

DEVELOPMENT PATHS AND COMPARATIVE ANALYSIS OF ESG AND GREEN IT AUDITS

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Abstract

This paper explores the growing importance of non-financial reporting as a critical challenge for modern organisations. As global standards for transparency evolve, the reliability of these disclosures is increasingly validated through specialised auditing practices, including ESG (Environmental, Social, and Governance) and “Green” IT auditing. While both are emerging as essential tools for sustainable development, they differ significantly in their operational scope and technical execution.

Through a comparative and systematic analysis, this study identifies the fundamental synergies between these two auditing types. The research finds that while the ESG audit provides a broad strategic framework for organisational sustainability—encompassing human resources and governance—the Green IT audit offers the necessary quantitative depth by focusing on the environmental performance of digital systems.

The paper concludes that these two approaches are profoundly complementary: the ESG audit defines the overall corporate vision, while the Green IT audit serves as its technological engine, ensuring that empirical data backs sustainability claims. By integrating both audit types, organisations can develop more resilient management systems and enhance the credibility of their non-financial reporting in a digitalised global economy.

Keywords: ESG audit, “green” IT audit, environmental friendliness, IT systems, corporate responsibility, digital technologies.

ESG ԱՌՈՒԴԻՏԻ ԵՎ «ԿԱՆԱՀ» IT ԱՌՈՒԴԻՏԻ ԶԱՐԳԱՅՄԱՆ ՈՒՂԻՆԵՐԸ. ՀԱՄԵՄԱՏԱԿԱՆ ՎԵՐԼՈՒԾՈՒԹՅՈՒՆԸ

ՌԻՄԱ ՄԱՐԳԱՐՅԱՆ

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Համառոտագիր

Այս հոդվածն ուսումնասիրում է ոչ ֆինանսական հաշվետվողականության աճող նշանակությունը՝ որպես ժամանակակից կազմակերպությունների առջև ծառայած հիմնարար մարտահրավեր: Թափանցիկության համաշխարհային չափանիշների զարգացմանը զուգընթաց՝ հրապարակվող տվյալների արժանահավատությունն ավելի ու ավելի հաճախ է հաստատվում մասնագիտացված աուդիտորական գործունեության միջոցով, մասնավորապես՝ ESG (բնապահպանական, սոցիալական և կառավարչական) և «կանաչ» SS աուդիտների տեսքով: Չնայած երկու ուղղություններն էլ դիտարկվում են որպես կայուն զարգացման անհրաժեշտ գործիքներ, այնուամենայնիվ դրանք էապես տարբերվում են իրենց գործառնական շրջանակով և տեխնիկական իրականացման առանձնահատկություններով:

Համեմատական և համակարգային վերլուծության միջոցով սույն հետազոտությունը վեր հանեց տվյալ աուդիտորական մոտեցումների միջև առկա հիմնարար սիներգիաները: Հետազոտության արդյունքները փաստում են, որ եթե ESG աուդիտն ապահովում է կազմակերպչական կայունության լայն ռազմավարական շրջանակը՝ ներառելով մարդկային ռեսուրսների կառավարումն ու կորպորատիվ կառավարումը, ապա «կանաչ» SS աուդիտն ապահովում է անհրաժեշտ քանակական խորությունը՝ կենտրոնանալով թվային համակարգերի բնապահպանական արդյունավետության վրա:

Հոդվածում եզրահանգում է արվում, որ այս երկու մոտեցումները խորապես փոխլրացնող են. ESG աուդիտը սահմանում է ընդհանուր կորպորատիվ տեսլականը, մինչդեռ «կանաչ» SS աուդիտը հանդես է գալիս որպես դրա տեխնոլոգիական հիմք (շարժիչ)՝ երաշխավորելով, որ կայուն զարգացման վերաբերյալ հայտարարությունները հիմնավորված լինեն էմպիրիկ տվյալներով: Աուդիտի այս երկու տեսակների ինտեգրման միջոցով կազմակերպությունները կարող են ձևավորել առավել դիմակայուն կառավարման համակարգեր և բարձրացնել ոչ ֆինանսական հաշվետվողականության վստահելիությունը թվայնացված գլոբալ տնտեսության պայմաններում:

Բանալի բառեր՝ ESG աուդիտ, «կանաչ» SS աուդիտ, էկոարդյունավետություն, SS համակարգեր, կորպորատիվ պատասխանատվություն,

թվային տեխնոլոգիաներ:

Introduction

Currently, the need for society, investors, and international organisations to achieve not only economic efficiency from business but also social and environmental responsibility has increased worldwide. Recent events are driven by new challenges caused by the depletion of natural resources, climate change, social inequality, and increased corporate opacity. In this context, the international business community has begun to actively embrace the principles of sustainable development as pillars of long-term competitiveness and trust.

In these changing conditions, the ESG (Environmental, Social, Governance) concept was formed, which covers the assessment of an organisation's activities not only based on financial indicators, but also in terms of environmental impact, social policy, and management system effectiveness. The ESG audit is aimed at assessing the organisation's compliance with three key areas, identifying risks and opportunities in the context of sustainable management and responsible work style.

On the other hand, rapid technological development and the growing role of IT systems across all sectors have raised new challenges, including the impact of information technology on the environment, energy consumption, environmental efficiency, and carbon emissions. To answer these questions, the concept of "Green" IT was developed, which combines the principles of sustainability of the IT sector. "Green" IT audit is aimed at evaluating the effectiveness of IT infrastructure and processes from an environmental point of view, from server power consumption to hardware processing, digital data management and digital efficiency policy.

Even though ESG audit and "green" IT audit serve a common goal—to increase the sustainability and responsibility of the organisation, they have developed in different directions and are often used in separate models. However, modern approaches and experience show that these two processes can complement each other.

Research methods

To evaluate the convergence of ESG and Green IT auditing, this study employs a qualitative research framework centred on conceptual and comparative analysis.

The core of the methodology lies in a systematic review of contemporary auditing standards and academic discourse. Rather than viewing these two audit types in isolation, a system analysis approach was used to understand how Green IT functions as a critical technical component within the broader ESG governance structure.

The comparative analysis evaluated both audit types against three primary

benchmarks: data source reliability, regulatory compliance (specifically the GRI and ISO frameworks), and their overall contribution to corporate transparency.

To ensure the findings remain relevant to current trends, the study synthesised data from international auditing guidelines and recent industry reports (2020–2025). Finally, inductive and deductive reasoning were applied to bridge the gap between general sustainability theory and the specific technical requirements of IT infrastructure auditing, leading to the practical conclusions presented in this paper.

Theory and Methodology

The theoretical foundation of this research is built upon the convergence of modern sustainability principles and the evolving environmental efficiency of information technologies. At its core, the study adopts the ESG (Environmental, Social, and Governance) framework, which remains deeply rooted in the broader theory of sustainable development.

To understand this evolution, one must look back to the landmark 1987 Brundtland Report. By defining sustainable development as progress that meets “the needs of the present without compromising the ability of future generations to meet their own needs” (Sanjay, 2022), the United Nations set the stage for modern corporate accountability. This research, however, moves beyond these foundational definitions to explore how they are operationally verified through auditing.

In this context, an ESG audit functions as a multidimensional diagnostic process. Unlike a traditional environmental audit, which focuses narrowly on ecological compliance, the ESG audit serves as a holistic evaluation of an entity’s governance structures and social impact (Prodanova et al., 2023). Our analysis suggests that the true value of an ESG audit lies in its ability to identify systemic risks and uncover hidden efficiencies within an organisation’s internal subsystems.

A critical, and often overlooked, component of this framework is the integration of “Green IT” auditing. As digital infrastructure expanded rapidly at the start of the 21st century, the environmental footprint of data centres and electronic waste became impossible to ignore (Murugesan, 2008). This study argues that Green IT auditing is not merely a technical sub-discipline; it is the technological engine of the ESG framework. By bridging the gap between high-level sustainability goals and the technical reality of IT operations, this integrated approach provides the empirical rigour necessary for modern corporate transparency.

Results

ESG audits come in many forms and serve different use cases. In general, an ESG audit is a systematic evaluation of a company’s performance and practices across environmental, social, and governance factors (Dqsglobal, 2025). It assesses how well a company aligns with sustainability standards and evaluates its impact

on stakeholders, including employees, communities, customers, investors, and our planet and its ecosystems. It also confirms the ESG-related risks an organisation may be exposed to.

Effective Internal Auditing is essential for managing ESG risks and validating controls to mitigate them (KPMG report, 2023). In addition, Internal Audit is critical in providing objective assurance and advice on ESG reporting and wider sustainability matters. By taking on this critical role, Internal Audits can help shape a more sustainable and responsible business future. Further, in doing so, they can mitigate reputational risks and ensure that the organisation's ESG goals and objectives align with stakeholder needs. Internal Audit should be critical in providing objective assurance and advice on ESG reporting and, more broadly, sustainability matters.

ESG issues are increasingly relevant for all organisations. As a result, ESG has gone from a nice-to-have to an integral piece of long-term financial success. The recent white paper from the Institute of Internal Auditors (IIA), 'Internal Audit's role in ESG reporting', highlights several driving factors that are hastening this change, such as the increasing expectations of stakeholders and the public for companies to manage ESG risks and consider the ESG impact of their initiatives.

Sustainability, and specifically ESG, have become increasingly important considerations for organisations for various reasons. One of the primary factors is the growing awareness of environmental and social issues such as climate change, pollution, social inequality, unethical labour practices, human rights, diversity and inclusion, and corruption.

ESG audits go beyond compliance, helping companies manage critical risks in environmental, social, and governance areas (Nirpendra, 2024). Climate risks, like resource shortages, supply chain issues, and extreme weather, threaten long-term business resilience. The 2023 World Economic Forum Global Risks Report highlights climate change, biodiversity loss, and resource depletion as top risks to businesses and economies. ESG audits help companies systematically assess these threats, enabling better risk management and informed decision-making.

ESG audits have become indispensable for companies committed to ethical, transparent, and sustainable operations. As transparency requirements increase, regulatory frameworks grow stronger, and ESG-related risks grow, companies should integrate ESG audits into their core strategy. By adopting best practices and embracing technology, organisations can enhance their ESG audits to secure compliance, build stakeholder confidence, and gain a competitive advantage in a values-driven global marketplace.

When significant frameworks are compared, they are seen to have at least some achievement and recurrent variation. GRI Standards are concerned with inclusivity for stakeholders and universal applicability, as well as environmental and social impacts, irrespective of their financial materiality. The SASB Standards, on

the other hand, are market-based and focus on specific industry-based financially material ESG risks. The TCFD Framework focuses more on governance, strategy, and risk management related to climate disclosures. In contrast, the IFRS S1 and S2 standards issued by the ISSB are designed to integrate these strategies into a universally consistent framework (Fagbemi et al., 2025).

Artificial Intelligence holds significant potential to transform ESG auditing from a reactive reporting function into a dynamic, predictive, and proactive management system (Okojiev et al., 2023). AI can ingest, process, and analyse vast volumes of structured and unstructured data from a wide array of sources—IoT sensors, satellite imagery, utility logs, social media, legal documents, and financial disclosures—far beyond human capacity. In environmental auditing, machine learning models can detect emissions anomalies, forecast energy usage, and simulate climate impacts with greater precision and granularity than manual evaluations. For social metrics, AI-driven geospatial analysis and natural language processing can map community vulnerability, track inclusivity in service delivery, and monitor sentiment around development projects. In governance audits, algorithms can parse through corporate filings, procurement records, and public policy databases to identify corruption risks, transparency gaps, or policy inconsistencies. Moreover, AI systems can automate real-time compliance checks against ESG standards, flagging deviations and generating adaptive recommendations. This continuous monitoring improves risk management, enhances stakeholder trust, and ensures timely interventions. Explainable AI frameworks also allow for transparency in decision-making, a core requirement in governance-focused ESG domains. AI's predictive capabilities empower planners and regulators to anticipate ESG failures before they occur, enabling infrastructure that not only meets today's standards but remains resilient to future challenges. When integrated with digital twins and urban analytics platforms, AI transforms ESG metrics into actionable intelligence that guides the sustainable design, construction, and operation of smart infrastructure in rapidly evolving urban environments.

Global standards and regulatory frameworks provide the foundation for consistent ESG evaluation in infrastructure development, particularly in cross-border urban projects and investor-backed initiatives. Regulatory expectations for ESG compliance have evolved from voluntary reporting to mandatory disclosures in many jurisdictions. Frameworks such as the Global Reporting Initiative (GRI), Sustainability Accounting Standards Board (SASB), Task Force on Climate-related Financial Disclosures (TCFD), and International Sustainability Standards Board (ISSB) offer structured guidelines for ESG metrics reporting (Imoh P., 2023). These standards encompass environmental impact (e.g., greenhouse gas emissions, water use), social indicators (e.g., diversity, human rights, health and safety), and governance measures (e.g., executive accountability, corruption control, board structure). Governments and financial institutions increasingly mandate adherence

to these standards in procurement, permitting, and funding processes for urban infrastructure projects. In the European Union, the Corporate Sustainability Reporting Directive (CSRD) requires large companies to disclose detailed ESG performance data, which directly influences infrastructure financing. Similarly, green bond frameworks, such as the ICMA Green Bond Principles, are ESG-linked and demand transparency on fund allocation to sustainable infrastructure. Local regulatory bodies are also establishing ESG-oriented building codes, transportation planning laws, and environmental permitting systems. These standards ensure comparability, traceability, and auditability across different projects and geographies. However, fragmentation among standards, lack of interoperability, and vague definitions remain challenges. As AI increasingly integrates into ESG auditing, aligning algorithmic assessments with these evolving regulatory expectations becomes crucial. Ensuring compliance in real time, across diverse metrics, requires both technological sophistication and legal harmonisation (Ogunsola K., 2021).

The resources used in information technology (IT) are infrastructure, applications, information and people (Guideline for Audit of IT, 2011). An IT system designed for use in financial and management reporting will include procedures and databases for initiating, recording, processing, and reporting transactions (as well as events and conditions), and for maintaining accountability for the corresponding assets, liabilities, and equity.

The methodology for auditing in an IT environment varies depending on whether the objective is a financial, performance, or IT audit. For illustrative purposes, this guideline focuses on the task of financial audit in an IT environment in accordance with the Court's Audit Policies and Standards (CAPS).

The audit of controls on IT systems should have specific objectives, including verification of the accounts or other data produced by the system (e.g. data extracted for sampling purposes). The evaluation of internal controls should vary according to the type of audit and the degree of reliance the auditor wishes to place on them (INTOSAI Auditing Standards ISSAI 300, 3.2).

A "green" IT audit uses standards to evaluate the environmental impact of an organisation's enterprise technology (Kirvan, 2024). This type of audit assesses tech's energy use, carbon footprint, water usage, e-waste, infrastructure sustainability and other factors that affect the planet.

More stringent than a green IT assessment, a green IT audit uses standards, regulations and other guidance to validate that the IT department complies with relevant benchmarks. For example, green IT audits can help organisations stay current with and prepare for national and global regulations such as the Inflation Reduction Act of 2022, the EU's Corporate Sustainability Reporting Directive of 2023, and the SEC's impending climate-related disclosures rule.

While there are many ways to organise and conduct an audit, the key activities are identifying the relevant controls, gathering evidence through

interviews and researching various data sources. From there, auditors will analyse the evidence versus the controls and prepare a report with findings and recommendations. For example, ISACA provides considerable guidance on the IT audit process. The organisation also offers a governance framework called COBIT.

After determining the appropriate audit framework, IT leaders should consider including relevant environmental attributes to refine the control framework.

Once the process ends, the auditor delivers a report with recommendations (Kirvan, 2024). Thoroughly reviewing the results is crucial to getting meaningful insights. Stakeholders should be part of the process to determine the next steps for implementing the auditor's recommendations.

The structure of the audit and the selected controls can help the company further understand the IT team's environmental performance.

CIOs and IT leaders should consider performing annual green IT audits to gather data that can enhance the organisation's long-term sustainability strategy. Periodic assessments can supplement green IT audits and evaluate the effectiveness of new and existing sustainability-focused policies and procedures.

DASCIN is advancing Data Best Practices through education, certification and community.

Since its founding in 2017, DASCIN has been at the forefront of empowering organisations, governments, and individuals to harness the power of data (DASCIN, 2025). Over the years, DASCIN has grown into a global leader in data science education, certification, and knowledge sharing, enabling smarter and more sustainable decision-making across industries.

The DASCIN Green IT Audit is an assessment framework designed to evaluate an organisation's IT sustainability practices based on the Green IT Framework (DASCIN, 2025). This audit helps organisations measure and improve their energy efficiency, carbon footprint, and environmental impact by analysing their IT infrastructure, operations, and policies. By undergoing a Green IT Audit, businesses can identify opportunities to reduce waste, optimise resource consumption, and implement eco-friendly technologies. The audit also provides a structured approach for aligning IT strategies with global sustainability goals, ensuring compliance with industry regulations and corporate social responsibility (CSR) initiatives.

Green IT spans two overlapping but distinct conceptual domains (Patón-Romero et al., 2009):

- Green in information technology (green in IT)— As a producer of goods and services, enterprise IT itself has an impact on the environment: It consumes energy and technology artefacts (including both hardware and software), produces emissions, etc. Therefore, IT departments can implement green IT internally to produce more efficiently and consume more sustainably.

- Green by information technology (green by IT)— As an enabler of efficient and sustainable practices, information and technology (I&T) can provide tools—the number and scope of which are virtually limitless—that facilitate sustainability outside the IT department, across the enterprise and beyond.

Enterprises today often audit green IT from a business perspective rather than operational and/or technical perspectives. It is critical to distinguish between these approaches: representing the business to customers and/or the general public in terms of sustainability is often a primary goal (i.e., sustainability reputation), compared with optimising green IT practices at the operational and technical levels. Enterprises often regard reputation as a primary driver of business benefit.

If the audit evaluates sustainable practices implemented and/or executed in IT intended to reduce the negative environmental impact of IT itself, the audit reflects a green in IT audit, and the scope is reduced to the IT department.

If the audit evaluates sustainable practices implemented or facilitated by IT and intended to reduce the negative environmental impact of other systems or business disciplines, the audit reflects a green-by-IT audit. Furthermore, the scope will encompass the information and technologies used for these purposes, as well as the systems and disciplines affected by them.

The scope of green IT audits is determined by the nature of the audit, whether green by IT or green in IT. If the audit evaluates sustainable practices implemented and/or executed in IT intended to reduce the negative environmental impact of IT itself, the audit reflects a green in IT audit, and the scope is reduced to the IT department.

If the audit evaluates sustainable practices implemented or facilitated by IT and intended to reduce the negative environmental impact of other systems or business disciplines, the audit reflects a green-by-IT audit. Furthermore, the scope will encompass the information and technologies used for these purposes, as well as the systems and disciplines affected by them.

Harmon and Auseklis (2009) emphasise that, for organisations to be sustainable, green IT initiatives should be developed through a “co-creation” process, working with customers and relevant stakeholders. When asked about consultation with customers during the development of green IT projects, none of the organisations, unfortunately, included customers in the process, except Company D, which operates as a consultancy and is therefore closer to and understands the requirements of their clients better (Chang, 2016). Understandably, this fosters a mutually beneficial relationship in the development of green IT solutions, which are in both the firm's and consumers' interests.

Environmental, social and governance controls also apply to the IT organisation. The IT-focused portion of the ESG audit focuses on the following issues (Kirvan, 2024):

- **Environment for IT audit.**This focuses on the IT department's policies, procedures, and culture regarding energy use, waste management, and carbon emissions. These elements might complement related green IT audit controls.
- **Social for IT audit.**This focuses on the IT department's commitment to diversity, equity and inclusion, particularly in its hiring practices and employee involvement in the company.
- **Governance for IT audit.**This focuses on operational policies, procedures, and practices, as well as risk management.

To better understand how sustainability goals translate into technical reality, this study compares ESG and Green IT auditing through two distinct lenses: their strategic alignment and their operational execution.

Let's present the similarities and differences in the form of a table.

Table 1.

Similarities between ESG audit and "green" IT audit¹

Characteristic	Similarity
Audit type	Both are varieties of modern auditing.
Goal	Both are aimed at achieving the Sustainable Development Goals.
Scope of regulation	Both are regulated by relevant international standards (e.g., GRI, SASB for ESG; ISO 14001/50001 for Green IT).
Relationship to corporate strategy	Both are related to corporate strategy.
Result	Both help external users of information make the right decisions in terms of sustainability.

The similarities outlined in Table 1 suggest that ESG and Green IT auditing are not merely parallel processes but are fundamentally interconnected through the lens of corporate accountability. Our analysis indicates that both disciplines serve as a ‘single source of truth’ for stakeholders. By aligning with international standards and UN Sustainable Development Goals, these audits move beyond simple compliance; they function as a strategic shield against ‘greenwashing,’ providing investors with the verifiable transparency needed in today’s ESG-driven market.

Now, let us look at the differences.

¹ All tables built by the author

Table 2.

Differences between ESG audit and “green” IT audit²

Characteristic	ESG audit	«Green» IT audit
Audit object	The organisation’s activities in the fields of the environment, the social sphere, and management.	Environmental sustainability of IT infrastructure and technologies.
Orientation	This is based on social responsibility.	It is based on technological efficiency and energy saving.
Technological depth	A general audit without an in-depth technical check.	In-depth technical assessment: servers, programs, and various computer equipment.
The management component	Focuses on corporate responsibility.	Focuses on technological issues.
Scope of application	All organizations.	Only IT organisations.

The distinctions presented in Table 2 provide a clearer understanding of the operational roles each audit plays. While the ESG audit offers the ‘qualitative vision’ and broad social responsibility of an organisation, the Green IT audit provides the ‘quantitative backbone.’

A key takeaway from this comparison is the shift in technical depth: the Green IT audit translates abstract environmental goals into measurable data—such as server efficiency and energy-saving metrics. Furthermore, although Table 2 notes that Green IT has traditionally been focused on IT-centric firms, this study argues that in the era of digital transformation, this distinction is fading. For any modern enterprise, the IT infrastructure is now a primary driver of its overall carbon footprint, making the Green IT audit an indispensable component of a credible ESG framework.

The organisation is trying to address its problems by leveraging the opportunities offered by modern auditing. Being audit types, they are actually very different. Different types of audits may complement each other at some point.

The ESG audit and the Green IT audit together form a multi-level sustainability audit system in which strategic and operational assessments complement each other, providing a more objective and in-depth assessment of organisations’ performance.

² All tables built by the author

Conclusion

The comparative analysis conducted in this study leads to several pivotal conclusions regarding the future of sustainability auditing. In an era when digital transformation and environmental accountability converge, the traditional boundaries of auditing are being redefined. Our research demonstrates that ESG and Green IT audits have emerged as indispensable tools for navigating the dual demands of corporate responsibility and technological efficiency.

First, this study confirms that while an ESG audit provides the necessary “strategic vision”—encompassing environmental, social, and governance pillars—it often lacks the granular technical data required for total transparency. We argue that Green IT auditing acts as the critical “missing link” or the quantitative backbone of this framework. By providing empirical evidence—such as energy optimisation metrics, hardware lifecycle data, and digital waste management—Green IT auditing validates an organisation’s broader ESG claims. It mitigates the growing risks of “greenwashing.”

Second, a significant finding of this research is the shifting scope of Green IT. We conclude that Green IT auditing should no longer be viewed as a niche requirement limited to the technology sector. In today’s digital-first economy, where data centres and digital infrastructure are primary drivers of carbon emissions, Green IT auditing must be integrated as a standard, operational component of any robust ESG governance system, regardless of the industry.

Ultimately, for modern organisations, these two approaches are not competing methodologies but deeply complementary ones. ESG defines the overall sustainability strategy, while Green IT ensures its technological implementation. We conclude that the simultaneous application of both audits is essential for ensuring that sustainable digital transformation is not just a strategic intent, but a verifiable reality. This synergy leads to more informed management decisions and strengthens long-term corporate resilience in a rapidly changing global regulatory environment.

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