carbon emissions, and waste generation. These sensors, when integrated with cloud platforms and analytics tools, allow organizations to gather granular sustainability data at operational levels. The collected data feeds into sustainability reports and compliance submissions, especially for frameworks like the TCFD and GRI 302/305 standards on energy and emissions (IFAC,2022). The IoT extends AI’s reach from the boardroom to the factory floor and the field. Sensors now whisper continuous data about energy use, water flow, emissions, and waste (IFAC, 2022). The review by Alhashmi et al.(2025) shows “an upward trend in the use of IoT systems within sustainability domains”. The authors found that



IOT technologies have wide range of significant applications in monitoring agricultural sustainability and the environment, enhancing healthcare accessibility and preventive care, climate action and environmental sustainability and in achieving the SDGs 1,2,3,13,15,7. However, the challenges and weaknesses of IoTs for sustainability reporting, and the SDGs include; high initial implementation cost, inadequate infrastructure, high e-waste and energy (environmental footprint) from millions of significant energy consumption for data processing, security/privacy vulnerabilities, lack of standardization, scalability and interoperability, difficulty in data verification and shortage of technical skills (Alhashmi et al.,2025;Wahyudi et al.,2025) When coupled with cloud analytics, this constant stream of environmental intelligence feeds compliance frameworks such as TCFD and GRI 302/305, enabling a precision that sustainability reporting has long lacked. Big data and cloud computing then bring scale and perspective, integrating information from across continents, subsidiaries, and suppliers into unified sustainability narratives (PwC,2021). Big data solutions have numerous potential to enhance the “value, relevance, timeliness, and completeness of sustainability disclosures required by stakeholders

(Hussien et al.,2025). However, some of the challenges and weaknesses of BD analytics for sustainability reporting, and the SDGs include; inequality and bias, privacy and security risks, technical and resources constraints, credibility due to voluntary reporting framework, data fragmentation, poor data quality lack of standardization and interoperability, and lack of standardized metrics (Hussien et al.,2025 Kothinti,2024; Nilashi et al.,2023; Big data and cloud computing infrastructure support the aggregation and analysis of large volumes of ESG data from diverse internal and external sources. Companies can now store, process, and visualize sustainability performance across business units, regions, and product lines. Cloud-based reporting platforms also support collaborative stakeholder engagement by making sustainability reports accessible and interactive, thereby strengthening transparency and accountability (PwC,2021). Additionally, data visualization technologies and sustainability software platforms (e.g., SAP Sustainability Control Tower, Microsoft Cloud for Sustainability, and IBM Envizi) empower CFOs, sustainability officers, and investors to translate ESG performance into actionable insights. These tools not only enhance internal governance but



also facilitate external assurance and compliance with emerging sustainability disclosure regulations. The synergy between AI, blockchain, IoT, and data visualization tools has transformed sustainability from a reporting obligation into a governance philosophy. Platforms like Microsoft Cloud for Sustainability, SAP's Sustainability Control Tower, and IBM Envizi allow CFOs and sustainability officers to see impact as it happens, translating ESG metrics into actionable insights.

2. AI as an Impediment and Limitation to Sustainability Reporting, and Sustainable Development, and the Counter-Arguments

The deployment of AI technologies is a double-edged sword as AI technologies can enhance reporting credibility, and also obscure it. AI's expanding role in sustainability disclosure introduces a new set of technical, ethical, and institutional challenges that must be confronted if transparency is to remain meaningful. The digital renaissance of sustainability reporting comes with its shadows. Data quality gaps, incompatible systems, cybersecurity risks, and unequal access to technology, especially in developing regions, threaten to widen the divide between the digitally capable and the digitally excluded. Even more

pressing is the specter of “greenwashing 2.0,” where sophisticated tools might polish appearances rather than reveal truths. Kopka and Grashof (2022) found that AI/green technologies are negatively associated with energy consumption. Galaz et al. (2021) categorize the systemic risks or challenges associated with the use of AI-technologies for sustainability in farming, forestry and extraction of marine resources to include; “algorithmic (training data and transfer context, and interpretation) bias and allocative harms, unequal access and benefits, shocks, cascading failures and external disruptions, and trade-offs between efficiency and resilience”. The authors argued that “training data bias could emerge if AI-systems are designed with poor, limited, or biased data sets”, and transfer context bias could emerge when AI-systems are designed for one ecological, climate, or social-ecological context, and then incorrectly transferred to another. Regime shifts in ecosystems can also create bias. Interpretation bias can result where “an AI-system might be working as intended by its designer, but the user does not fully understand its utility, or tries to infer different meaning that the system might not support”.

AI plays a dual, paradoxical role, acting as an enabler and a limitation to sustainability reporting and the



SDGs. In fact, AI poses a double-edge sword to achieve genuine sustainability. For instance, Mancuso et al (2025) explored the bright and dark sides of AI innovation for sustainable development, examining the paradoxical tension and conflict that arise between sustainable value creation and sustainable value destruction. While attributing the causes to “predictable or unpredictable issues that arise during the design, development, or deployment of AI innovation”, the authors argued that sustainable value is created when the existing or newly introduced grand challenges are reduced or mitigated through automation of defining the problem’s “root cause” or “augmentation of firm’s capabilities”. AI can accelerate sustainable development, and it may exacerbate inequalities, environmental degradation and costs, and other unintended consequences (Mustafa et al.,2025; Zhou &Chen,2023) if ethical issues are ignored. The survey’s finding of Wang et al. (2025) revealed users’ large variations in their perception of ethical priorities and potentials of AI across the 17 SDGs. Therefore, the result highlights the need to incorporate users’ perspectives into the design and governance of AI for SDG context. Wakunuma et al. (2020) advocated the use of SWOT analysis to highlight and understand

the socio-economic implications- opportunities and challenges of using AI to advance SDG 3 in Least Developing Countries because of the potential issues around data privacy, transparency and accountability, and to avoid the incidences of mismanagement and misappropriation of personally collected health data for AI-based decisions.

Nutas (2024) has argued that over-reliance on AI technical solutions because of the fueled optimism that AI will tackle sustainability challenges, and undermining of ethical complexities “of justice, power relations, cultural values, and human and non-human dignity that shape sustainability challenges”, would result in the risks of “overlooking diverse values and epistemic hubris”. Despite the advances of AI, challenges persist such as issues relating to data quality, interoperability of systems, cybersecurity, and the digital divide, especially in developing economies, may hinder the widespread adoption of technology-driven sustainability reporting. The impediments which comprise the core challenges and ethical considerations of AI technologies for sustainability, ESG reporting, and the SDGs include; availability, quality, and privacy of data, bias and fairness of AI algorithms, energy consumption of AI systems, bias, cost and implementation,



governance issues and regulatory complexities, need for human oversight, lack of standardized metrics and frameworks, risk of greenwashing, discrimination of women and vulnerable persons, job displacement among others (AU,2024,Correia & Agua, 2024; Olawade et al.,2024).

AI can create intentional misinformation, gender bias, and exacerbate existing inequalities among women, minorities, and low-income groups, and massive electronic wastes (Hall & Ellis,2023; UNEP,2024). AI can enhance and also hinder or limit the following SDGs such as; results in high energy consumption (SDG 7, 13), exacerbates socio-economic inequalities (SDG 10), reinforces data bias impacting gender diversity and creating stereotypes (SDG 5), accessibility divide (SDG 2,10), and a lack of transparency which challenges rather than supports ethical reporting.AI limits sustainability reporting through data inaccuracy and opaqueness, resource intensive nature, fragmented integration and technology inequality, hidden costs and ethical risks among others (Mustafa et al.,2025;Wang et al.,2025).

1. Data quality and availability: AI thrives on high-quality data, but ESG information is often fragmented, incomplete, or inconsistent across jurisdictions.

When algorithms feed on weak or biased data, the outputs can mislead rather than enlighten. There is limited access to reliable environmental or social datasets, especially in developing economies. This restricts AI’s analytical depth, producing sustainability narratives that are more computational than contextual.

3. Algorithmic Bias and the “Black Box” Problem: AI systems learn from patterns embedded in data, which means they can easily replicate historical biases as revealed new insights. If trained on selective or skewed information, algorithms may unintentionally amplify disparities in sustainability evaluations, portraying some industries or regions more favorably than others. The opacity of complex models, particularly deep learning systems, compounds this risk; their decisions are often inscrutable even to their creators, creating what scholars describe as “black-box accountability.” Such opacity conflicts with the foundational principle of transparency in sustainability reporting. Data heterogeneity poses a significant challenge for AI models.

4. Regulatory and Compliance Volatility: AI-driven sustainability tools also struggle to keep pace with an ever-shifting regulatory



environment. Disclosure frameworks evolve faster than the algorithms designed to interpret them. Without regular recalibration, AI systems risk generating reports that are misaligned with current standards, exposing firms to compliance failures or reputational damage.

5. Environmental Paradox of AI of High energy consumption:

Ironically, the pursuit of sustainability through AI is not environmentally neutral. Training and running large-scale machine learning models require vast computational power, often translating into significant energy use and carbon emissions (Vinuesa et al.,2020). Furthermore, the rapid obsolescence of hardware used in AI systems contributes to growing electronic waste, a contradiction that undermines the very sustainability goals these technologies aim to support. Zhuk (2023) found that a lot of environmental, ethical and political-legal issues associated with the training, use and development of AI consumes a significant amount of energy (mainly from non-renewable sources). This leads to increase in carbon emissions and constitutes obstacle to sustainable ecological development. Training a single state-of-the-art AI model can emit as much carbon dioxide as the

lifetime emissions of five cars (Strubell et al.,2019).

6. Socio-Ethical Complexities:

AI's ability to quantify does not necessarily equate to understanding. Social and cultural aspects of sustainability, such as community wellbeing, cultural heritage, or social equity, resist easy quantification. Algorithms may oversimplify these dimensions, sidelining nuanced human experiences in favor of easily measurable metrics. Additionally, the mass collection of data raises privacy and surveillance concerns, especially in workforce diversity monitoring or social impact assessment.

7.Structural and Capacity

Barriers: The diffusion of AI technologies in sustainability reporting is uneven. While multinational corporations deploy sophisticated analytics platforms, small and medium-sized enterprises (SMEs) and organizations in the Global South often lack the technical expertise, financial resources, or digital infrastructure to do the same. This creates a global asymmetry in reporting capacity and perpetuates inequality in sustainability benchmarking.

8. Governance and Oversight

Gaps: Perhaps most critically is the integration of AI into ESG practices



has outpaced governance frameworks. Current sustainability standards provide limited guidance on algorithmic transparency, ethical AI deployment, or data governance. Initiatives such as the EU AI Act are a step forward, but remain disconnected from ESG-specific accountability mechanisms. There is a growing need for AI-specific governance standards that require explainability, auditability, and ethical oversight to safeguard against systemic risks in AI-driven disclosures.

8. Scalability and replicability of AI-driven solutions: There is challenge in scaling AI applications to a global level and replicating their successes across different regions and context

9. Ethical considerations: The unintended consequences of AI-driven decisions, the impact on employment and socioeconomic factors, and the need for transparency and accountability are important ethical dimensions and challenges.

Practical Implementation Challenges of AIs in Sustainability Contexts of ESG Reporting and the SDGs

Beyond the governance and ethical concerns and challenges, organisations encounter substantial practical difficulties when implementing AI-driven

sustainability reporting systems and for the SDGs. Data fragmentation across departments and legacy information systems often constrains interoperability and limits the effectiveness of real-time analytics (PwC, 2021). In addition, capacity constraints, particularly among small and medium-sized enterprises and firms operating in developing economies, restricted access to advanced AI tools, and specialised expertise result in uneven reporting capabilities (Adebayo & Ogunleye, 2021). Cybersecurity and data privacy risks complicate the implementation of environmental sustainability (Chaudhary,2023), as well as increased reliance of sustainability reporting on sensitive workforce, community, and supply-chain information. There is also lack of adequate performance indicators, and unreliable human behavioral responses (Nishant et al. 2020), massive carbon footprint, and the wrong focus on AI's application motivated by economic and commercial gains rather than the achievement of SDGs, and ethical concerns of AIs (Whittaker et al.,2018).

The United Nations Environment Programme (UNEP,2024) has found that the accurate estimation of AI's environmental impact along its life-cycle (software vs hardware) is affected by challenges of measurement and insufficient data



on indirect and higher-order effects; biases, and poor quality of training data. Distor et al. (2014) identified practical challenges in the usage and aligning of AI to SDG implementation from 30 cases in 14 Asian-Pacific cities. They found that cities can leverage responsible AI towards achievement of the SDGs, from enhancing public services to improving societal well-being (UN-Habitat, 2024) by closing the capacity and skills gaps, invest largely in infrastructures and have robust regulatory frameworks (Birkstedt et al., 2023). The challenges of technical implementation include adoption of AI technology, and policies and ethical standards for AI deployment, poor infrastructure, data management, privacy and security concerns, shift in public priorities and managing human resources due to turnover of trained personnel, lack of AI skills and timely verification mechanisms for citizen-contributed information, and the robotic approach and lack of human contact in AI systems which thwarts communication and engagement with citizens.

Harnessing the Prospects by Addressing the Limitations of AI's Use and Misuse

AI's dual role in sustainability reporting is paradoxical, both as a bridge to deeper accountability and a barrier to genuine transparency. Its

ability to revolutionize data management, assurance, and forecasting is undeniable, yet its unintended consequences remind us that technology alone cannot guarantee sustainability. The challenge lies not in rejecting AI but in steering it responsibly, ensuring that automation complements human judgment, that efficiency does not eclipse ethics, and that progress remains anchored in purpose. To confront and counter the obstacles and limitations posed by AI in sustainability reporting and SDGs requires more than mere technical fixes. It calls for a holistic rethinking of how organizations design, govern, and ethically ground their digital ecosystems.

To begin with, the reliability of AI-driven sustainability insights is inseparable from the quality of the data that fuels them. When the data is of poor quality- incomplete, inconsistent, or biased, AI models inherit these imperfections, amplifying distortions rather than solving them. Robust data governance frameworks must therefore form the foundation of every sustainability reporting system, which ensure that data is not only accurate and comprehensive but also representative of diverse realities.

Mienye et al. (2024) argued that the establishment of robust ethical



regulatory frameworks and robust regulatory frameworks and ethical guidelines is crucial for the responsible development and deployment of AI technologies. These would include; developing AI policies and regulations, ethical guidelines, strengthening partnership and collaborations, monitoring and evaluation. They proposed a conceptual framework of five pillars consisting of Infrastructure, Human Capital, Innovation, Policy and Governance, and Partnerships, to maximize the potential of AI for the sustainable development of Africa. Olawade et al. (2024) reviewed extant literature on the potentials of AI for net zero sustainability. They found enabling role of AI in optimizing energy systems, enhancing climate modelling and prediction, improving sustainability in various sectors such as transportation, agriculture, and waste management, and enabling effective emissions monitoring and tracking. The review also highlighted challenges related to data availability, quality, privacy, energy consumption, bias, fairness, human-AI collaboration, and governance. They suggested “ethical considerations, such as transparency, accountability, fairness, and privacy, should be embedded in the development and deployment of AI technologies for climate change mitigation and adaptation”.

Microsoft Corporation (2025) argues that to derive the greatest benefits from AI for sustainability, there is need to minimize the sustainability impacts of AI’s operations, minimize resource use in data centers, support the communities where the datacenters are located, and expand to zero carbon-electricity. It outlines 5 plays in its playbooks to address societal challenges in order to create benefits for global community to include; “1. Invest in AI for sustainability for instance Microsoft is building MatterGen, MatterSum and Aurora; 2. Develop digital and data infrastructures for inclusive use of AI for sustainability;3. Minimize resource use, expand access to carbon-free electricity and support local communities,4. Advance AI policy principles and governance for sustainability, and 5. Build workforce capacity to use AI for sustainability”. Since there are different public concerns, challenges and governance of AI for sustainable development between developing and developing countries, Maghsoudi et al. (2025) “provide new insights into the complex interplay between technological innovation, societal concerns, and sustainable development, illustrating how distinct socio-economic contexts shape public narratives around AI”. The authors highlighted the need for “inclusive, adaptive AI policy



frameworks that reflect global disparities while fostering equitable development”.

Equally critical is the challenge of algorithmic bias. Because humans curate training data and define model parameters, bias is not an occasional flaw but a structural risk embedded in AI design. Addressing this requires the creation of transparent and interpretable models whose reasoning pathways can be understood and challenged. Ameen et al. (2021) caution, ML systems are not intelligent in themselves, they simply mirror the intelligence and biases of those who train them. The so-called “black box” nature of many advanced algorithms undermines one of sustainability reporting’s core principles, transparency (Doshi-Velez & Kim, 2017). AI must therefore evolve toward explainability, where stakeholders can trace how conclusions are reached and what ethical choices are encoded in those decisions.

Moreover, AI’s rapid integration into business operations has created an unsettling paradox: while the technology drives innovation, it also threatens to displace human labour and disrupt established skill ecosystems (Odia & Odia, 2021). In the context of many developing economies, the scarcity of advanced digital competencies deepens the divide between technological potentials and practical

implementation. The high cost of acquiring, maintaining, and adapting AI tools compounds this challenge. Thus, organizations must cultivate specialist capabilities beyond basic digital literacy, ensuring that employees can engage critically and ethically with the technologies shaping their work environments. To mitigate these challenges, firms must embed AI ethics directly into their ESG frameworks. making fairness, transparency, and accountability explicit criteria in sustainability performance assessments. Ethical AI governance involves hybrid models where human oversight complements machine analytics, ensuring that algorithmic outputs remain aligned with human values and contextual understanding.

Furthermore, open-source ESG–AI tools can democratize access, enabling small and medium enterprises (SMEs) and organizations in low-resource settings to participate meaningfully in digital sustainability transitions. Another overlooked dimension is the environmental footprint of AI itself. High-performance computing infrastructures, data centers, and machine learning processes consume vast amounts of energy. Sustainable AI practices, such as adopting green data centers, energy-efficient servers, and optimized computational architectures, are essential to ensure that technology



designed to report on sustainability does not, paradoxically, erode it. For AI systems to generate reliable sustainability insights, they must also be integrated seamlessly with existing organizational infrastructure. Many firms rely on legacy systems that are not designed to accommodate the demands of real-time AI analytics. Without interoperability, data remains siloed, hindering cross-departmental collaboration and timely decision-making. Effective integration enables fluid data exchange, supporting continuous monitoring, predictive analysis, and adaptive reporting. Beyond technical integration, organizations must invest in impact measurement mechanisms that assess how AI adoption contributes to environmental and social outcomes.

7.0. Conclusion

AI is an enabler to promote sustainability reporting and help in the achievement of the SDGs by 2030. Although AI advances sustainability through real-time monitoring, predictive analytics, and dynamic ESG reporting, it casts long shadows because of the risks and challenges associated therewith. The vast computational appetite strains energy resources, and generate new forms of digital waste. The learning algorithms can replicate historical inequities, embedding bias into the very tools designed to promote fairness. And

their complexity can render them opaque, challenging the principles of accountability and transparency that sustainability itself demands. These risks will limit the benefits of AIs. There can be risk of “greenwashing” through the misuse of digital tools. Therefore, there is need for robust ethical principles, regulatory frameworks, and third-party assurance mechanisms. A well-developed AI policies and regulations, ethical guidelines would help to address the ethical issues. Responsible governance, transparent data use, and equitable access to AI infrastructure are not an option but prerequisites for a sustainable digital future. AI represents more than a technological milestone; it is a moral crossroad for sustainable reporting and sustainable development.

AI guided by human intention and ethical foresight can make sustainability measurable, predictable, and actionable. And as global sustainability standards evolve, and the quest to optimize the benefits of AI for sustainable development, organizations and governments must strategically integrate these digital innovations into their operations. There must be sustained investment infrastructure; build digital and data infrastructures, technical capabilities, and connectivity that would support AI successful deployment; up-skill the AI literacy



level, and embrace AI's capacity building and education for sustainability. The effort to harness the full power of AI for sustainability reporting and the SDGs must be a collective pursuit that thrives on local and international partnerships, and collaboration, curiosity, and shared purpose. Ultimately, the promise of AI in sustainability reporting and the SDGs lies not in its computational power but in the alignment with ethical and ecological imperatives. When responsibly deployed, AI can amplify transparency, enhance data credibility, and deepen our understanding of sustainability impacts. Yet, without vigilance, it can equally obscure accountability, entrench bias, and widen inequalities. To reap the full benefits of AI in sustainability, the challenges must need by addressed. In essence, AI should not replace human judgment but augment humanity's capacity for ethical reflection and responsible stewardship. The convergence of AI and sustainability must therefore be guided by the principle that technology exists to serve human and planetary well-beings, not the other way around.

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