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INTEGRATING GREEN ACCOUNTING AND GREEN AUDIT INTO CORPORATE SUSTAINABILITY GOVERNANCE: A CONCEPTUAL FRAMEWORK FOR EMERGING ECONOMIES

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Abstract: The transition toward a low-carbon and resource-efficient economy has transformed environmental information from a voluntary reputational disclosure into a strategic element of corporate reporting, audit evidence and investment decision-making. This article develops an integrated conceptual framework for green accounting and green audit in emerging economies. The study is based on an integrative review of international sustainability reporting and assurance requirements, including IFRS S1 and IFRS S2, the GRI Standards, ISO 14001, ISO 14064, the EU Corporate Sustainability Reporting Directive and the International Standard on Sustainability Assurance 5000. The research identifies the main institutional gap between environmental data generation in accounting systems and independent verification through audit and assurance procedures. The proposed framework connects five components: recognition and classification of environmental costs, measurement of environmental liabilities and climate-related risks, internal control over sustainability information, green audit procedures, and the use of verified sustainability data in corporate governance and investment analysis. The results show that green accounting and green audit should not be treated as isolated environmental management tools; they form a single accountability cycle that improves transparency, reduces greenwashing risk and increases the reliability of sustainability-related financial information. The article contributes to the literature by proposing a Green Accountability Maturity Index that can be applied by companies, auditors and regulators to assess the readiness of organizations for credible sustainability reporting. The findings are particularly relevant for emerging economies, including Uzbekistan, where green economy strategies create demand for transparent environmental accounting, reliable non-financial reporting and independent audit mechanisms.

Keywords: green accounting; green audit; sustainability assurance; environmental costs; IFRS S1; IFRS S2; GRI Standards; ESG reporting; emerging economies.

JEL Classification: M41; M42; Q56; G34.

Introduction

The global movement toward sustainable development has significantly changed the role of accounting and auditing. Traditional financial accounting was primarily designed to measure assets, liabilities, income and expenses in monetary terms. However, climate change, resource scarcity, pollution, biodiversity loss and stakeholder pressure have created a need for accounting systems that can capture the environmental consequences of business activities. In this context, green accounting is increasingly viewed as a methodological extension of accounting that identifies, measures and reports environmental costs, environmental liabilities, carbon-related information and resource efficiency indicators.

At the same time, green audit has become necessary because environmental information is exposed to the same reliability problems as financial information. Companies may overstate environmental achievements, underreport pollution-related obligations, use inconsistent methodologies for greenhouse gas accounting or provide sustainability disclosures that are

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difficult to compare across periods and entities. Therefore, independent audit and assurance procedures are required to evaluate whether environmental information is complete, accurate, consistent and useful for decision-making[1].

The relevance of this topic has increased after the creation of a more formal global sustainability reporting architecture. IFRS S1 requires entities to disclose material information about sustainability-related risks and opportunities, while IFRS S2 focuses on climate-related disclosures. These standards are designed to make sustainability information useful for investors and other providers of capital. The GRI Standards, by contrast, are oriented toward reporting organizational impacts on the economy, environment and society. In addition, the EU Corporate Sustainability Reporting Directive requires companies within its scope to report according to European Sustainability Reporting Standards, and ISSA 5000 provides a global framework for sustainability assurance engagements.

For emerging economies, the issue is especially important. Many countries are adopting green growth strategies, developing green finance instruments and encouraging enterprises to improve energy efficiency and environmental performance. Uzbekistan is an illustrative case: the national transition toward a green economy up to 2030 and related policy reforms require better environmental data, transparent sustainability reporting and credible audit mechanisms. Without an integrated green accounting and green audit system, green economy policy may remain disconnected from enterprise-level financial reporting and corporate governance.

The research problem addressed in this article is the institutional and methodological gap between environmental information generation and its independent verification. In many enterprises, environmental costs are recorded only as ordinary operating expenses, environmental liabilities are not systematically assessed, sustainability data are prepared outside the accounting system, and audit procedures focus mainly on financial statements. As a result, environmental information remains fragmented, weakly controlled and insufficiently useful for investors, creditors, regulators and other stakeholders.

The purpose of this article is to develop an integrated conceptual framework that links green accounting and green audit into a single corporate sustainability governance system. The article answers three research questions: (1) what is the functional difference and relationship between green accounting and green audit; (2) what components should be included in a practical framework for integrating environmental accounting data with audit procedures; and (3) how can the maturity of green accountability be assessed in emerging economies?

The scientific novelty of the article lies in treating green accounting and green audit as mutually dependent elements of the same accountability cycle. Green accounting creates structured environmental information, while green audit evaluates the reliability of that information and the effectiveness of internal controls over sustainability reporting. This approach makes it possible to transform environmental reporting from a voluntary image-building exercise into a verifiable governance mechanism.

Literature Review and Theoretical Background

The concept of green accounting is rooted in the broader field of social and environmental accounting. Early research emphasized that conventional accounting tends to externalize environmental damage and fails to reflect the full ecological consequences of economic activity. Gray (2010) argued that accounting for sustainability should not be limited to presenting additional disclosures, because genuine sustainability requires rethinking what is measured, why

[1] Deegan, C. (2002). Introduction: The legitimising effect of social and environmental disclosures: A theoretical foundation. Accounting, Auditing & Accountability Journal, 15(3), 282-311.

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it is measured and for whom it is reported. Schaltegger and Burritt (2000) further developed environmental management accounting by linking physical information on materials and energy flows with monetary information on costs and benefits.

Green accounting can be interpreted at three interconnected levels. At the macroeconomic level, it adjusts national accounts by including natural resource depletion, environmental degradation and ecosystem services. At the corporate financial accounting level, it recognizes environmental liabilities, asset retirement obligations, provisions, impairment risks and pollution-related costs. At the managerial accounting level, it provides information on energy use, waste, water consumption, environmental taxes, carbon costs and resource efficiency for internal decision-making.

Green audit is also multidimensional. It can refer to environmental compliance audit, environmental management system audit, audit of environmental liabilities in financial statements, audit of sustainability reports and assurance over climate-related information. INTOSAI guidance on environmental auditing is particularly important in the public sector, while ISSA 5000 expands the assurance framework for sustainability information across different reporting frameworks and topics. This confirms that green audit is not limited to checking environmental certificates; it is an evidence-based professional process aimed at strengthening the credibility of environmental information[2].

The theoretical foundation of green accounting and green audit may be explained through stakeholder theory, legitimacy theory and accountability theory. Stakeholder theory suggests that enterprises must provide information not only to shareholders but also to creditors, employees, customers, communities, regulators and society. Legitimacy theory explains why firms disclose environmental information to maintain social acceptance and reduce reputational risk. Accountability theory provides the strongest foundation for audit, because it requires that reported information be supported by evidence, internal controls and independent verification.

Recent international standards have moved the field from voluntary reporting toward structured disclosure and assurance. IFRS S1 and IFRS S2 provide an investor-oriented approach to sustainability-related financial disclosures. The GRI Standards provide an impact-oriented approach to sustainability reporting. ISO 14001 provides requirements for environmental management systems, and ISO 14064 supports greenhouse gas quantification, reporting and verification. The EU CSRD has accelerated the institutionalization of sustainability reporting, while ISSA 5000 offers assurance requirements applicable to sustainability information prepared under different frameworks.

Despite these developments, the literature still shows a methodological gap. Many studies analyze sustainability reporting, environmental management accounting or audit assurance separately. Fewer studies explain how accounting data, internal control, environmental management systems and audit procedures should be connected at the enterprise level. This article addresses that gap by proposing an integrated framework that can be adapted to the institutional conditions of emerging economies.

Table 1.

Functional distinction and interaction between green accounting and green audit[3]

Criterion	Green accounting	Green audit	Integrated governance effect
Core purpose	To identify, measure and report environmental costs,	To verify the reliability, completeness and	Transforms environmental information into

[2] Global Reporting Initiative. (2021). GRI Standards. https://www.globalreporting.org/standards/

[3] Developed by the author based on IFRS S1/S2, GRI Standards and ISSA 5000 principles.

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Criterion	Green accounting	Green audit	Integrated governance effect
	liabilities, resource use and climate-related information.	compliance of environmental information and controls.	credible decision-useful data.
Main users	Managers, accountants, investors, creditors, regulators and sustainability teams.	Boards, audit committees, external auditors, assurance providers, regulators and stakeholders.	Improves trust between preparers and users of sustainability information.
Main evidence base	Accounting records, environmental cost centers, emission data, resource consumption reports and provisions.	Audit evidence, control testing, recalculation, reconciliation, inspection, inquiry and analytical procedures.	Creates a chain of evidence from transaction-level data to public reporting.
Key risk	Misclassification of environmental costs, incomplete measurement of liabilities and inconsistent ESG metrics.	Insufficient audit evidence, weak criteria, lack of expertise and greenwashing risk.	Reduces information asymmetry and sustainability reporting risk.
Expected output	Environmental cost reports, carbon data, sustainability metrics and green investment indicators.	Audit findings, assurance conclusion, recommendations and follow-up monitoring.	Supports sustainable investment, risk management and accountability.

Materials and Methods

This article applies a qualitative conceptual research design based on an integrative literature review and normative analysis of international standards. The purpose of the method is not to test a statistical hypothesis, but to synthesize existing knowledge and develop a practical framework that can be used by enterprises, auditors and policymakers.

The study used three groups of sources. The first group includes academic literature on environmental accounting, sustainability accounting, legitimacy theory, stakeholder theory and accountability theory. The second group includes international reporting and assurance standards, especially IFRS S1, IFRS S2, GRI Standards, ISO 14001, ISO 14064, EU sustainability reporting requirements and ISSA 5000. The third group includes policy and institutional sources related to green economy development in emerging economies, with Uzbekistan used as a contextual reference.

The analytical procedure consisted of four steps. First, the author identified recurring concepts in the literature: environmental cost recognition, environmental liabilities, greenhouse gas data, environmental management systems, internal control and assurance. Second, these concepts were compared with the requirements and logic of international sustainability reporting

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and assurance frameworks. Third, the functional relationship between green accounting and green audit was mapped. Fourth, a maturity assessment model was designed to evaluate whether an organization is ready to produce and verify credible environmental information.

The proposed framework follows a process logic: environmental events create accounting data; accounting data require classification and measurement; measured data require internal controls; controlled data require audit and assurance; verified data support governance, reporting and investment decisions. This process logic is consistent with the audit evidence approach because sustainability information must be traceable from the original source to the final report.

A limitation of the methodology is that it does not provide a company-level empirical test. However, this limitation is consistent with the objective of the article, which is to build a conceptual and methodological foundation. Future research may apply the proposed Green Accountability Maturity Index to a sample of enterprises and test its association with reporting quality, audit opinion, cost of capital or green investment attraction.

Table 2.

Methodological design of the article[4]

Methodological element	Description	Research output
Research design	Qualitative conceptual research based on an integrative literature review.	A structured model for linking green accounting and green audit.
Source base	Academic literature, sustainability standards, assurance standards and green economy policy sources.	Theoretical and normative foundation of the framework.
Analytical focus	Environmental costs, liabilities, climate-related risks, internal controls and audit evidence.	Identification of key components of green accountability.
Main method	Comparative and logical analysis of reporting and assurance requirements.	A practical sequence of accounting and audit procedures.
Novel element	Development of a Green Accountability Maturity Index.	Assessment tool for enterprises and auditors.

Results

Green accounting requires both monetary and physical measures. Monetary measures include environmental costs, liabilities, provisions, investments and savings from resource efficiency. Physical measures include greenhouse gas emissions, energy consumption, water use, waste volumes and recycling rates. A strong green accounting system reconciles physical data with monetary information, because sustainability reporting becomes weak when environmental metrics are prepared outside the control environment of the accounting function.

Environmental data should be subject to authorization, documentation, reconciliation, segregation of duties, IT controls and management review. For example, emission data should be reconciled with production volumes and energy invoices; waste data should be reconciled with waste disposal contracts; and environmental provisions should be supported by legal, technical and financial evidence.

[4] Developed by the author.

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The auditor assesses the suitability of criteria, the reliability of data sources, the design and operating effectiveness of controls and the consistency of disclosures. Finally, verified information is used in sustainability reports, financial statements, investment analysis, green financing and board-level decision-making.

Environmental events	Green accounting measurement	Internal control	Green audit / assurance	Sustainability report	Governance and investment decisions

Figure 1.

Integrated green accounting and green audit model[5]

Components of green accounting in corporate reporting

The second result is the identification of the minimum components of corporate green accounting. These components should be built into the financial and management accounting system. The first component is environmental cost accounting. Environmental costs should be grouped into prevention costs, control costs, remediation costs, compliance costs, waste management costs, carbon-related costs and green innovation costs. This classification helps management identify where environmental spending is reactive and where it creates long-term value.

The second component is accounting for environmental liabilities and provisions. Enterprises may have legal or constructive obligations related to land restoration, waste disposal, pollution treatment, asset decommissioning and environmental penalties. These obligations must be assessed using the same professional rigor as other liabilities. Failure to recognize environmental liabilities may overstate financial position and reduce the reliability of financial statements.

The third component is climate-related risk measurement. Climate risks may be physical, such as drought, flood, heat stress or water scarcity, and transitional, such as carbon pricing, environmental regulation, changes in consumer demand and technology shifts. Green accounting should provide information on how these risks affect assets, liabilities, impairment testing, useful lives, production costs and investment plans.

The fourth component is resource efficiency accounting. Companies should measure savings and productivity effects arising from energy efficiency, water efficiency, waste reduction and recycling. This component is important because green accounting should not only report environmental burdens; it should also identify economic benefits from sustainable innovation.

The fifth component is environmental performance reporting. This includes key performance indicators such as energy intensity, emission intensity, water intensity, waste intensity, share of renewable energy, share of recycled materials and environmental expenditure as a percentage of revenue or operating costs.

Table 3.

Proposed structure of corporate green accounting indicators

Indicator group	Examples of indicators	Accounting data source	Decision-making value
Environmental costs	Pollution control costs, waste disposal costs, environmental taxes, certification	General ledger, cost centers, invoices, contracts and budgets.	Shows the financial burden and efficiency of environmental

[5] Developed by the author.

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Indicator group	Examples of indicators	Accounting data source	Decision-making value
	costs, remediation expenses.		management.
Environmental liabilities	Restoration obligations, legal claims, environmental provisions, decommissioning obligations.	Legal files, technical reports, management estimates and financial statements.	Prevents understatement of liabilities and supports prudent reporting.
Resource efficiency	Energy consumption per unit, water use per unit, waste per unit, recycling rate.	Production reports, meter data, utility invoices and operational records.	Identifies cost-saving opportunities and operational risks.
Climate-related information	Scope 1, Scope 2 and relevant Scope 3 emissions, carbon cost exposure, physical climate risks.	Emission registers, energy data, supplier data and risk assessments.	Supports IFRS S2-type climate disclosure and investment planning.
Green investments	Capital expenditures for cleaner technology, renewable energy and resource-efficient equipment.	Capital budget, fixed asset register and project documents.	Links sustainability strategy with capital allocation.

Source: Developed by the author based on IFRS S1/S2, GRI Standards and ISSA 5000 principles.

Discussion

The results of this study show that green accounting and green audit should be understood as complementary mechanisms. Green accounting provides the language and measurement base for environmental information, while green audit provides credibility and discipline. A company that has environmental policies but no green accounting system cannot reliably measure environmental performance. Similarly, a company that prepares sustainability reports without audit or assurance exposes users to greenwashing risk.

The proposed integrated framework is consistent with the direction of global sustainability regulation. IFRS S1 and IFRS S2 emphasize decision-useful sustainability-related financial information. GRI emphasizes impacts and stakeholder accountability. ISSA 5000 emphasizes assurance over sustainability information prepared under various criteria. These developments indicate that the future of corporate reporting will not be divided into financial and non-financial information in a simplistic way. Instead, companies will need integrated systems in which sustainability risks, environmental costs and climate-related opportunities are connected with financial performance and enterprise value.

For auditors, the framework implies a need for new professional competencies. Traditional audit skills remain important, including risk assessment, evidence collection, documentation, analytical procedures and professional skepticism. However, green audit also requires knowledge of environmental regulation, greenhouse gas accounting, sustainability metrics, environmental

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management systems and climate-related risk. Audit firms therefore need internal methodologies, specialized training and multidisciplinary teams.

The Uzbekistan context illustrates this policy relevance. The country's transition toward green economy and green growth creates demand for reliable environmental information in enterprises, banks and public institutions. Green accounting can help identify the financial implications of water use, energy efficiency, waste management and carbon-related risks. Green audit can increase confidence in sustainability reports, green bonds, investment projects and public-private initiatives. This makes the proposed framework relevant not only for academic debate but also for practical institutional reform.

The framework also contributes to reducing greenwashing. Greenwashing occurs when companies present environmental claims that are selective, exaggerated or unsupported by evidence. A mature green accounting and green audit system reduces this risk by requiring traceable data, suitable criteria, internal control and independent verification. Thus, the proposed Green Accountability Maturity Index may be used as a preventive governance tool.

Conclusion and Recommendations

This article developed an integrated conceptual framework for green accounting and green audit in corporate sustainability governance. The study demonstrated that green accounting and green audit are not separate or optional environmental tools. They are interdependent elements of a single accountability cycle that begins with the identification of environmental events and ends with verified sustainability information used in governance and investment decisions.

Based on the findings, the following recommendations are offered. First, enterprises should introduce separate analytical accounts and cost centers for environmental costs and green investments. Second, environmental liabilities and provisions should be assessed systematically and supported by legal, technical and financial evidence. Third, companies should reconcile physical environmental indicators with monetary accounting data. Fourth, internal control over sustainability information should be documented and tested. Fifth, audit firms should develop green audit methodologies aligned with international assurance standards. Sixth, regulators in emerging economies should encourage sustainability assurance and provide methodological guidance for environmental accounting.

Future research may empirically test the proposed maturity index using survey data, annual reports or assurance reports of companies in different industries. It may also examine whether higher green accountability maturity is associated with lower cost of capital, higher investment attractiveness, better environmental performance or stronger stakeholder trust. Another promising direction is the development of sector-specific green audit checklists for agriculture, energy, construction, manufacturing and financial institutions.

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