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A Critical Review of Sustainability Outcomes and Measurement Challenges in Environmental, Social, and Governance (ESG) Frameworks

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Abstract

ESG frameworks have become one of the key instruments to consider corporate sustainability and make responsible investment choices. The last decade has been characterized by the blistering development of sustainable investments and ESG reporting as an indication of the paradigm change towards incorporating the non-financial performance into the business strategy. Nevertheless, even as they continue to gain prominence, ESG frameworks have a major challenge in terms of measurement inconsistencies, non-standardisation, data reliability, and the absence of impact on real results in sustainability. This review critically analyzes the relevance of ESG reporting towards the attainment of sustainable development objectives with its major limitations including greenwashing, methodology and disjointed disclosure. Moreover, it examines how the adoption of ESG is at variance with the actual sustainability change. There is also a discussion of the necessity of interdisciplinary solutions, the inclusion of social sciences and engineering solutions, and ecological perspectives to improve the ESG reporting systems. The paper will conclude by outlining avenues through which ESG measurement frameworks can be improved to enable the transparency, comparability and materially relevant contribution to the global sustainability goals.

Keywords: Environmental, Social and Governance (ESG); ESG Frameworks; Sustainability Reporting; Sustainable Investments; Non-Financial Performance; ESG Measurement Challenges; Economic Growth

1. Introduction

Businesses worldwide acknowledge the importance of environmental, social, and governance (ESG) challenges, which are encapsulated by the acronym "ESG." Thus, there is no disputing the global emphasis on sustainability. According to scientists, investments in ESG may significantly influence a company's financial prognosis, as sustainable development and ESG are directly correlated with economic strength [1]. In addition, ESG ratings have emerged as critical indicators of a company's sustainability due to their demonstration of its dedication to environmental, social, and governance concerns [1]. The sustainability academic community remains skeptical about the ability of ESG reporting to effect the fundamental changes necessary to sustain 1.5 ◦C levels, despite its increasing prominence. This begs the question of whether these disclosures inadvertently divert attention from the most important sustainability imperatives [3–5].

On April 2, 2019, the chair of the International Accounting Standards Board (IASB) issued a cautionary statement: "We should not overestimate the potential of sustainability reporting to serve as agents of change." The reality that corporate compensation excess did not substantially decrease as a result of complete transparency should not be disregarded. Likewise, it is unfeasible to anticipate that sustainability reporting will motivate businesses to prioritize the environment over profits. There was a significant amount of greenwashing. Consequently, I am of the firm conviction that the most promising aspect of sustainability reporting is the establishment of standards that emphasize the impact of sustainability challenges on the company's future returns and investors. Compared to reporting that emphasizes a company's contribution to the public welfare, this form of sustainability reporting is more consistent with our Management Commentary Practice Statement [6].

The increase in the prevalence of sustainable investments is evidenced by the fact that the global assets allocated to sustainable investing methods increased from USD 13.3 trillion in 2012 to USD 35.3 trillion in 2020 [7, 8]. In the same vein, the green bond market has experienced substantial growth, with investments increasing from USD 2.6 billion in 2012 to USD 257.7 billion in 2019 [9,10]. In 2021, 84% of asset owners worldwide implemented sustainable investing strategies, as opposed to 53% in 2018 [11]. Environmental initiatives are particularly well-received in Asian markets [12]. As a result of these modifications, ESG reporting has emerged as a new industry standard. Is it possible to guarantee a fair transition to a more sustainable, inclusive, and resilient economy through the increasing prevalence of sustainable investments and ESG reporting? In what ways could the current ESG information disclosure space be modified to more closely align with the overarching objective of sustainable development? Businesses are pursuing ESG activities solely for fragile reputational advantages, rather than addressing governance, social, and environmental issues. This is a cause for concern, as ESG is being used as a greenwashing tool. Subsequently, there is an elevated level of anxiety. This abuse of ESG not only undermines the legitimacy and efficacy of the framework, but also impedes efforts to accomplish substantial sustainability outcomes within the constraints of planetary bounds.

Global corporations are increasingly being held accountable for environmental issues, including the overconsumption of natural resources, greenhouse gas emissions, and global warming [13]. These industrial operations seriously imperil the long-term existence of living things and seriously jeopardize the health, biodiversity, and natural habitats of these organisms. Key ESG performance indicators (KPIs) have emerged as a means of evaluating and disseminating industry sustainability practices in response to these challenges [14]. They offer a comprehensive perspective on a business's non-financial performance, which encompasses environmental effects, corporate governance, and social interactions [14]. The primary objective is to assist investors in making more sustainable and socially conscious investment decisions. Despite the fact that businesses frequently employ their ESG KPIs to demonstrate their preparedness for climate change threats, it is imperative that they recognize that these risks are not limited to their immediate operations. The emphasis should be redirected from a limited focus on self-preservation to a more comprehensive commitment to the planet's sustainability, in accordance with the 17 UN Sustainable Development Goals (SDGs).

ESG or sustainability reporting on key performance indicators (KPIs) by corporate entities serves two purposes: "performance enhancement," which is essential for corporations, and "transparency," which is important for investors [15]. The ESG Risk Ratings (also referred to as ESG scores) are a metric that assesses a company's exposure to industry-specific material climate hazards and its efforts to mitigate these risks. These ratings are derived from disclosed KPIs. Independent organizations, including Bloomberg, Refinitiv, and Morgan Stanley Capital International, provide ESG ratings through surveys or questionnaires in addition to the KPIs that each firm discloses. The company's sustainable operations and general functioning are demonstrated by the individual E, S, and G pillar scores, as well as the overall ESG score [14]. ESG is a framework for socially conscientious investment that is extensively marketed and encourages businesses and institutions to adopt sustainable practices, thereby advancing sustainability. Nevertheless, the ratings may become irrelevant and potentially mislead sustainable investment initiatives if the underlying KPI data that informs these ESG ratings is questionable.

Investors employ ESG reporting to optimize their capital allocation decisions, while businesses implement it to accumulate data regarding sustainability risks, opportunities, and management oversight [15,16]. The positive feedback loop (Figure 1) [17] implies that these objectives will ultimately result in a sustainable form of capitalism. This suggests that the flow of capital from investors may enable organizations to innovate for productivity and development (while managing risks and opportunities) without adversely impacting society or the environment. The pervasive use of various investment-screening processes will ensure that only organizations that are closely aligned with the sustainable development objective are permitted to expand. When executed publicly, this scenario allows stakeholders, such as governments and consumers,

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to exert influence over the activities of entities. Consequently, the intended positive results may be accomplished by considering the corporation's impact. This is referred to as the "ESG dream." Regrettably, the impact of ESG reporting and measurement has been exaggerated, and these findings have not been realized [17].

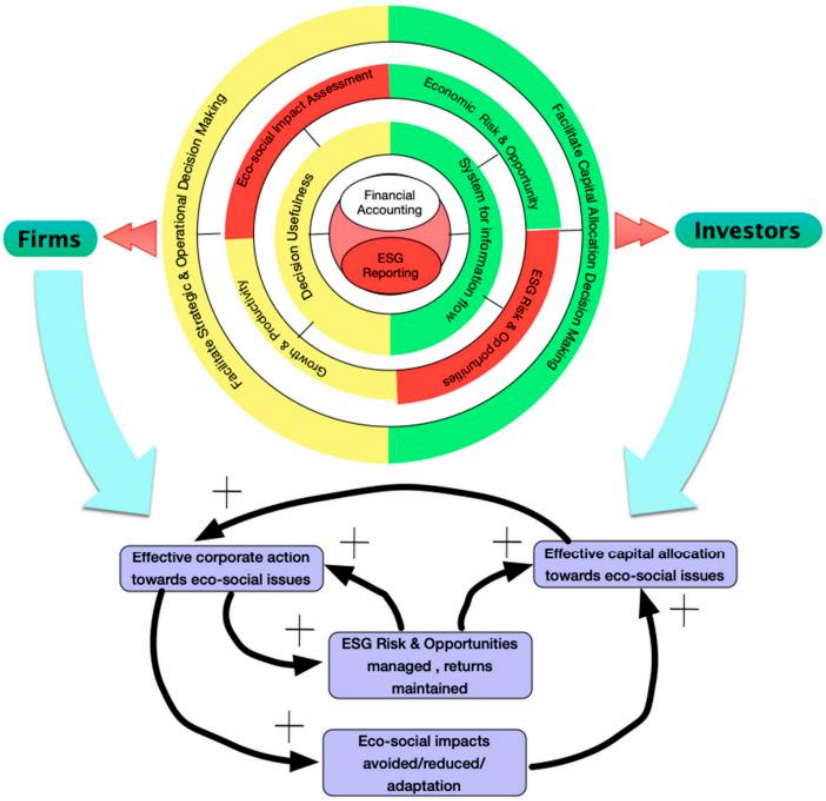

Figure 1. ESG Dream: Financial accounting and ESG-reporting paradigm currently in action. The implementation of this ESG Dream is a weakly reinforced feedback loop due to certain challenges that primarily enable the sustainability of corporates rather than the achievement of just, equitable, and sustainable societies. A (+) sign means a change in the influencing variable will produce a change of the same direction in the target variable.

In general, researchers have concurred that ESG reporting is ineffective in addressing environmental concerns and promoting society's sustainability objectives [16,18–23]. Empirical research has exacerbated concerns regarding this inefficiency by emphasizing the importance of reputation in non-financial disclosures and exposing greenwashing [24–31]. The adoption of "green" initiatives and ESG practices is being driven by stakeholder advocacy, which is enhancing both ESG and financial performance [32]. This is indicative of a more generalized social trend, in which businesses are increasingly in tune with environmental, social, and governance (ESG) principles and sustainable practices. Customers are actively seeking out eco-friendly products that are consistent with their values and contribute to the profitability of a business [33]. Nevertheless, the future of sustainable development remains uncertain in terms of the impact of ESG reporting. Consequently, a global framework is necessary to mitigate the complexity of ESG disclosure, improve comparability, and prevent fragmentation [34].

There are numerous reasons why it is imperative to assess the impact of corporate disclosures on the advancement of sustainable development in society. Initially, the failure to address critical issues on a global scale is exacerbated by a limited focus on corporate sustainability, which necessitates collaborative action beyond conventional business practices [35]. Secondly, firms are anticipated to have a positive impact on people, the environment, and profits, given the urgent need for rapid transitions toward sustainability in a world that is currently dealing with socioeconomic challenges and uncertainties caused by climate change [36]. Third, the destiny of the planet is significantly influenced by corporations. Levin observes that governments have historically been anticipated to address issues related to the general welfare; however, their capacity to do so independently is becoming increasingly restricted, particularly in industrialized nations, as public resources diminish [37, 38]. Additionally, a substantial portion of the wealth is concentrated in a small number of companies [39, 40]. Consequently, it is imperative to guarantee corporate accountability for the well-being of its employees and the environment prior to prioritizing profits. Fourth, despite its apparent promise, ESG reporting is susceptible to the formation of an illusion [41]. It has the capacity to redirect public attention to what may actually be a distraction—the appearance of a successful solution [42]. Rather than merely acknowledging its critical role in sustaining "business as usual," these factors have motivated us to understand and assess the genuine significance of ESG reporting within the context of sustainable development for all.

The significance of non-financial disclosures in sustainable development has been the subject of extensive scholarly debate for more than 50 years within the framework of Social and Environmental Accounting (SEA) literature [43]. The primary objectives of research conducted within the SEA are to advance social justice, enhance corporate responsibility, and promote sustainable practices [43]. SEA is a sequence of procedures that involve the collection and organization of data to inform internal and external constituents about a company's impact on the environment and communities. The terms "green accounting," "resource accounting," "economic accounting," and "integrated accounting" are employed to refer to it, as they emphasize the sustainable use of natural resources and ethical management [44, 45]. This field encompasses a diverse array of research areas, such as the study of the connections between Corporate Social Performance (CSP), Corporate Social Disclosure (CSD), and Corporate Financial Performance (CFP), as well as accounting for social accountability, human rights, biodiversity, sustainable development accounting, and management accounting for social and environmental concerns [46].

SEA scholarship was actively engaged in integrative endeavors to address social and ecological issues during the early 1990s. However, by the early 1920s, this enthusiasm had diminished as sustainability reporting began to dominate research, which concentrated more on the impact of

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sustainability on firms than on the impact of corporate entities on sustainable development [21]. With the exception of Abela (2022) [47] and Busch et al. (2016) [48], the recent literature has not paid much attention to the role of ESG in sustainable development. The Double Materiality concept for corporate disclosures is a positive advancement, as it mandates that businesses disclose the influence of sustainability issues on their own performance and the impact of their own operations on sustainability issues [49]. In the same vein, this article anticipates the operationalization and innovation of ESG reporting research in this field that is interconnected on an ecological, social, and economic level. The UN SDGs and Planetary Boundaries (PBs) are exemplary of how ESG has progressed beyond the entity level and how it contributes to broader objectives. This article provides an alternative viewpoint on the current ESG reporting landscape. In order to fulfill this commitment, we advocate for the establishment of interdisciplinary frameworks within the field of SEA research, which is situated at the intersection of social sciences, engineering, and ecology.

2. Literature Review

As Jagrič, T., Mumel, D., and Skaza (2025) [117] emphasize, the assessment of the Environmental, Social, and Governance (ESG) risks is predetermined by the lack of consistency in their definitions, data access, and rating scales, which restrict the comparability and lower the efficiency of making decisions on the basis of ESG. Equally, Yusof and Widyasamratri (2025) [118] also note that even though ESG is now an important tool of evaluating corporate sustainability, which goes beyond conventional financial indicators, a multitude of differences between the rating systems, data processing methods, and disclosure norms of different agencies results in divergent ESG scores and decreased reliability. In line with this, Meiden and Silaban (2023) [122] suggest that the absence of standardized environmental measures and cross-linkage of the ESG dimensions make it difficult to measure performance, whereas Tang (2023) [123] notes that the role of regulatory frameworks like TCFD in enhancing transparency and accountability is increasing, yet the standardization is still rather problematic. Additionally, according to Linnenluecke (2022) [124], ESG frameworks do not typically include the complexity of supply chains and the views of local stakeholders, especially in emerging markets, thus making their evaluation incomplete and possibly biased. Senadheera et al. (2021) [126] further observe that irregular methodologies, lack of data and aggregated environmental measures greatly diminish the utility of ESG measures in sustainable finance. Simultaneously, an increasing range of literature proves the strategic importance of ESG integration in improving corporate performance and sustainability results. Empirical evidence presented by Noor and Raza (2025) [119] that a high ESG performance is positively correlated with financial metrics like the return on assets, the return on equity, and market valuation, as well as it lowers the risk and volatility levels in a firm. Padilla-Rivera et al. (2025) [120] also add value to the current state of the art by suggesting a more comprehensive and practical Life Cycle Sustainability Assessment (LCSA) framework that will allow conducting sustainable analyses of industries based on the ESG and SDGs. Furthermore, Alhazemi (2025) [121] emphasizes that ESGs, coupled with ethical leadership, are effective in enhancing employee well-being, diversity, and organizational inclusivity, which enhance social sustainability and resilience of institutions. Nonetheless, Aldowaish et al. (2022) [125] warn that most companies implement ESG because of external influence by financial markets instead of being devoted to sustainability, which shows a mismatch between the implementation and the adoption of the initiative. Taken together, these investigations indicate that even though ESG has great potential in achieving sustainable value creation and responsible business operations, its applicability is highly dependent on the enhanced standardization, enhanced reporting, and integration into organizational strategies.

3. Identifying the Challenges in Reporting and Pathways for Future

The initial step in acknowledging the transformational potential of ESG reporting within a broader SD agenda is to comprehend the current reporting issues. Consequently, this section investigates the obstacles associated with ESG reporting from the viewpoints of investors and entities.

3.1. Challenges to ESG

Reporting corporations report and disclose information to preserve their social licenses and maximize shareholder value. Nevertheless, they face four distinct kinds of challenges when it comes to ESG reporting at the entity level: contextual, methodological, behavioral, and data credibility issues. Table 1 provides a comprehensive summary of the issues associated with each category, as well as pertinent literature references.

Table 1. Challenges in ESG reporting.

Challenge Category	Description	Literature References
Behavioral challenges	Short-term focus due to economic pressure	[58]
	Reputational-risk-influenced decisions	[27, 28, 31, 59, 60]
	Powerful-stakeholder-influenced decisions	[26, 61, 62]
	Fear of revealing excessive information	[63]
Data-based challenges	Data acquisition, treatment, and validation cost	[64, 65]
	Data normalization challenges	[66, 67]
	Inconsistent reporting by firms	[1, 67]
	Lack of historical data availability, missing data	[66, 67]
Methodological challenges	Reporting challenges for multiple businesses (i.e., conglomerates)	[68]
	Neglected considerations for impact interconnectedness	[69, 70]
	Unclear boundaries for the reporting entity (issue of scope-3)	[71, 72]
	Lack of appropriate quantitative measures (especially for social issues)	[73]
	Challenges in entity-level science-based target derivation	

The capacity of entity management to impartially bear responsibility for environmental and social issues is impeded by behavioral resistance, which exacerbates governance concerns, particularly the constraints it encounters. The operational challenges that organizations encounter when attempting to establish data credibility include a dearth of data sharing along the value chain, ambiguous data administration standards, and high data collection expenses. The technical constraints of various impact appraisal accounting approaches for various environmental and social concerns are underscored by these methodological difficulties. The specific E-pillar ratings were found to have both strong and weak connections with the total ESG score, according to recent research conducted by the Organization for Economic Co-operation and Development (OECD). The study was founded on the data of numerous assessment agencies. This outcome is primarily attributable to the fact that providers are graded using distinct methodologies to assess each ESG metric [90]. Furthermore, providers prioritize various ESG components; some prioritize environmental concerns, while others emphasize financial materiality or social governance. ESG reporting is restricted by the absence of enduring datasets, which may result in contentious findings [91].The complex adaptive structure of socio-ecological economic systems, which are characterized by interconnectivity, variety, and evolving global patterns, is the primary source of contextual problems. These systems generate ambiguity, uncertainty, and ignorance by offering dynamic issue spaces that contain fragmentary entity-level information [92].

3.2. Seeking Future Pathways for ESG Reporting : Even though certain data-related and methodological issues may be resolved in the future through increased data availability, standardization, and technological advancements, targeted reporting for SD remains substantially impeded by behavioral and contextual issues [93]. The concept of "maintaining a social license to operate," which involves the fiduciary obligation to

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maximize shareholders' wealth while operating sustainably, presents behavioral obstacles for entities. The problem with this formulation is that, rather than serving as an independent objective, the "preservement of a social license" is essential for the "operational" objective to be sustained. Consequently, the environment and humanity are prioritized over profit. In order to achieve the ideal of a socially equitable and sustainable society, we contend that a new framework for social contracts is required in light of the current global crises. Levin et al. (2020) [37] and Ricart and Rey (2022) [35] demonstrated a propensity for the concept of purpose-driven firms, which transcends the conventional business model. Nevertheless, it remains uncertain what type of social contract formulation may be the consequence of this in order to effect substantial change. In addition to a sense of purpose, contextual obstacles that necessitate coordinated systemic efforts motivate enterprises to transcend "business as usual." A diverse array of stakeholders, such as individuals, corporations, financial institutions, NGOs, and governments, are required to engage in collective action and coordination, as per Levin et al. (2020) [37]. Despite the fact that entities are promoting resilience building through adaptation, the challenges of high unpredictability and limited resilience due to socioeconomic stressors continue to exist. A loss in cross-scale resilience is the consequence of a restricted interpretation of resilience as an organizational characteristic, as it disregards critical signals from other geographical scales, as per Williams et al. (2021) [94]. Industrial ecology studies for entities address the same dilemma and disclose sustainability issues at both geographical and temporal scales by considering the complexity of resource, production, and consumption systems. Consequently, engineering scholarship may employ technical applications and creativity to develop systems and solutions that address these issues. Lastly, the discipline of social science offers a framework that enables the evaluation and application of these issues and solutions to achieve societal and long-term objectives.

4. Seeking Innovation: ESG Reporting for Sustainable Development: ESG reporting is mandated for a variety of reasons, such as the requisite non-financial disclosure and reporting mandated by regulations and directives. For example, organizations with a workforce exceeding 500 employees are required to disclose non-financial hazards and opportunities in accordance with their business models [95]. Furthermore, we are of the opinion that the development of ESG disclosure systems should occur at the intersection of the social sciences, engineering, and environment. This raises the critical issue of establishing an interdisciplinary framework to facilitate the advancement of concepts such as ESG disclosure and assist organizations in addressing the intricate issues of (un-)sustainability, which are referred to as "Wicked Problems" with "Wicked Solutions." The interdisciplinary framework's originality may be enhanced by the discipline of SEA study.

4.1 The SEA Scholarship's contribution to the advancement of sustainable development : The primary concentration of SEA, a dynamic field of study, is the social and environmental impacts of organizations and accounting [21,88,96]. Nevertheless, SEA scholarship has the potential to effect social change by expanding its influence beyond the entity level [97,98]. Recent publications [21, 43, 99–101] also demonstrate a transition in accounting studies from a "entity-centered" to a "problem-centered" perspective. We were motivated by this change to determine whether SEA could serve as a foundation for the development of integrated accounting systems for SD. In order to regulate capitalist behaviors within eco-social limits, we offer four justifications for the design, production, and application of such systems through collaborative research between the scientific and engineering communities under SEA scholarship. Initially, the intricacy of SD is becoming more widely acknowledged in SEA research [21, 43, 65, 96, 101–105]. The recognition of complexity and the admission of insufficient knowledge have led to the necessity of interdisciplinary [21] and transdisciplinary research [65] in accounting. Furthermore, there has been a transition from accounting-based to accountability-based institutions, which ensures contextual justice for marginalized and disadvantaged social groups [18, 43, 106]. These developments substantiate our belief that SEA research is well-positioned to enhance science-based limitations in collaboration with other disciplines within complex adaptive social, economic, and ecological systems. Secondly, SEA scholarship encompasses institutional structures, practices, methodologies, and knowledge repositories [103,107]. Environmental engineering and organizational management are the subjects of multidisciplinary research [108]. However, there has not been sufficient research conducted to identify quantifiable changes in the direction of sustainability. The interaction between SEA academicians and other disciplines, including political economics [111], sustainability science [21], governmentality [109,110], and complex systems theory, is readily apparent. Nevertheless, in order to make substantial strides toward SD objectives, these disciplines must attain a higher degree of convergence. Feger et al. (2019) [100] recently made a compelling argument in favor of incorporating scientific models and methodologies from the disciplines of biodiversity conservation into accounting research. This serves as an illustration of the type of engagement that we are advocating. The framework that SEA research can provide for knowledge on the subject of what to account for, how to account for it, how to govern, and, ultimately, how responsibility is discharged toward human and non-human animals may be utilized by other disciplines. Thirdly, major strides have been made in the fields of industrial ecology and systems engineering with respect to the identification of what and how to account for it. Life Cycle Assessment (LCA) was initiated to resolve conventional concerns, as per Finkbeiner et al. (2014) [112]. Numerous standards, approaches, LCA categories, case studies, databases, and software solutions have been developed to facilitate these evaluations [112]. Numerous single-dimensional life cycle assessments (LCAs), including carbon footprints, have already been implemented at the organizational level. Carbon, water, nitrogen, ecology, economics, ethics, and society methodologies have been developed [113]. The development of impact evaluation and valuation procedures [114] may be achieved by integrating these advancements with participatory decision-making frameworks from sustainability science [21]. These standards may be incorporated into conventional financial accounting systems. Nevertheless, there is a need for additional research to be conducted on the issue of integrating eco-social effect estimations with financial accounting statements. Finally, the innovation cycle for organizations may be expedited by the utilization of technology, particularly the exponential growth of digitalization and advancements in technologies such as the Internet of Things (IoT), Big Data, Blockchain, and Artificial Intelligence. By imagining accounting systems that are supplemented with inventories of satellite photographs, photographic evidence, historical maps and records, industrial-geographic effect information, local community input, and media information, the associated potential is demonstrated. The implementation of these methodologies may facilitate the pursuit of sustainability innovation and competition for organizations of all sizes (SME, MNC, NGO, and non-profit) and types (public or private). Concerns have been expressed regarding the development of automated impact assessment tools and methodologies [115]. Despite the fact that technology is essential for the security and integrity of data, additional research is required to address issues such as reliability, data breaches, and excessive energy consumption. These issues may be resolved by decentralized database systems, such as distributed ledger technology (DLT), which is frequently referred to as blockchain. These systems guarantee security through authorization-control-based features and provide transparency through audit traces. Saberi et al. (2019) [116] provide an overview in this regard. They argue persuasively in favor of the utilization of distributed ledger technology to preserve sustainability components within a supply chain network.

The intersection of these components offers a distinctive opportunity for academicians from a variety of disciplines to collaborate, create, and execute accounting systems that address the pressing issues of global sustainability and the current deficiencies in ESG reporting systems. Alternatives to the current ineffectual ESG disclosure narrative may be offered by accounting systems that prioritize sustainability.

5. Limitations, Future Outlook : recognition of the necessity for a sustainable transformation, which is the motivating force behind the transition in ESG reporting. Nevertheless, our perspective is restricted by the absence of the requisite conditions for organizations to adopt a cooperative, purpose-driven approach to this transformation. The development of standards regarding the externality-based social and environmental accounting of entities will result from efforts in this area, with justice at the vanguard of the necessary modifications for SD. ECO-social-

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economically integrated accounting and reporting systems for SD can only be developed when such endeavors are successful in enabling an equitable distribution of growth within planetary boundaries. Researchers must investigate this proposed "to be" element of the ESG ideal at this time. The following primary aspects should be the focus of future research when developing ESG accounting and reporting systems for SD:

- The integration of social and environmental factors into financial accounting;
- Other social and environmental ramifications, such as Scope 3 GHG emissions, that have indirect consequences on a business's value chain;
- Evaluating and fortifying the supply chain's capacity to adapt and endure disturbances caused by transition risks, such as carbon levies, and physical risks, such as severe weather;
- Governance frameworks for SD's integrated accounting systems;
- The future of reporting systems in terms of technology;
- The geographical contextualization of data, as well as the methodological specifications for the impact appraisal of social and environmental problems;
- The transitional requirements and future responsibilities of auditors and accountants;
- Educational reform to equip future auditors and accountants with sustainable expertise for ESG-focused reporting systems.

There is a scarcity of individuals with multidisciplinary skill sets in ecological sciences, engineering, project management, and social sciences research, in addition to the obstacles associated with viewing the world through an accounting and reporting lens. The attainment of sustainable development is significantly impeded by this lack of proficiency. In order to meet the demands of the market, it is imperative that the engineering and finance curriculum incorporate multidisciplinary training. In order to accomplish sustainable development, organizations must adopt a transformational, purpose-driven approach and resolve the deficiencies of the social contract. The current market-driven ESG reporting system must align with the concept of "just sustainabilities" and transcend its restrictive focus on a company's own sustainability and risk-centered expansion. In order to achieve this, we suggest that traditional accounting methods be modified to align with the sophisticated and forward-thinking nature of ESG disclosure systems. In order to accomplish this operationalization, it is necessary to integrate research from the social sciences, engineering, and ecological sciences. It is imperative to establish frameworks that facilitate such research and to train a workforce with multidisciplinary skill sets in order to satisfy the market's demand for this expertise. It is anticipated that these endeavors will improve the legitimacy and efficacy of accounting and reporting systems, thereby advancing global sustainability objectives and promoting the development of sustainable finance. The transition to the ESG "to-be" state has the potential to cultivate sustainable, equitable, and fair communities on a global, national, regional, and local scale. This is a cooperative effort that is indispensable for the sake of our shared future.

A methodical and iterative approach is required for the development and validation of solutions to devastating situations such as the one we are currently experiencing. Through the utilization of industrial ecology concepts, it is possible to conduct a systematic evaluation and analysis of ESG disclosure systems through case studies. This approach ensures that the complex relationships between energy, materials, and specific enterprises are considered and that no unexpected consequences arise. Furthermore, in order to guarantee that ESG disclosure systems are both sustainable and effective in the long term, it is imperative that we consistently evaluate and enhance them, considering emerging trends, evolving contexts, and new information, as there is always room for improvement when it comes to addressing pernicious problems.

Conclusion

ESG reporting is motivated by a variety of factors. Finally. The most significant of these is the increasing demand from stakeholders, such as investors, consumers, and employees, for transparency regarding a company's social and environmental impacts. Companies that adhere to ethical standards are prioritized by stakeholders. Additionally, ESG reporting functions as a risk management instrument. Businesses recognize that disregarding environmental and social issues may result in adverse financial and reputational consequences, such as regulatory penalties and legal liability. Conversely, proactive ESG initiatives may generate a competitive edge by encouraging efficiency enhancements, cost reductions, and innovation. Regulatory compliance is alluring due to the fact that numerous regions require ESG reporting. Sustainability and resilience are promoted by a long-term perspective on value generation, which is encouraged by ESG reporting. Organizations are additionally motivated by their moral and ethical obligations to mitigate their adverse consequences and preserve robust governance standards. A dedication to addressing significant global issues is demonstrated by alignment with global objectives, such as the United Nations Sustainable Development Goals (SDGs). Furthermore, the value and reputation of a brand are improved by ESG reporting, which in turn increases consumer loyalty. ESG reporting has become an essential instrument for companies to demonstrate their commitment to sustainability, responsible governance, and long-term value creation in a world that is constantly evolving.

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