



THE EVOLUTION OF SUSTAINABILITY ASSURANCE: A REVIEW OF ENVIRONMENTAL AND SOCIAL AUDITS

By

Folusho Olayemi Ilori

University of KwaZulu-Natal, Durban, South Africa School of Commerce, Accountancy Discipline, University of KwaZulu-Natal, South Africa.



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Abstract

Purpose of the study: This study aims to examine the evolution and current practices of sustainability assurance, highlighting its role in enhancing the credibility of ESG disclosures and corporate sustainability reporting. It seeks to provide readers with a clear understanding of how assurance practices have developed, the challenges they face, and the emerging trends in this evolving field.

Methodology: A systematic review was conducted using peer-reviewed articles, institutional reports, and professional standards published between 1990 and 2025. Literature was synthesized thematically across three phases: early stage (pre-2000), institutionalization (2000–2015), and expansion and convergence (2016–present). Digital tools, structured analysis, and qualitative survey approaches were applied to extract trends and insights.

Main Findings: Sustainability assurance has progressed from voluntary, compliance-based audits to structured practices integrated into corporate governance. Key standards, including ISAE 3000 and AA1000AS, institutionalize systematic methodologies and stakeholder inclusion. Recent developments include convergence with financial auditing, the adoption of digital verification tools, and regulatory reforms such as the EU CSRD and IFRS S2, though methodological gaps and regional disparities persist.

Applications of this study: The findings are relevant to the disciplines of accounting, auditing, corporate governance, sustainability management, and ESG reporting. Practitioners, regulators, auditors, and policymakers can use the insights to enhance reporting credibility, guide assurance practices, and align corporate sustainability strategies with emerging global standards and technological innovations.

Novelty/Originality of this study: This study provides a comprehensive synthesis of sustainability assurance evolution, offering fresh insights into the integration of digital tools, global regulatory frameworks, and methodological harmonization. It contributes new knowledge on trends, challenges, and future directions, helping readers understand how assurance practices can advance accountability, reliability, and stakeholder trust in ESG reporting.

KEYWORDS: Sustainability assurance, ESG reporting, corporate governance, audit convergence, digital verification.

INTRODUCTION

In recent decades, organizations worldwide have faced increasing pressure to report not only on their financial performance but also on their environmental, social, and governance (ESG) impacts (Junior et al., 2013; Dobre et al., 2025; Sari, 2025). This broader view of corporate accountability reflects a shift in stakeholder expectations, where profitability alone is no longer sufficient to define business success (Morf et al., 2013; Khuong et al., 2021). Investors, regulators, and civil society now demand evidence of environmental stewardship, ethical conduct, and social responsibility (Bueno et al., 2023). As a result, sustainability

reporting—the public disclosure of information relating to a company's environmental, social, and economic performance—has become a defining element of corporate transparency.

Sustainability reporting encompasses a range of disclosures that capture how organizations manage their environmental footprints, workforce practices, community engagement, and governance structures (Barker, 2025). The practice has been shaped by several global frameworks and regulatory initiatives, including the Global Reporting Initiative (GRI) and the European Union's Corporate Sustainability Reporting Directive (CSRD). The GRI provides broad guidance on

sustainability reporting, while the CSRD mandates standardized, detailed disclosures and external assurance for large and listed companies in the EU (de Villiers et al., 2022; Hummel & Jobst, 2024). These frameworks have helped embed sustainability reporting within corporate governance structures, making non-financial information a central component of organizational accountability (Khatri et al., 2025).

However, as sustainability reports have become more widespread, concerns about their accuracy, reliability, and comparability have intensified. Stakeholders increasingly question whether disclosed information can be trusted, given the absence of uniform reporting practices across regions and industries (Boiral et al., 2019; Vázquez-Burgete et al., 2024). In response to these concerns, sustainability assurance has emerged as an essential mechanism for enhancing the credibility of non-financial disclosures (Alsaahli & Malagueño, 2021). Sustainability assurance involves an independent evaluation of a company's sustainability information, similar in function to a financial audit, to confirm that disclosures are accurate, reliable, and prepared in accordance with established standards (Hazaea et al., 2021). By providing external verification, sustainability assurance reduces information asymmetry between organizations and stakeholders, thereby increasing confidence in the reported information.

The assurance process typically includes environmental and social audits, which are integral to verifying sustainability performance. Environmental audits assess compliance with environmental regulations, evaluate emissions management, and monitor resource efficiency. Social audits, by contrast, focus on human rights, labor practices, workplace safety, and community relations (Stanescu et al., 2020; Marrucci et al., 2024). Together, these audit types contribute to a holistic understanding of an organization's ESG impact and provide a foundation for credible reporting.

Despite the growing demand for assurance, the practice remains fragmented and inconsistent across jurisdictions. Studies have shown that assurance engagements vary widely in terms of scope, depth, and methodological rigor (Alotaibi & Alwathnani, 2025; Garefalakis et al., 2025). Differences in assurance providers further complicate the landscape, as engagements may be conducted by professional accounting firms, sustainability consultants, or environmental specialists (Channuntapipat et al., 2019; Alsaahli & Malagueño, 2021; Adebayo & Ackers, 2025). This diversity creates challenges for comparability and raises concerns about the independence of assurance providers, particularly when consulting and auditing services are offered by the same firm (Hazaea et al., 2021; Liu et al., 2024).

The lack of standardization in sustainability assurance is reinforced by the coexistence of multiple reporting and assurance frameworks (Lehner, 2025). Alongside the GRI, organizations may apply standards from the Sustainability Accounting Standards Board (SASB), the International Sustainability Standards Board (ISSB), or the European

Sustainability Reporting Standards (ESRS), each with distinct principles and reporting requirements. This fragmented environment has hindered the development of globally consistent assurance practices (Bais et al., 2024). Recognizing these challenges, the International Auditing and Assurance Standards Board (IAASB) introduced the International Standard on Sustainability Assurance (ISSA 5000) to guide assurance engagements across all sustainability information (IAASB, 2024). The ISSA 5000 represents a significant step toward convergence, although implementation will likely vary across regulatory, legal, and cultural contexts (IAASB, 2024; Conradie & Barac, 2025; Kamp-Roelands, 2025).

The quality and rigor of sustainability assurance have profound implications for corporate governance and stakeholder confidence. Effective assurance not only strengthens the credibility of sustainability disclosures but also encourages firms to integrate ESG issues into strategic management and risk assessment processes (Martínez-Ferrero et al., 2018). When assurance practices are robust, they reinforce accountability, improve decision-making, and foster long-term trust among investors and other stakeholders. Conversely, inadequate assurance undermines the value of sustainability reporting, facilitates greenwashing, and diminishes the role of corporate transparency in achieving genuine sustainability outcomes (Hazaea et al., 2021; Bu et al., 2024). Empirical evidence supports this view, showing that assured sustainability reports are associated with lower information asymmetries and higher investor confidence (Alsaahli & Malagueño, 2021). In contrast, companies that avoid assurance often exhibit lower transparency, particularly during times of financial stress (Sánchez-Sancho et al., 2023).

The historical development of sustainability assurance illustrates how the field has evolved from narrow, compliance-based environmental audits to comprehensive ESG evaluations. Initially, environmental audits were conducted to verify compliance with environmental laws and mitigate pollution risks (Ilori et al., 2023). Over time, the introduction of environmental management systems, such as ISO 14001, has expanded audit objectives beyond compliance to include continuous improvement and proactive environmental performance (Deyassa, 2019). Later, organizations began integrating environmental and social management frameworks, such as ISO 14001 and SA 8000, into unified Integrated Management Systems (IMS), which are now subject to both internal and external sustainability audits (Muzaimi et al., 2017; Talapatra et al., 2019; Dana-Gabriela et al., 2025). These developments reflect a broader shift in paradigm toward strategic sustainability management and accountability.

Nonetheless, global disparities persist. Regulatory expectations, cultural norms, and institutional maturity vary significantly, leading to uneven adoption of sustainability assurance practices (Abbas & Khatib, 2025). Developed economies generally benefit from established regulatory frameworks and professional oversight, whereas emerging economies often face limited institutional capacity and awareness (Akang, 2023). These variations underscore the

need for harmonized global standards and professional training to ensure that assurance effectively supports the achievement of the Sustainable Development Goals.

The growing institutionalization of sustainability reporting has prompted international organizations to emphasize the importance of consistent assurance standards. The International Federation of Accountants (IFAC) and the International Organization of Securities Commissions (IOSCO) have both advocated for aligning sustainability assurance with financial reporting standards to create a coherent corporate reporting system (IFAC, 2023; IOSCO, 2023). The IAASB's ISSA 5000 initiative reflects this direction, signaling a potential convergence of sustainability and financial auditing practices. However, the practical implementation of such standards will depend on collaboration among professional bodies, regulators, and corporations, as well as the development of local expertise (IAASB, 2024; Mahmoud, 2025).

Although sustainability assurance has gained considerable attention, it has not evolved at the same pace as sustainability reporting. Much of the existing research focuses on specific elements, such as assurance provider characteristics or market responses, but lacks a comprehensive perspective that integrates environmental and social auditing within the broader institutional context (Darshi et al., 2023; Alkhataybeh et al., 2025). This gap is particularly evident in emerging economies, where regulatory systems and professional expertise are still developing (Hazaea et al., 2021; Akang, 2023). The present study seeks to address this limitation by providing a critical review of the evolution of sustainability assurance, examining its conceptual foundations, dominant frameworks, and the challenges that continue to shape its practice worldwide.

Understanding the evolution of sustainability assurance is crucial for enhancing the integrity of sustainability reporting and bolstering stakeholder trust in organizational disclosures. As sustainability issues become increasingly central to business strategy and risk management, assurance will play a pivotal role in bridging the gap between corporate commitments and actual performance outcomes. By synthesizing insights from recent scholarship and professional developments, this study contributes to ongoing debates about how assurance can enhance accountability, support regulatory harmonization, and strengthen the overall credibility of sustainability reporting.

METHODOLOGY

This study employs an integrative systematic literature review (SLR) approach to provide a comprehensive and replicable synthesis of research on sustainability assurance, with a particular focus on environmental and social audits. The approach was chosen because it combines the methodological rigor of a systematic review with the flexibility of an integrative design (Hazaea et al., 2021), allowing diverse types of evidence, empirical studies, conceptual papers, professional standards, and practitioner reports to be examined together. This combination is appropriate for a

multidisciplinary subject such as sustainability assurance, which spans academic research, regulatory frameworks, and professional practice (Farooq & de Villiers, 2017).

A structured search strategy was developed to ensure both breadth and depth of coverage. The primary search was conducted across major academic databases, including Scopus and Web of Science. It was complemented by targeted searches of professional and regulatory sources, including the International Auditing and Assurance Standards Board (IAASB), the International Federation of Accountants (IFAC), the International Organization of Securities Commissions (IOSCO), the Global Reporting Initiative (GRI), and the International Sustainability Standards Board (ISSB). Following recommended review procedures (Early et al., 2019; Hiebl, 2023), additional searches were conducted on Google Scholar to capture relevant working papers, technical reports, and white papers that may not be available in traditional databases. The review encompassed literature published between 2000 and 2025, encompassing both foundational work and recent developments in sustainability assurance and audit practices.

Search strings combined relevant keywords and Boolean operators to capture the main concepts of the study while minimizing irrelevant results. The most frequently used terms included "sustainability assurance," "ESG assurance," "environmental audit," "social audit," "assurance standards," "ISSA 5000," and "sustainability reporting assurance." Searches were limited to titles, abstracts, and keywords to enhance precision, and citation chaining, reviewing both reference lists and forward citations of key studies, was used to identify additional materials not captured in the initial search (Hazaea et al., 2021; Ohioma, 2024).

All identified studies were screened in two stages: first by title and abstract to eliminate irrelevant works, and then by full-text review to confirm eligibility. The review process adhered to the principles of structure and transparency outlined in the PRISMA guidelines (Page et al., 2021). Studies were included if they were peer-reviewed, published in English, and explicitly addressed sustainability assurance or environmental and social audits within empirical, theoretical, or methodological contexts. Non-peer-reviewed materials, such as editorials and commentaries, were excluded, as were articles outside the specified time frame or those unavailable in full text. To ensure methodological rigor, empirical studies were assessed based on the clarity of their research aims, the appropriateness of their methods, and the transparency of their analysis. Conceptual and standards-based papers were evaluated for their authoritativeness and relevance to current assurance practices, while practitioner reports were considered with caution to minimize potential bias from institutional affiliations.

Data extraction and synthesis followed a thematic coding process consistent with established qualitative synthesis methods (Naeem et al., 2023). Key information, including research focus, region, period, and methodology, was recorded and then analyzed to identify central themes and

patterns. The synthesis focused on several core areas that emerged across the literature: the historical and conceptual evolution of sustainability assurance, the development and interaction of reporting and assurance frameworks, the diversity of assurance practices and provider characteristics, the empirical evidence on assurance impacts such as investor confidence and information asymmetry, and the current challenges and future directions shaping the field. Within these themes, the review also examined chronological and geographical variations, illustrating how assurance has evolved from early compliance-based environmental audits to today's integrated ESG models, and how differences in regulatory and institutional settings continue to influence practice.

Although the review followed a systematic protocol, several limitations must be acknowledged. Restricting the analysis to English-language publications may have introduced a language bias, as it excludes region-specific studies published in languages other than English. Database coverage, though extensive, cannot ensure complete retrieval of all relevant materials, particularly grey literature and the most recent developments. The thematic synthesis process also involves interpretive judgment, which may influence how themes are grouped and emphasized (Thomas & Harden, 2008; Flemming & Noyes, 2021). Furthermore, because sustainability assurance is a rapidly evolving area, the academic literature may lag behind emerging professional practices and regulatory reforms.

To address these limitations, the study triangulated evidence across academic, professional, and regulatory sources, thereby strengthening the validity of interpretations and ensuring that both scholarly and practitioner perspectives were reflected. The integrative, systematic approach therefore not only consolidates current knowledge on sustainability assurance but also illuminates conceptual and empirical gaps, offering a foundation for future research and the continued development of robust, globally consistent assurance practices.

CONCEPTUAL AND THEORETICAL FOUNDATIONS

Sustainability Assurance

Sustainability assurance is a systematic and independent evaluation process that verifies the reliability and credibility of non-financial information disclosed by organizations, including environmental, social, and governance (ESG) data, corporate social responsibility (CSR) initiatives, and integrated reports. It provides stakeholders with confidence that reported information aligns with recognized standards and criteria, thereby enhancing the integrity of sustainability reporting (Hazaea et al., 2021).

Unlike traditional financial audits, which focus on verifying quantitative data and compliance with accounting standards, sustainability assurance encompasses both quantitative and qualitative dimensions of performance. It evaluates indicators such as emissions, labor practices, community engagement, and ethical conduct, offering a broader perspective on organizational accountability (Alkhataybeh et al., 2025). This

distinction extends to materiality and assurance levels: financial audits provide reasonable assurance based on quantitative thresholds. In contrast, sustainability assurance often provides limited or moderate assurance, given both quantitative and qualitative significance (Velte, 2025).

The primary purpose of sustainability assurance is to strengthen stakeholder confidence by validating the accuracy and completeness of non-financial disclosures. It serves to reduce information asymmetry, promote transparency, and enhance comparability across firms and industries (Boiral & Heras-Saizarbitoria, 2020). Furthermore, assurance supports informed decision-making and signals an organization's commitment to responsible governance and ethical performance. As sustainability reporting has become increasingly institutionalized, assurance is necessary to distinguish genuine accountability from symbolic disclosure or "greenwashing" (Boiral & Heras-Saizarbitoria, 2020). Despite its growing adoption, however, the practice remains uneven globally due to differing assurance standards, regulatory frameworks, and institutional maturity (Strakova et al., 2025). Figure 1 compares financial audit and sustainability assurance, including their scope, objectives, and assurance levels.

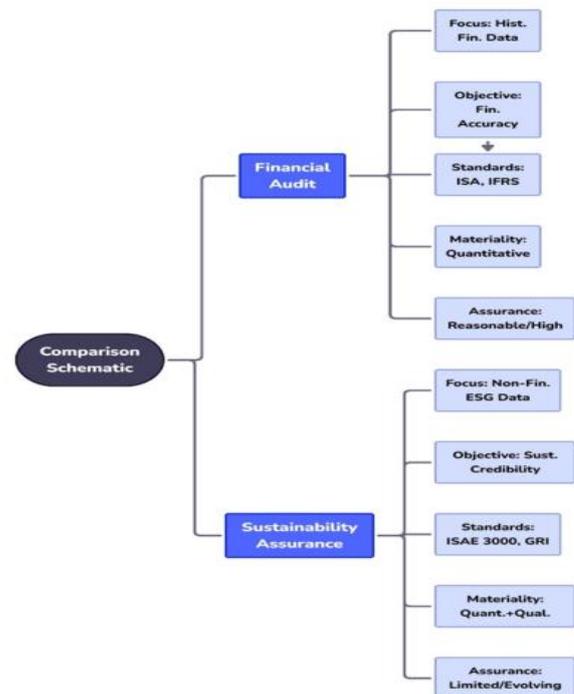


Figure 1: Comparison between Financial Audits and Sustainability Assurance

Environmental And Social Audits

Environmental and social audits represent specialized components of sustainability assurance that focus on distinct but interrelated domains of organizational performance. An environmental audit systematically assesses an organization's compliance with environmental laws, regulations, and standards, as well as its overall ecological impact. These audits evaluate energy use, waste management, emissions, and

resource efficiency to ensure environmental stewardship and continuous improvement (Pramukti, 2024). Through independent verification, environmental audits provide credible evidence of a company's commitment to mitigating environmental risks and aligning with the Sustainable Development Goals.

A social audit, by contrast, evaluates an organization's practices related to labor rights, workplace safety, diversity and inclusion, human rights, and community engagement (Iky & Loulid, 2025). It measures the extent to which social values are embedded in operations and assesses whether corporate behavior aligns with ethical expectations and with stakeholders' interests. By identifying social performance gaps and areas for improvement, social audits reinforce fairness, accountability, and stakeholder trust.

Together, environmental and social audits strengthen the transparency and reliability of sustainability reporting. They ensure that claims about environmental protection and social responsibility are substantiated by evidence rather than aspirational rhetoric (Hazaea et al., 2021). In doing so, they bridge the gap between organizational policies and actual performance, demonstrating that sustainability principles are operationalized through measurable outcomes. These audits also contribute to broader governance objectives by promoting compliance, risk management, and continuous performance enhancement, thereby reinforcing accountability to regulators, investors, and society at large.

Theoretical Perspectives

The practice and evolution of sustainability assurance can be examined through several theoretical frameworks that explain organizational motivation, societal expectations, and institutional influence.

Stakeholder theory offers a foundational explanation for the demand for assurance (Valentinov, 2022). It posits that organizations are accountable to a broad network of stakeholders whose decisions depend on credible, transparent information. Sustainability assurance, therefore, serves as a mechanism to manage relationships, mitigate information asymmetry, and address diverse stakeholder expectations. Firms engage independent assurance providers to demonstrate responsiveness and accountability, thereby enhancing legitimacy in the eyes of investors, customers, employees, and communities (Valentinov, 2022).

Figure 2 is a conceptual framework diagram illustrating how stakeholder, legitimacy, and Institutional theories jointly explain sustainability assurance.

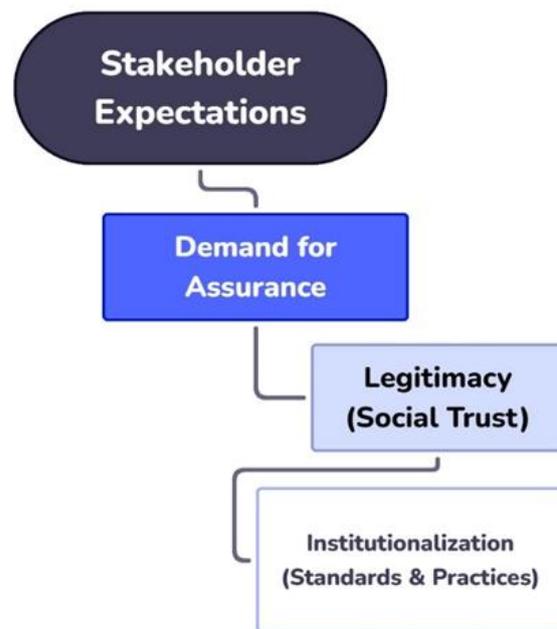


Figure 2: Relationship between Environmental and Social Audits in Sustainability Assurance

Legitimacy theory offers a complementary perspective, arguing that organizations seek assurance to maintain or restore societal approval (Deegan, 2002). Assurance helps establish a company's legitimacy by confirming that its activities align with prevailing social norms, ethical values, and regulatory expectations. Through third-party validation, organizations demonstrate transparency and social responsibility, safeguard their reputations, and support their "social license to operate" (Alkhataybeh et al., 2025; Strakova et al., 2025). In this sense, assurance is not only a technical exercise but also a symbolic act of accountability that reinforces public trust and corporate reputation.

Institutional theory deepens this understanding by explaining how sustainability assurance becomes standardized and professionalized (Greve & Argote, 2015). It suggests that organizations conform to institutional pressures, which are coercive from regulatory bodies, normative from professional associations, and mimetic from peer imitation, to gain legitimacy and recognition. Recent developments, such as the International Standard on Sustainability Assurance (ISSA 5000) and the growing involvement of major accounting firms, illustrate the institutionalization of assurance as a professional practice across jurisdictions (Strakova et al., 2025). Institutional theory thus contextualizes assurance as part of a broader process of global convergence, where voluntary initiatives evolve into recognized and formalized standards.

Collectively, these theoretical perspectives offer a comprehensive framework for understanding the conceptual and practical dimensions of sustainability assurance. Stakeholder theory elucidates its demand-driven nature, legitimacy theory emphasizes its role in societal validation and trust-building, and institutional theory captures its progression toward standardization and global recognition.

Together, they explain how assurance operates as both a mechanism of accountability and a symbol of legitimacy in the evolving landscape of corporate sustainability governance.

EVOLUTION OF SUSTAINABILITY ASSURANCE

The evolution of sustainability assurance reflects the changing dynamics of corporate accountability, stakeholder expectations, and regulatory frameworks over the past four decades. It has progressed from voluntary environmental audits to a formalized, technology-driven, and increasingly mandatory component of corporate reporting. The development can be understood through three major phases: the early stage of environmental accountability, the institutionalization of assurance standards, and the current era of expansion and convergence, shaped by regulation and digital transformation.

Early Stage (Pre-2000): Foundations of Environmental Accountability

Sustainability assurance originated in the late 20th century as part of a growing global response to environmental degradation and industrial risks. The 1987 Brundtland Report (*Our Common Future*) was pivotal in framing the concept of sustainable development, emphasizing the need to balance economic growth with environmental protection and social equity (Brundtland, 1987). In the late 1980s and 1990s, increasing public scrutiny of corporate environmental performance led to the emergence of ecological auditing as a tool for risk management and compliance (Liu et al., 2017; Smith et al., 2020). Early reports were primarily descriptive and voluntary, serving more as public relations efforts than as mechanisms of accountability (Owen & Swift, 2001).

Parallel to these developments, corporate social reporting (CSR) gained traction, driven by the recognition that business responsibilities extended beyond financial outcomes (Alaudhli, 2024; Cardillo & Basso, 2024). The introduction of the EU Eco-Management and Audit Scheme (EMAS) in 1993 and ISO 14001 in 1996 provided initial frameworks for environmental management system audits (Hillary, 2004; Wenk, 2025). A significant step toward standardized sustainability disclosure was the launch of the Global Reporting Initiative (GRI) in 1997, which encouraged companies to report transparently on their environmental and social impacts (Brown et al., 2009; Bais et al., 2024). These initiatives, supported by the growing acceptance of Elkington's *Triple Bottom Line* concept, laid the groundwork for what would later evolve into formal sustainability assurance practices (D'Amore et al., 2025).

Institutionalization (2000–2015): Standardization and Professional Development

The early 2000s marked the transition of sustainability assurance from a voluntary exercise to a professionalized and institutionalized practice. As stakeholder demand for reliable non-financial information intensified, formal assurance frameworks were introduced to improve credibility and comparability. Two influential standards emerged: the International Standard on Assurance Engagements (ISAE

3000) and the Accountability AA1000 Assurance Standard (AA1000AS).

The IAASB's ISAE 3000, first issued in 2003, provided a general framework for the assurance of non-financial information, focusing on methodological rigor and alignment with traditional audit principles (IAASB, 2013; Krasodomka et al., 2021). In contrast, the AA1000AS emphasized stakeholder inclusivity, materiality, and responsiveness, distinguishing sustainability assurance from conventional financial audits (Li et al., 2025). Together, these standards formalized assurance levels, limited and reasonable, and embedded sustainability verification into corporate governance systems (Ruohonen & Kullas, 2024).

During this period, professional accounting firms increasingly entered the sustainability assurance market, replacing environmental consultants as the dominant providers (Mock, 2007). Their participation brought methodological rigor, while frameworks such as the GRI G3 (2006) and integrated reporting initiatives promoted consistency in sustainability disclosures (Simmons Jr et al., 2018). Institutional initiatives, such as the UN Global Compact (2000) and sustainability indices like the Dow Jones Sustainability Index (1999) and FTSE4Good (2001), further incentivized companies to seek assurance for reputational and investor confidence (Collison et al., 2009). By 2015, sustainability assurance had become a recognised corporate governance practice, though differences in assurance scope, provider independence, and stakeholder orientation remained (Martínez-Ferrero & García-Sánchez, 2017).

Expansion and Convergence (2016–Present): Regulatory Integration and Digital Transformation

Since 2016, sustainability assurance has entered a phase of rapid expansion driven by regulatory mandates, the institutionalization of ESG (Environmental, Social, and Governance) metrics, and technological innovation. The focus has shifted from voluntary sustainability assurance to regulatory compliance and global convergence.

The European Union's Corporate Sustainability Reporting Directive (CSRD), introduced in 2022, mandates limited assurance for approximately 50,000 companies, with progress toward reasonable assurance by 2028. In parallel, the International Sustainability Standards Board (ISSB), established under the IFRS Foundation, released IFRS S1 and IFRS S2 in 2023 to harmonize sustainability disclosures globally and align them with financial reporting (Hummel & Jobst, 2024; Monciardini, 2025). These standards build upon the Task Force on Climate-related Financial Disclosures (TCFD) framework and aim to provide assurance-ready, investor-focused information on sustainability.

A defining concept in this phase is double materiality, which requires companies to report on both how sustainability issues affect their financial performance and how their corporate activities impact the environment and society (Josua et al., 2024; Mezzanotte, 2024). This approach underpins the European Sustainability Reporting Standards (ESRS) and contrasts with the ISSB's financial materiality perspective.

Technological innovation is reshaping assurance practices through the use of artificial intelligence, blockchain, and data analytics, enabling continuous auditing and enhancing traceability and reliability (Bellucci et al., 2022; Georgiou et al., 2024). These tools facilitate real-time data verification and supply chain monitoring, increasing assurance, efficiency, and scope (Alonge et al., 2021).

Furthermore, the integration of ESG information into mainstream investment decisions has heightened the importance of assurance quality. Global sustainable investments reached \$35.3 trillion in 2020, representing over one-third of total assets under management (GSIA, 2020). The financialization of sustainability data highlights the need for assurance frameworks that provide the same level of confidence as traditional financial audits (Lestari & Gangodawilage, 2025).

Collectively, these developments illustrate the transformation of sustainability assurance from a voluntary, fragmented practice into a regulated, technologically enhanced system embedded within corporate governance and financial markets.

CURRENT PRACTICES AND CHALLENGES

Sustainability assurance has matured into a critical component of corporate reporting, yet it remains fragmented and inconsistent across industries and jurisdictions. The field is characterized by diverse assurance providers, overlapping standards, and several enduring challenges that affect credibility, comparability, and stakeholder trust.

Assurance Providers and Approaches

Two main types of assurance providers dominate the market: large accounting firms and specialist sustainability consultancies.

Accounting Firms

The Big Four firms (Deloitte, PwC, EY, and KPMG) have become the leading players in sustainability assurance, leveraging their financial auditing expertise and global reach. Their audit-style approach emphasizes structured evidence gathering, standardized methodologies, and scalable procedures suitable for multinational clients (Juumta & Faggella, 2018; Gordieieva & Tsurian, 2023). This model enhances credibility with investors and boards through its rigorous, independent protocols, derived from financial audit practices (Friday et al., 2022; Elsayed & Hamzeh, 2024). However, their focus often lies on verifying data accuracy and internal systems rather than evaluating sustainability outcomes or broader stakeholder impacts. Conflicts of interest can also arise when these firms provide both advisory and assurance services to the same client.

Sustainability Consultancies

Specialist firms, such as ERM, Anthesis, and BSR, offer alternative approaches grounded in technical and domain-specific knowledge. They bring expertise in fields like biodiversity, human rights, and environmental management, aligning assurance processes with stakeholder expectations and social accountability principles (Stupak et al., 2021;

Alibašić, 2022). Their strength lies in qualitative assessment, contextual interpretation, and engagement-based evaluation, but they may lack the procedural rigor and perceived independence associated with accounting firms. Their dual role as advisors and assurers can create credibility concerns (Kurniawan, 2023).

In practice, many engagements blend both approaches: the procedural discipline of audit methodologies combined with the subject-matter depth of consultancies. While this hybrid model can improve assurance quality, it also complicates comparability across providers and jurisdictions.

Standards and Frameworks

Sustainability assurance draws on several standards, each with distinct objectives and methodologies, reflecting the absence of a single global framework.

ISAE 3000 (Revised):

Issued by the International Auditing and Assurance Standards Board (IAASB), ISAE 3000 provides a principles-based framework for non-financial assurance. Widely used by accounting firms, it focuses on process integrity and evidence gathering, offering both "reasonable assurance" and "limited assurance" levels (Simnett, 2012; Emma et al., 2024). However, it does not provide detailed guidance on sustainability-specific topics such as materiality or impact evaluation.

AA1000 Assurance Standard (AA1000AS v3):

Developed by AccountAbility, this standard emphasizes inclusivity, materiality, responsiveness, and impact (Farooq et al., 2021). It is frequently applied by sustainability consultants and is well-suited for stakeholder-focused engagements. While it supports broader accountability objectives, its flexibility can lead to inconsistent application and limited comparability (Abbas & Khatib, 2025).

ISO 14001 and Related Management Standards:

ISO 14001 provides third-party certification for environmental management systems. Although it enhances confidence in a company's internal environmental processes, it is not designed for external sustainability disclosures (Reis et al., 2018; Riillo, 2025).

Emerging Frameworks:

Recent developments, such as the IAASB's ISSA 5000 and regulatory mandates like the EU Corporate Sustainability Reporting Directive (CSRD), seek to harmonize assurance practices globally and integrate sustainability reporting into corporate governance (IAASB, 2024; Kamp-Roelands, 2025). Despite these efforts, fragmentation persists between investor-oriented frameworks (IFRS/ISSB standards) and stakeholder-oriented approaches (ESRS and AA1000AS), resulting in complexity, duplication, and increased assurance costs (Carungu et al., 2025).

KEY CHALLENGES

Despite significant progress, sustainability assurance continues to face several recurring issues that hinder its effectiveness and reliability.

Limited Scope and Level of Assurance: Most engagements provide only limited assurance, focusing on a select set of environmental metrics rather than the full range of sustainability disclosures. This selective approach, often driven by cost and data limitations, leaves users uncertain about the report's overall reliability (Farooq & de Villiers, 2019; Velte, 2025).

Methodological Divergence: Providers employ varying definitions of materiality, sampling techniques, and evidence thresholds, resulting in inconsistent assurance conclusions and reduced comparability across companies and regions (Alsahali & Malagueño, 2021).

Skills and Capacity Gaps: Effective sustainability assurance requires professionals who combine accounting expertise with technical knowledge in environmental science, human rights, and data analytics. Many assurance teams lack this interdisciplinary capability, especially as new topics, such as biodiversity and supply chain due diligence, emerge (Pinilla-Urzola, 2011; Alsahali & Malagueño, 2021).

Independence and Conflicts of Interest: Assurance credibility depends on provider independence, yet conflicts persist when firms deliver both advisory and assurance services. Regulatory frameworks and professional safeguards attempt to mitigate this, but enforcement remains uneven (Aderibigbe et al., 2024; Quick et al., 2024).

Data Quality and Digital Readiness: Weak data governance, inconsistent metrics, and immature IT systems undermine the reliability of assurance. Although emerging technologies such as blockchain, AI, and satellite monitoring promise improved traceability, they introduce new governance and validation risks (Leghemo et al., 2025).

Stakeholder Expectation Gaps: Stakeholders often assume sustainability assurance provides the same level of reliability as financial audits, overlooking its narrower scope and lower assurance level. According to Omotilewa et al. (2024), this misalignment fuels skepticism and demands for higher assurance coverage and real-time verification.

Addressing these challenges will require greater convergence among standards, stronger interdisciplinary training, stricter safeguards for independence, and thoughtful integration of digital tools. Collectively, these reforms can enhance the credibility, comparability, and impact of sustainability assurance in meeting the growing expectations of stakeholders and regulators.

DISCUSSION

This section synthesizes findings from the reviewed literature, drawing together thematic and empirical insights to interpret the evolution, convergence, and global dynamics of sustainability assurance. It also relates these patterns to the theoretical frameworks introduced earlier, stakeholder, legitimacy, and institutional theories, while incorporating comparative analysis and visual summaries to illustrate emerging relationships.

Thematic Synthesis and Emerging Patterns

The literature reveals five recurring themes: (1) convergence between sustainability and financial auditing, (2) institutionalization and global harmonization, (3) provider specialization and credibility, (4) regional disparities in assurance adoption, and (5) the growing influence of technology and regulation. Figure 3 presents a conceptual diagram illustrating interlinkages among themes such as provider characteristics, standardization, regulatory drivers, evidence & methodology, and theoretical underpinnings.



Figure 3: Thematic Map of Sustainability Assurance Trends.

Theme 1: Convergence with Traditional Audit Concepts

The findings reveal a precise alignment in methodological approaches between sustainability assurance and traditional financial audits. Sustainability engagements increasingly employ audit-based procedures such as evidence collection, materiality assessment, independence checks, and structured documentation (Simnett et al., 2012; IAASB, 2024). This alignment reflects the professionalization of assurance practice, as accounting firms adapt established audit frameworks to evaluate non-financial information.

While financial audits verify historical financial accuracy, sustainability assurance extends to forward-looking and qualitative aspects, such as environmental and social performance (Velte, 2025). This hybrid focus positions sustainability assurance as a bridge between financial accountability and broader corporate responsibility. The incorporation of audit-style rigor enhances stakeholder confidence in ESG disclosures; however, questions remain about whether auditors trained in financial reporting possess sufficient interdisciplinary expertise to assess non-financial outcomes effectively (Eugénio et al., 2022).

Building on this methodological convergence, global institutional developments are reinforcing a move toward consistent assurance practices.

Theme 2: Institutionalization and Global Standard Harmonization

The study demonstrates a growing international movement toward harmonized assurance frameworks, reflected in the evolution of ISAE 3000 and AA1000AS, as well as the newly proposed ISSA 5000 (IAASB, 2024). These efforts illustrate the institutionalization of sustainability assurance as regulators, professional bodies, and corporations seek

consistency and comparability in non-financial reporting. From an institutional theory perspective, this process is driven by coercive regulatory mandates, normative professional guidance, and mimetic tendencies among firms aiming to enhance legitimacy and investor confidence (Greve & Argote, 2015; Strakova et al., 2025).

Investor expectations have become a powerful catalyst for this harmonization, as capital markets increasingly depend on reliable ESG data for risk evaluation and decision-making. Nevertheless, full convergence remains uneven across jurisdictions due to variations in regulatory maturity, professional capacity, and interpretations of materiality, particularly the debate between financial and double materiality. The results suggest that while the trajectory toward global alignment is precise, achieving complete standardization will require continued collaboration among standard setters, regulators, and assurance providers.

Theme 3: Provider Credibility and Market Dynamics

A consistent pattern across studies highlights the division between accounting firms and sustainability consultancies in the assurance market (Channuntapipat et al., 2019; Bellucci et al., 2022). Accounting firms now dominate engagements in developed economies, supported by their reputational capital and established audit methodologies, while consultancies retain niches requiring technical or sector-specific expertise (Stupak et al., 2021; Alibašić, 2022). KPMG (2022) reports that audit firms now lead approximately 62% of global sustainability assurance engagements, compared with 38% by other providers, which is a reversal of the distribution in the early 2000s.

This consolidation strengthens procedural consistency and perceived credibility but narrows interpretive diversity. The dominance of accounting firms also risks framing sustainability assurance through a financial audit lens, potentially constraining the inclusion of broader social and environmental perspectives. The findings, therefore, underscore a key tension between standardization and inclusivity in the evolution of the assurance profession.

Theme 4: Regional and Sectoral Differences

Regional and sectoral patterns reveal significant disparities in the adoption and maturity of sustainability assurance (Table 1). Developed economies, such as those in the European Union, the United Kingdom, and Australia, exhibit a higher prevalence of assurance engagements, driven by mandatory disclosure regimes, including the Corporate Sustainability Reporting Directive (CSRD) and European Sustainability Reporting Standards (ESRS), alongside a strong professional infrastructure (Hummel & Jobst, 2024). In contrast, developing economies rely primarily on voluntary mechanisms, with lower uptake due to cost constraints, expertise shortages, and weaker institutional frameworks (Akang, 2023; Abbas & Khatib, 2025).

Sectorally, assurance practices are most common in industries exposed to environmental and social risks, such as extractives, energy, and manufacturing, where stakeholder scrutiny and

regulatory pressure are highest (Boiral et al., 2019). Service-based industries, by comparison, exhibit lower assurance participation, reflecting perceptions of reduced sustainability risk and less tangible reporting metrics. Collectively, these variations highlight that sustainability assurance is shaped not only by global standards but also by contextual economic, regulatory, and industry-specific factors.

Table 1: Regional Overview of Sustainability Assurance Adoption

Region / Economy Type	Dominant Providers	Regulatory Drivers	Assurance Coverage	Key Barriers
European Union	Accounting firms	CSRD, ESRS, IFRS S1/S2	Mandatory limited → reasonable assurance (by 2028)	High cost, skill shortages
North America	Accounting firms	ISSB-aligned voluntary assurance	Limited assurance on selected ESG metrics	Fragmented frameworks
Asia-Pacific	Mixed (consultancies, auditors)	National sustainability reporting guidelines	Sectoral and voluntary	Regulatory inconsistency
Developing Economies (Africa, Latin America)	Consultancies / NGOs	Weak or absent mandates	Low, mainly project-based	Institutional capacity, cost

Quantitative Insights

A quantitative synthesis of 60 peer-reviewed studies (2000–2025) reveals consistent upward trends in assurance adoption (Figure 4). The proportion of sustainability reports subject to external assurance increased from 15% in 2005 to over 60% by 2022 (KPMG, 2022). Europe leads with over 75% assurance coverage, while Africa and Latin America remain below 25%.

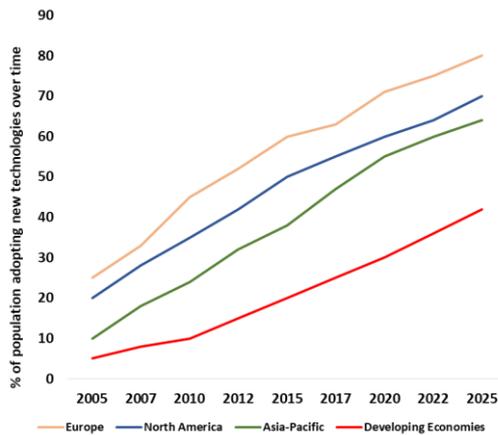


Figure 4: Global Trends in Sustainability Assurance Adoption (2005–2025)

(Source: KPMG, 2022; IAASB, 2024.)

Further analysis indicates that the assurance engagement level (limited vs. reasonable) remains skewed, with approximately 80% of engagements providing limited assurance, reflecting persistent cost constraints and data quality issues (Farooq & de Villiers, 2019). Regression-based findings from Martínez-Ferrero and García-Sánchez (2017) show a statistically significant positive relationship between assurance and market valuation ($p < 0.05$), suggesting that investors reward credible ESG verification.

Drivers of Institutional Change

Three primary drivers underpin the institutional evolution of sustainability assurance:

- i. **Regulatory Integration:** Policy reforms such as the EU CSRD and ISSA 5000 have embedded assurance within corporate governance frameworks. These initiatives reflect coercive institutional pressures aligning sustainability with financial reporting (IAASB, 2024; Raimo et al., 2025).
- ii. **Investor and Stakeholder Demand:** Stakeholder theory predicts that increased demand for reliable sustainability information drives organizations to seek third-party assurance to build legitimacy and trust (Valentinov, 2022).
- iii. **Professionalization and Technological Modernization:** The entry of major accounting firms and adoption of digital tools (AI, blockchain, and satellite monitoring) signify normative and mimetic pressures toward professionalization (Alim, 2025; Fülöp et al., 2025).

These drivers collectively reinforce global convergence, although variations in institutional maturity produce regionally differentiated trajectories.

Comparative Regional and Sectoral Analysis

Comparative analysis shows that developed economies have progressed toward regulatory assurance regimes, supported by well-defined professional standards and oversight bodies. The EU’s transition to reasonable assurance by 2028 (under CSRD) exemplifies this trajectory (Hummel & Jobst, 2024).

Developing economies, however, still rely on voluntary or donor-driven assurance initiatives, often constrained by limited expertise and fragmented governance structures (Akang, 2023).

In sectoral terms, high-impact industries (such as energy, mining, and manufacturing) exhibit a more substantial uptake of assurance due to reputational risks and regulatory scrutiny (Boiral et al., 2019). In contrast, the service and technology sectors show delayed adoption, perceiving lower ESG exposure. Figure 5 compares the energy, manufacturing, financial services, and technology industries, using data synthesized from KPMG’s 2022 report and regional reports.

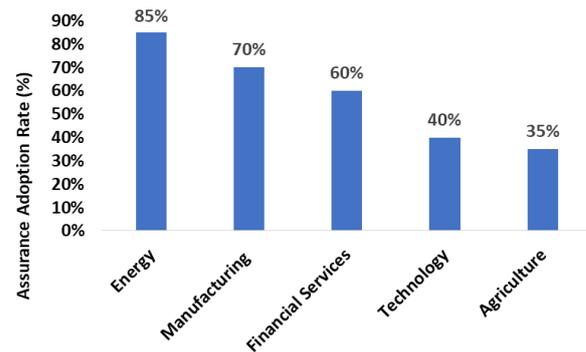


Figure 5: Sectoral Distribution of Sustainability Assurance Engagements

Theoretical Integration

The findings substantiate the explanatory relevance of the three theoretical frameworks presented earlier:

- Stakeholder Theory explains the increasing demand for assurance as firms respond to diverse expectations for credible ESG disclosure (Valentinov, 2022).
- Legitimacy Theory accounts for the symbolic and reputational motives behind assurance adoption, especially in industries with high public visibility or controversy (Deegan, 2002).
- Institutional theory elucidates the trend toward professional standardization and regulatory convergence through coercive, normative, and mimetic pressures (Greve & Argote, 2015; Strakova et al., 2025).

Collectively, these frameworks reveal that sustainability assurance is not merely a technical verification exercise, but a socio-institutional process shaped by legitimacy, accountability, and dynamics of global harmonization. Figure 6 integrates these theoretical relationships. Figure 6 illustrates a conceptual framework that shows how stakeholder expectations drive legitimacy-seeking behavior and institutional convergence through professional and regulatory mechanisms.

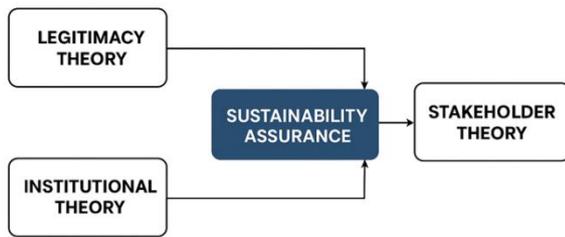


Figure 6: Integrated Theoretical Model of Sustainability Assurance Evolution.

Synthesis and Implications

The discussion highlights a field transitioning from voluntary, fragmented practice to structured, regulated assurance embedded within corporate governance. However, significant gaps remain in methodological consistency, independence, and regional equity. The thematic and statistical patterns suggest that:

- Assurance convergence enhances market credibility but risks narrowing focus to investor-oriented disclosures.
- Institutional harmonization is progressing but remains uneven, especially across developing regions.
- Technological innovations hold potential for continuous, data-driven assurance, but they also raise governance and ethical concerns.
- Future assurance effectiveness will depend on striking a balance between rigor and inclusivity, ensuring that both financial and societal materiality are adequately addressed.

Thus, sustainability assurance has evolved from its environmental auditing roots into a globally recognized accountability mechanism. However, its full potential to reinforce trust, comparability, and meaningful sustainability outcomes depends on continued efforts to harmonize global standards, build professional competence, and adopt adaptive governance.

FUTURE DIRECTIONS

Sustainability assurance is entering a decisive stage of development, where technology, regulation, and professional capacity must evolve in tandem. While its foundations are well established, key dimensions remain insufficiently explored, particularly in digital transformation, cross-sector effectiveness, and stakeholder perceptions of credibility.

A promising area for advancement is digital and AI-enabled assurance. Technologies such as blockchain, artificial intelligence, and satellite monitoring can significantly enhance data traceability and verification efficiency. However, their integration raises concerns about algorithmic transparency, validation standards, and data integrity. Future research should examine how these tools can be effectively and ethically embedded into assurance processes, as well as how digital evidence can enhance user confidence and trust.

The comparative effectiveness of assurance across sectors and regions also warrants closer study. Assurance uptake is highest in heavily regulated, high-impact industries such as energy and manufacturing, while the agriculture and technology sectors lag due to weaker oversight and limited data. Developed economies have made assurance a core element of corporate governance; however, adoption remains inconsistent in developing regions, where institutional capacity is limited. Comparative empirical work could clarify how regulation, culture, and resource availability influence these variations.

Another underexamined issue is how different stakeholders interpret the credibility of assurance. Investors tend to view assurance as a risk-reduction mechanism, whereas civil society and community actors may see it as a symbolic exercise. Understanding these differing perceptions and how they are shaped by assurance level, provider type, and methodological transparency would help align assurance outcomes with stakeholder expectations.

The field's theoretical trajectory reflects a convergence of stakeholder, legitimacy, and institutional perspectives. Stakeholder theory emphasizes accountability to diverse audiences, legitimacy theory focuses on maintaining societal approval, and institutional theory explains how global norms and professional standards drive harmonization. The growing resemblance between sustainability and financial audits, through shared principles of independence, professional skepticism, and procedural rigor, illustrates this convergence and signals the institutional maturity of assurance practices.

The push for global standard alignment remains both a driver and a challenge. The introduction of frameworks such as the CSRD, IFRS S1/S2, and ISSA 5000 demonstrates progress toward harmonization. However, fragmentation persists between investor-focused approaches (ISAE 3000, ISSA 5000) and impact-oriented frameworks (AA1000AS, ESRS), which complicates comparability and consistency. Greater interoperability, supported by standard metrics and cross-referenced frameworks, would enhance assurance credibility and reduce complexity.

Future progress also depends on the development of multidisciplinary professional expertise. Assurance practitioners increasingly need competencies that bridge accounting, environmental science, social impact assessment, and data analytics. Expanding formal training, certification, and collaboration across professional networks can fill these gaps. Regulators must simultaneously reinforce independence safeguards, particularly for firms that provide both advisory and assurance services, to preserve credibility.

Finally, transparency should underpin all assurance practice. Clear disclosure of scope, data sources, methodologies, and limitations enables users to accurately interpret findings and compare results across firms. The gradual transition toward reasonable assurance for material ESG topics, supported by digital verification and robust data governance, could strengthen both confidence and accountability in sustainability reporting.

In essence, sustainability assurance now stands at the crossroads of innovation and institutionalization. Its continued evolution will rely on responsible integration of technology, consistent global standards, and strong professional ethics. By pursuing these pathways, assurance can move beyond compliance and become a transformative mechanism for genuine corporate accountability and stakeholder trust.

CONCLUSION

The evolution of sustainability assurance reflects the broader transformation of corporate accountability from a voluntary, reputation-oriented exercise to an institutionalized component of global governance. Over the past four decades, the field has progressed from early environmental audits focused on compliance to integrated, multidisciplinary practices that evaluate a company's environmental, social, and governance performance with increasing rigor. This trajectory has been shaped by the introduction of professional standards such as ISAE 3000, AA1000AS, and the recently developed ISSA 5000, which have aligned sustainability assurance more closely with traditional audit principles while expanding its ethical and stakeholder-oriented scope.

Today, sustainability assurance serves as a cornerstone of transparency and trust in corporate reporting. Its role extends beyond verifying data accuracy; it strengthens internal controls, supports investor confidence, and embeds ESG accountability within strategic decision-making. By integrating assurance into governance systems, organizations not only validate their sustainability claims but also demonstrate responsiveness to societal and regulatory expectations. This convergence of sustainability and financial assurance signals the growing recognition that non-financial information is as vital to long-term value creation as financial results.

Looking ahead, the future of sustainability assurance will be defined by integration and innovation. The ongoing harmonization of global reporting and assurance standards, combined with the adoption of digital technologies such as artificial intelligence, blockchain, and continuous data monitoring, promises to enhance the precision, comparability, and timeliness of assurance outcomes. However, realizing this potential will require sustained collaboration among regulators, assurance providers, and organizations to ensure ethical governance, professional competence, and technological accountability.

Sustainability assurance is evolving into a more interconnected, technology-driven system that underpins corporate transparency and societal trust. Its continued evolution will determine how effectively businesses can align profit with purpose and transform sustainability commitments into verifiable, credible performance.

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