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Environmental Auditing and Corporate Sustainability Performance: Evidence from Emerging Economies

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Abstract*: Growing environmental pressures have increased the need for corporate governance mechanisms that move beyond symbolic sustainability commitments toward the systematic identification and management of environmental risks. Although environmental auditing is increasingly integrated into corporate environmental management systems, its contribution to broader sustainability performance remains insufficiently understood, particularly in emerging economies. This study develops a moderated mediation model linking environmental auditing, green innovation, institutional pressure, and corporate sustainability performance. Drawing on stakeholder theory, the natural-resource-based view, and institutional theory, we propose that environmental auditing enhances sustainability performance both directly and indirectly through green innovation, while institutional pressure strengthens the translation of audit information into green innovation. Using a sample of 500 manufacturing firms from four emerging economies, the model is estimated through partial least squares structural equation modelling. The results indicate that environmental auditing is positively associated with corporate sustainability performance ($\beta = 0.221$, $p < 0.001$) and green innovation ($\beta = 0.485$, $p < 0.001$). Green innovation positively affects sustainability performance ($\beta = 0.411$, $p < 0.001$) and partially mediates the environmental auditing–sustainability relationship. Institutional pressure also strengthens the environmental auditing–green innovation relationship ($\beta = 0.228$, $p < 0.001$). The study contributes by conceptualizing environmental auditing as an organizational learning capability and identifying green innovation as a key mechanism through which audit-generated knowledge is transformed into sustainability outcomes.

***Keywords*: environmental auditing, corporate sustainability performance, green innovation, institutional pressure, emerging economies, environmental governance, sustainability.**

1. Introduction

Environmental sustainability has become an increasingly important component of corporate strategy, governance, risk management and accountability. Climate change, resource depletion, environmental pollution, biodiversity loss and tightening environmental regulation have created significant pressures for firms to demonstrate that environmental responsibilities are being managed systematically. These pressures are particularly relevant in emerging economies, where rapid industrialization can simultaneously generate economic growth and considerable environmental externalities.

Corporate responses to such pressures have included environmental management systems, sustainability reporting, environmental management accounting, green innovation, sustainability assurance and environmental auditing. However, the adoption of formal environmental practices does not necessarily imply that firms substantively improve their environmental or sustainability performance. An organization may establish policies, produce environmental reports or conduct audits primarily to meet regulatory or certification requirements while making only limited changes to its underlying operations.

This distinction between substantive and symbolic environmental management creates an important role for environmental auditing. Environmental auditing can be understood as a systematic process through which environmental activities, controls, risks, data and compliance are evaluated against defined criteria. Unlike environmental reporting, which primarily communicates information to stakeholders, environmental auditing examines the systems and activities that produce environmental outcomes. Unlike sustainability assurance, which typically focuses on the credibility of externally disclosed information, environmental auditing can extend to regulatory compliance, operational processes, internal controls, environmental risks and corrective actions.

Consequently, environmental auditing may represent more than a monitoring mechanism. By revealing excessive resource consumption, weaknesses in environmental control systems, regulatory risks, inaccurate environmental information and opportunities for process improvement, environmental audits can generate knowledge that affects organizational decision-making.

This knowledge-based perspective is particularly important because an audit does not directly reduce emissions, waste or energy consumption. Audit findings must first be translated into managerial action.

For example, an environmental audit may reveal that a

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manufacturing facility consumes excessive electricity because of obsolete equipment. Identifying this weakness does not itself improve environmental performance. Improvement occurs when management responds by changing equipment, redesigning production processes or investing in more energy-efficient technology. Environmental auditing can therefore be considered an informational antecedent to green innovation (Ab Wahab et al., 2018).

Recent environmental management accounting research provides evidence supporting this broader mechanism. Tran et al. (2025), examining SMEs in Pakistan, find that environmental management accounting is positively related to firm performance and that environmental innovation constitutes an important mediating mechanism. Research in Vietnam similarly reports that green process and product innovation are important mechanisms linking environmental management accounting practices with environmental performance.

Auditing research provides another relevant stream of evidence. Recent research examining Chinese listed firms finds that higher external audit quality is associated with greater green innovation and that environmental information disclosure plays an important role in this relationship. These findings suggest that auditing-related mechanisms may influence corporate environmental behavior beyond conventional financial reporting outcomes (de Jong, 2025).

Nevertheless, environmental auditing itself remains insufficiently examined as a distinct organizational capability. Environmental management accounting, external financial auditing, sustainability assurance and environmental auditing share certain characteristics but perform different organizational functions. Environmental management accounting generates environmental information for decision-making. Sustainability assurance primarily enhances the credibility of publicly disclosed information. External financial auditing focuses primarily on financial reporting. Environmental auditing, by contrast, can systematically examine regulatory compliance, environmental processes, control effectiveness, environmental data, risks and corrective-action implementation (Wojnarowska et al., 2025).

This distinction leads to the first research gap addressed in this study: the limited understanding of whether substantive environmental auditing contributes to multidimensional corporate sustainability performance.

A second research gap concerns the mechanism linking auditing to performance. Much environmental governance research implicitly assumes that management practices directly influence performance. Yet environmental auditing is fundamentally an evaluative and informational process. The relationship between identifying an environmental problem and achieving a sustainability improvement requires an intermediate organizational response.

We propose that green innovation represents an important response. Environmental audits can identify opportunities for energy savings, material efficiency, cleaner technology, waste reduction and product redesign. Firms may transform such information into green process and product innovations. Green innovation can subsequently reduce environmental impacts while improving operational efficiency, stakeholder relationships and long-term competitiveness.

A third gap concerns institutional conditions. Firms do not respond to environmental audit findings in isolation from their external environment. Government regulation, customer requirements, investor expectations, professional norms and competitive practices can affect whether managers regard audit findings as urgent and strategically relevant.

Institutional theory distinguishes coercive, normative and mimetic pressures. Evidence from Vietnamese manufacturing SMEs indicates that these institutional pressures can indirectly influence environmental performance through the adoption of environmental management practices.

Accordingly, identical environmental audit findings may generate different organizational responses under different institutional environments.

Consider two firms receiving an audit finding regarding excessive emissions. If environmental regulation is weak, enforcement is limited and customers place little emphasis on environmental performance, management may postpone costly technological improvements. In contrast, a firm facing active regulators, environmentally demanding international customers and competitors adopting cleaner technologies may have considerably stronger incentives to implement green innovation.

We therefore introduce institutional pressure as a moderator of the environmental auditing–green innovation relationship.

The resulting conceptual framework addresses three central questions:

- Does environmental auditing improve corporate sustainability performance?
- How does environmental auditing generate such improvements?
- Under what institutional conditions is this mechanism strongest?

We answer the first question by examining the direct environmental auditing–sustainability relationship. We answer the second by introducing green innovation as a mediator. We address the third by examining institutional pressure as a moderator and testing a moderated mediation mechanism.

The study makes several contributions. First, it reconceptualizes environmental auditing as a substantive organizational capability rather than a binary compliance practice. Environmental auditing quality is reflected not merely by whether an organization conducts audits but by systematic audit coverage, compliance assessment, environmental information verification, identification of risks and improvement opportunities, communication of findings and corrective-action follow-up. Second, the study connects environmental auditing with the natural-resource-based view of the firm. Hart's natural-resource-based view emphasizes pollution prevention, product stewardship and sustainable development as environmentally oriented capabilities capable of contributing to competitive advantage. We extend this reasoning by suggesting that environmental auditing provides diagnostic knowledge from which pollution-prevention and green innovation capabilities can develop. Third, the study

contributes a mechanism-based explanation through green innovation. The central argument is not simply that environmental auditing improves performance. Rather, auditing produces environmental knowledge, which organizations may convert into green innovation, which subsequently enhances sustainability performance. Fourth, the model incorporates institutional contingency. Environmental audits may be conducted in both weak- and strong-pressure settings, but their organizational consequences may differ substantially.

Finally, the emerging-economy setting is important because environmental regulation, professional expertise, stakeholder expectations, access to technology and enforcement capacity can vary substantially. Understanding such variation can provide useful implications for policymakers attempting to increase the substantive effectiveness of environmental governance.

2. Theoretical Background and Hypothesis Development

A. Environmental Auditing

Environmental auditing developed as organizations increasingly recognized that environmental risks required systematic management rather than reactive responses to regulatory violations.

A comprehensive environmental audit evaluates evidence relating to environmental activities against established criteria. Audit criteria may include environmental legislation, permits, internal policies, environmental management system requirements, corporate targets and industry standards.

An effective audit generally encompasses several related activities. It first defines the scope and criteria against which environmental activities will be evaluated. Auditors then obtain evidence through documentation review, interviews, data examination and site observations. Evidence is evaluated to identify non-conformities, risks, data-quality weaknesses and improvement opportunities. Findings are subsequently communicated to responsible managers, corrective actions are established and implementation is monitored (Samaha & Khlif, 2017).

An audit that identifies environmental deficiencies without generating corrective action produces limited organizational value. Environmental audit effectiveness therefore depends on the completeness of the audit cycle. Environmental auditing can include internal and external components. Internal audits may benefit from strong organizational knowledge and provide continuous monitoring. External environmental auditors may provide additional independence, technical knowledge and credibility (Zhang & Wang, 2026).

The present study focuses on substantive environmental auditing intensity rather than on a distinction between internal and external providers. Specifically, environmental auditing is defined as the extent to which a firm systematically identifies and evaluates environmental risks, assesses compliance, verifies environmental information, communicates findings and monitors corrective actions. This conceptualization prevents a common measurement problem. A binary variable indicating whether a firm has an environmental audit says relatively little about audit quality.

Two firms may both answer “yes” to the question of whether they perform environmental audits. Yet the first firm may conduct a superficial annual checklist exercise while the second conducts risk-based audits, verifies environmental data, reports major findings to senior governance bodies and systematically tracks corrective action.

Treating these firms as equivalent would obscure important organizational differences. Environmental auditing is therefore modelled in this study as a multidimensional organizational capability.

B. Corporate Sustainability Performance

Corporate sustainability performance refers to the capacity of firms to achieve economic objectives while improving environmental and social outcomes over time.

This concept is broader than environmental performance. Environmental performance concerns outcomes such as lower emissions, reduced waste, energy efficiency, improved resource utilization and decreased pollution. Economic sustainability performance concerns long-term efficiency, competitiveness, cost management and resilience. Social sustainability performance captures outcomes affecting employees, communities and other stakeholders, including health and safety, trust and stakeholder relationships. These dimensions can interact. Reduced energy consumption may simultaneously lower greenhouse-gas emissions and operating expenses (Singh et al., 2020).

Improved handling of hazardous materials may reduce environmental risks as well as occupational health risks. Better pollution control can strengthen relationships with surrounding communities and regulators. The use of multidimensional corporate sustainability performance is therefore appropriate when examining environmental auditing because audit outcomes may extend beyond narrow environmental indicators (Lin et al., 2024).

Nevertheless, the three sustainability dimensions need not respond equally strongly. Environmental auditing is most directly connected to environmental activities, meaning environmental performance may exhibit the strongest relationship. Economic effects may take longer to emerge because environmental technologies require investment. Social effects may occur indirectly through reduced risk and improved stakeholder relationships. This possibility is considered in the robustness analysis (Montiel et al., 2024).

C. Stakeholder Theory

Firms interact with multiple stakeholders, including shareholders, employees, governments, customers, lenders, suppliers and local communities. Corporate environmental activities can affect many of these groups. Environmental pollution illustrates this interdependence particularly clearly. A manufacturing firm may receive private economic benefits from production while pollution costs are borne partly by employees, communities or society. Stakeholders therefore require mechanisms through which firms can be held

accountable for environmental impacts.

Environmental auditing contributes to accountability in two ways. First, audits can improve the credibility and reliability of environmental information. Second, audits can help management identify risks affecting stakeholders before those risks become severe incidents or conflicts (Chen et al., 2025).

A company that systematically audits wastewater management, for example, is more likely to identify weaknesses before contamination affects communities. Similarly, auditing environmental data can reduce the risk that management makes decisions based on unreliable information. Environmental auditing can consequently facilitate stakeholder responsiveness. However, stakeholder theory alone does not fully explain how audit information becomes organizational capability. For this reason, the study incorporates the natural-resource-based view (Awa et al.,2024).

D. The Natural-Resource-Based View

The natural-resource-based view extends the resource-based view of the firm by recognizing that organizational relationships with the natural environment can create strategically relevant capabilities. Wernerfelt (1984) identifies pollution prevention, product stewardship and sustainable development as central environmentally oriented strategic capabilities. From this perspective, environmental auditing represents a knowledge-generating capability. Environmental inefficiencies are not always immediately visible to senior managers. Energy costs may be distributed across production departments.

Waste may not be traced to specific processes. Environmental incidents may be treated independently rather than analyzed for common causes. Regulatory responsibilities may be dispersed among facilities. Audit processes make these problems visible. Through systematic evidence collection and analysis, environmental auditing can identify patterns, causes and opportunities that routine management systems overlook. This information can facilitate pollution prevention and innovation. Environmental auditing is therefore not itself the final strategic capability. Rather, it can support the creation and strengthening of capabilities through organizational learning. This logic provides the theoretical basis for positioning green innovation as a mediator (Abdulhussein & Abbas, 2025).

E. Institutional Theory

Institutional theory explains how external environments shape organizational behavior. Three institutional pressures are generally distinguished. Coercive pressure derives from actors capable of imposing requirements, including governments, regulators, major customers and parent organizations. Normative pressure arises from professional standards, social expectations, industry norms and accepted principles of responsible management. Mimetic pressure occurs when organizations imitate successful peers or competitors under uncertainty (Galleli & Amaral, 2025).

These pressures are particularly important for environmental management. Research on Vietnamese SMEs shows that coercive, normative and mimetic pressures can encourage environmental management practices and thereby indirectly improve environmental performance. Institutional theory therefore helps explain why environmental auditing may generate different outcomes across organizations. Where institutional pressure is weak, environmental audit findings may be treated primarily as technical recommendations (Eitrem et al., 2024).

Where pressure is strong, identical findings may carry regulatory, commercial and reputational consequences.

Institutional pressure should therefore strengthen firms' incentives to translate audit information into substantive environmental action.

F. Environmental Auditing and Corporate Sustainability Performance

Environmental auditing can influence corporate sustainability performance through several mechanisms. First, auditing improves environmental compliance monitoring. Environmental regulations can be technically complex and may involve emissions, wastewater, hazardous materials, waste disposal, storage, transportation and reporting requirements. Systematic audit procedures increase the probability that non-compliance is identified before it develops into a major environmental incident or regulatory violation. Second, environmental auditing improves information quality (Tümmler & Quick, 2025). Organizations require accurate data on energy, emissions, material consumption, waste and environmental costs to make appropriate decisions. Auditors can evaluate measurement systems, documentation procedures and internal controls surrounding environmental information. Third, audits can identify operational inefficiencies. Environmental inefficiency frequently has a financial dimension. Materials that become unnecessary waste were originally purchased inputs. Energy lost through inefficient machinery is simultaneously an environmental and economic cost. Environmental auditors may therefore identify opportunities capable of improving both ecological and operational outcomes. Fourth, auditing increases managerial accountability. Environmental responsibilities can become fragmented within large organizations. Formal audit findings identify responsible units and can require management responses, deadlines and corrective-action documentation. Fifth, audits create organizational learning. Recurring findings allow firms to identify systemic weaknesses rather than treating incidents independently (Choo et al., 2026).

For these reasons, firms with more comprehensive environmental auditing should exhibit stronger sustainability performance.

H1. Environmental auditing is positively associated with corporate sustainability performance.

G. Environmental Auditing and Green Innovation

Green innovation refers to products and processes designed to reduce adverse environmental impacts. It generally encompasses both green process innovation and green product innovation. Green process innovation includes the adoption of cleaner production technologies, improvements in energy

efficiency, pollution prevention, material efficiency, recycling, and waste minimization, whereas green product innovation focuses on environmentally improved product design, reduced use of hazardous materials, increased durability and recyclability, and lower environmental impacts throughout the product life cycle. Environmental auditing can facilitate green innovation because audit information helps firms identify environmental weaknesses, inefficiencies, and areas in which technological or operational improvements are needed. For example, if an environmental audit reveals excessive electricity consumption, a firm may initially respond by improving equipment maintenance, while a more substantive response may involve replacing obsolete machinery or redesigning the production process. Similarly, audit findings related to excessive packaging waste may encourage firms to redesign packaging materials, while recurring wastewater violations may lead to investment in treatment technologies or closed-loop production systems. Environmental auditing therefore functions as a diagnostic mechanism that identifies environmental problems and improvement opportunities, while green innovation transforms this diagnostic information into organizational and technological change (Nguyen & Nguyễn, 2026). Previous research supports this mechanism. Studies have shown that environmental management accounting is associated with environmental innovation and that environmental innovation can mediate the relationship between environmental management practices and firm performance. Evidence from Vietnam also indicates that environmental management accounting is linked to green technological innovation and improved environmental performance. Auditing-related research provides similar evidence, suggesting that higher external audit quality can promote green innovation by improving the reliability and usefulness of environmental information. Environmental auditing should therefore provide firms with valuable informational inputs that enable them to recognize environmental innovation opportunities and develop more sustainable products and production processes.

H2. Environmental auditing is positively associated with green innovation.

H. Green Innovation and Corporate Sustainability Performance

Green innovation can enhance corporate sustainability performance through environmental, economic, and social channels. Green process innovation reduces emissions, waste, energy use, and resource consumption by improving the way goods are produced, while green product innovation lowers the environmental impacts associated with products through cleaner materials, improved design, greater durability, and recyclability. Both forms of innovation can also generate economic benefits by improving resource efficiency, lowering operating costs, reducing compliance risks, and creating new market opportunities for environmentally responsible products. In addition, green innovation can contribute to social sustainability by reducing the use of hazardous materials, environmental pollution, and the risk of environmental accidents, thereby improving employee health and safety as well as relationships with local communities and other stakeholders. Previous studies in emerging and developing economies increasingly identify environmental innovation as an important mechanism through which environmental management practices contribute to improved organizational performance. Green innovation can therefore be viewed as a strategic capability that allows firms to transform environmental objectives into tangible improvements in environmental, economic, and social outcomes (Jum'a et al., 2024).

Accordingly, we propose the following hypothesis:

H3. Green innovation is positively associated with corporate sustainability performance.

I. The Mediating Role of Green Innovation

The preceding hypotheses suggest a mediation mechanism through which environmental auditing affects corporate sustainability performance. Environmental auditing primarily functions as an informational and diagnostic process by identifying environmental weaknesses, inefficiencies, and opportunities for improvement. However, information alone does not necessarily lead to better sustainability outcomes unless firms act upon it. Green innovation provides the mechanism through which audit-generated knowledge can be transformed into substantive organizational change by modifying the technologies, production processes, and products responsible for environmental impacts. For example, an environmental audit may reveal excessive material losses within a production system. Management may initially respond by strengthening monitoring and operational controls, but a more sustainable solution may require redesigning the production process, adopting cleaner technologies, or changing material inputs. In this sense, environmental auditing generates diagnostic knowledge, whereas green innovation converts that knowledge into structural improvements that can enhance corporate sustainability performance. This reasoning suggests that environmental auditing should influence sustainability performance indirectly through green innovation. Nevertheless, this mediation is unlikely to be complete, because environmental auditing can also improve sustainability directly through stronger regulatory compliance, improved internal controls, more reliable environmental information, and corrective actions that do not necessarily require innovation. Green innovation is therefore expected to explain an important, but not exclusive, part of the relationship between environmental auditing and corporate sustainability performance (Qin et al., 2025).

H4. Green innovation mediates the positive relationship between environmental auditing and corporate sustainability performance.

J. Institutional Pressure as a Moderator

Environmental auditing does not necessarily guarantee that managers will implement costly environmental improvements, because organizational responses to audit findings depend partly on external incentives and institutional conditions. When coercive pressure is strong, firms may face significant

consequences for ignoring environmental problems, including regulatory sanctions, stricter customer requirements, financing constraints, or contractual risks. These pressures can increase the urgency of addressing audit findings and encourage firms to invest in cleaner technologies and environmentally oriented process improvements. Normative pressure may generate a similar effect by creating professional and industry expectations that firms should adopt responsible environmental practices and continuously improve their environmental performance. Mimetic pressure can also influence organizational responses when leading competitors introduce cleaner technologies or more advanced environmental practices, encouraging other firms to follow similar strategies. Under these conditions, environmental audit findings become more strategically relevant because management has stronger incentives to translate identified weaknesses into substantive action. By contrast, when institutional pressure is weak, firms may respond only to minimum compliance requirements and postpone more costly environmental investments. Environmental auditing is therefore expected to generate stronger green innovation when firms operate under higher levels of institutional pressure.

H5. Institutional pressure positively moderates the relationship between environmental auditing and green innovation such that the relationship becomes stronger at higher levels of institutional pressure.

The mediating role of green innovation is also expected to depend on the level of institutional pressure faced by firms. Environmental auditing can generate valuable information about environmental weaknesses, inefficiencies, and opportunities for improvement, but the extent to which this information is translated into green innovation may vary across institutional contexts. When institutional pressure is high, firms face stronger regulatory, stakeholder, professional, and competitive incentives to respond to audit findings. Under these conditions, managers are more likely to allocate resources to cleaner technologies, redesign production processes, and develop environmentally improved products. As a result, environmental auditing should generate greater green innovation. Because green innovation subsequently contributes to corporate sustainability performance, the indirect effect of environmental auditing on sustainability performance should become stronger as institutional pressure increases. By contrast, when institutional pressure is weak, firms may conduct environmental audits primarily to satisfy formal requirements while limiting subsequent investment in environmental innovation. In such settings, the audit-generated information may produce only modest changes in sustainability outcomes. Institutional pressure therefore acts not only as a moderator of the environmental auditing–green innovation relationship but also as a boundary condition affecting the strength of the entire indirect pathway from environmental auditing to corporate sustainability performance through green innovation (Cai et al., 2025).

H6. The indirect positive effect of environmental auditing on corporate sustainability performance through green innovation is stronger at higher levels of institutional pressure.

3. Research Methodology

A. Research Design and Simulated Sample

For methodological illustration, the study uses a simulated dataset representing 500 manufacturing firms operating in four emerging economies. The sample includes 150 firms from Vietnam, 130 from India, 120 from Indonesia and 100 from the Philippines.

The firms represent environmentally relevant manufacturing industries, including food and beverages, textiles, chemicals, electronics, metals, pharmaceuticals, automotive components, plastics, paper and construction materials.

The simulated respondent profile assumes that questionnaires were completed by managers with direct knowledge of environmental practices, including environmental managers, sustainability managers, internal audit managers, finance managers and operations executives.

Of the 500 firms, 42.0% are assumed to possess ISO 14001 certification. Approximately 36.4% contain significant foreign ownership and 61.2% participate in export markets.

Average organizational age is assumed to be 18.7 years. The sample is deliberately heterogeneous to represent variation in environmental management maturity.

B. Measurement Instrument

All latent constructs are measured using seven-point Likert scales ranging from 1 = strongly disagree to 7 = strongly agree. Environmental auditing is represented by 12 indicators capturing the regularity and systematic nature of audit activities, coverage of environmental risks, assessment of regulatory and internal compliance, verification of environmental information, identification of control weaknesses, communication of audit findings, and monitoring of corrective actions. Green innovation is measured using eight indicators covering two dimensions: green product innovation and green process innovation. Institutional pressure is assessed through nine indicators reflecting coercive, normative, and mimetic pressures arising from regulators, customers, professional expectations, industry practices, and competitors. Corporate sustainability performance is conceptualized as a higher-order construct comprising environmental, economic, and social performance dimensions. Before being used for actual data collection, the measurement instrument should undergo expert review and pilot testing to ensure content validity, clarity, and reliability. Where the survey is administered in languages other than English, appropriate translation and back-translation procedures should also be applied to maintain conceptual equivalence across different language versions.

C. Control Variables

Four organizational control variables are included in the analysis to account for firm-level characteristics that may influence corporate sustainability performance. Firm size is measured using the natural logarithm of the number of employees, as larger firms may possess greater financial and organizational resources to invest in environmental management and green innovation. Firm age is measured as the

number of years since establishment and is included to capture differences in organizational experience and accumulated capabilities. ISO 14001 certification is represented by a binary indicator distinguishing certified from non-certified firms, given that certified firms may have more formalized environmental management systems. Export intensity is measured as the percentage of total sales generated from international markets, as export-oriented firms may face stronger environmental requirements from foreign customers and global supply chains. In addition to these firm-level controls, country and industry effects are incorporated in supplementary model specifications to account for potential differences in institutional environments, regulatory conditions, and environmental sensitivity across national and sectoral contexts.

D. Analytical Procedure

The conceptual model is estimated using partial least squares structural equation modelling (PLS-SEM), which is appropriate for the proposed study because the framework includes higher-order constructs, mediation, moderation, and conditional indirect effects. The analysis is conducted in two main stages. First, the measurement model is assessed to examine the reliability and validity of the latent constructs. Reflective measurement quality is evaluated using indicator loadings, Cronbach's alpha, composite reliability, average variance extracted, and the heterotrait-monotrait ratio to assess internal consistency, convergent validity, and discriminant validity. Second, the structural model is evaluated to test the hypothesized relationships among environmental auditing, green innovation, institutional pressure, and corporate sustainability performance. Structural relationships are assessed using bootstrapped path coefficients, t-values, p-values, confidence intervals, and coefficients of determination. For the simulated analysis, 5,000 bootstrap resamples are used to obtain robust estimates of the direct, indirect, and interaction effects. The mediation effect of green innovation is assessed through the bootstrapped indirect effect, while the moderating role of institutional pressure is examined through the interaction between environmental auditing and institutional pressure. Finally, conditional indirect effects are estimated at one standard deviation below the mean, at the mean, and one standard deviation above the mean of institutional pressure to evaluate the proposed moderated mediation relationship.

4. Results

A. Descriptive Statistics

Table 1 presents the descriptive statistics and correlations among the principal constructs.

The simulated firms exhibit moderate-to-high average environmental auditing, institutional pressure and sustainability performance.

Environmental auditing is positively correlated with green innovation (r = 0.612) and corporate sustainability performance (r = 0.519).

Green innovation exhibits the strongest bivariate correlation with corporate sustainability performance (r = 0.588), providing preliminary support for the proposed mediating role.

The correlations remain below levels that would ordinarily indicate severe multicollinearity.

B. Measurement Model

Table 2 reports measurement-model reliability and convergent validity.

All standardized indicator loadings exceed 0.70.

Cronbach's alpha and composite reliability values exceed conventional reliability thresholds.

Average variance extracted ranges from 0.646 to 0.685, indicating that each construct explains more than half of its indicators' variance.

Discriminant validity is examined using HTMT.

Table 3
HTMT discriminant validity assessment

Construct	EA	GI	IP	CSP
EA	—			
GI	0.654	—		
IP	0.324	0.389	—	
CSP	0.562	0.632	0.351	—

All HTMT ratios are below 0.85, supporting discriminant validity.

Variance inflation factors are below 3.0, suggesting that multicollinearity does not materially affect the structural estimates.

Overall, the simulated measurement model demonstrates satisfactory reliability, convergent validity and discriminant validity.

C. Structural Model

The model explains 44.8% of the variance in green innovation and 37.9% of the variance in corporate sustainability

Table 1
Descriptive statistics and correlations

Construct	Mean	SD	1	2	3	4
Environmental auditing	4.73	1.12	1.000			
Green innovation	4.55	1.05	0.612	1.000		
Institutional pressure	4.88	1.02	0.298	0.361	1.000	
Corporate sustainability performance	4.69	0.96	0.519	0.588	0.327	1.000

Table 2
Reliability and convergent validity

Construct	Cronbach's α	Composite reliability	AVE	Loading range
Environmental auditing	0.946	0.946	0.685	0.797–0.863
Green innovation	0.928	0.929	0.685	0.766–0.868
Institutional pressure	0.917	0.916	0.646	0.767–0.847
Corporate sustainability performance	0.951	0.950	0.680	0.779–0.866

Table 4
Structural-model results

Hypothesis	Relationship	β	t-value	p-value	Decision
H1	EA → CSP	0.221	5.31	<0.001	Supported
H2	EA → GI	0.485	12.74	<0.001	Supported
H3	GI → CSP	0.411	9.68	<0.001	Supported
H4	EA → GI → CSP	0.199	7.58	<0.001	Supported
H5	EA × IP → GI	0.228	5.96	<0.001	Supported
H6	Moderated mediation index	0.094	5.07	<0.001	Supported

performance.

These values indicate moderate explanatory power.

Table 4 reports the hypothesis tests.

Environmental auditing has a positive and statistically significant direct relationship with corporate sustainability performance ($\beta = 0.221$, $t = 5.31$, $p < 0.001$).

H1 is therefore supported.

Environmental auditing also has a considerably stronger relationship with green innovation ($\beta = 0.485$, $t = 12.74$, $p < 0.001$), supporting H2.

This coefficient suggests that firms with more developed environmental audit processes exhibit substantially greater green innovation.

Green innovation is positively related to corporate sustainability performance ($\beta = 0.411$, $t = 9.68$, $p < 0.001$).

H3 is supported.

The results therefore establish the two component relationships required for mediation: environmental auditing predicts green innovation, and green innovation predicts sustainability performance.

D. Mediating Role of Green Innovation

The next analysis examines the mediating role of green innovation proposed in H4. Before green innovation is incorporated into the model, environmental auditing has a positive and statistically significant total effect on corporate sustainability performance ($\beta = 0.430$, $p < 0.001$). After green innovation is introduced as the mediating variable, the direct effect of environmental auditing on corporate sustainability performance decreases to $\beta = 0.221$ but remains statistically significant at $p < 0.001$. The indirect effect of environmental auditing on corporate sustainability performance through green innovation is $\beta = 0.199$. Bootstrapping yields a 95% confidence interval ranging from 0.149 to 0.254. Because the confidence interval does not include zero, the indirect effect is statistically significant, providing support for H4. At the same time, the direct relationship between environmental auditing and corporate sustainability performance remains significant after the mediator is included, indicating partial rather than full mediation. This result suggests that green innovation explains a substantial proportion of the overall relationship between environmental auditing and sustainability performance. Environmental auditing therefore appears to influence corporate sustainability through two complementary pathways: a direct governance pathway involving improved compliance monitoring, environmental information, accountability, and corrective action, and an indirect innovation pathway through which audit-generated information encourages changes in products, production processes, and environmental technologies.

E. Moderating Effect of Institutional Pressure

H5 predicts that institutional pressure strengthens the relationship between environmental auditing and green innovation.

The interaction coefficient is positive and statistically significant:

$\beta = 0.228$, $t = 5.96$, $p < 0.001$.

H5 is therefore supported.

To interpret this relationship, simple slopes are estimated at low, average and high levels of institutional pressure.

Table 5
Conditional effect of environmental auditing on green innovation

Institutional pressure	EA → GI
Low: −1 SD	0.257
Mean	0.485
High: +1 SD	0.714

The relationship between environmental auditing and green innovation is positive across all three levels of institutional pressure but becomes substantially stronger as institutional pressure increases. Under low institutional pressure, a one-standard-deviation increase in environmental auditing is associated with a 0.257-standard-deviation increase in green innovation. At the mean level of institutional pressure, the estimated effect rises to 0.485, while under high institutional pressure it reaches 0.714. This progressive increase indicates that institutional pressure strengthens the extent to which firms transform environmental audit information into innovative environmental responses. The magnitude of this difference also has important organizational implications, as environmental audits appear to generate more substantial changes in products, processes, and technologies when firms face stronger regulatory requirements, customer expectations, professional norms, and competitive pressures. In such environments, management has greater incentives to respond to environmental weaknesses identified through auditing and to allocate resources to cleaner technologies and process improvements. These results therefore suggest that the effectiveness of environmental auditing should not be assessed independently of the institutional context in which firms operate, because external pressures can significantly influence whether audit findings lead to substantive green innovation.

F. Moderated Mediation

H6 examines whether the indirect relationship between environmental auditing and corporate sustainability performance through green innovation varies with institutional pressure.

Table 6 presents the conditional indirect effects.

Table 6
Conditional indirect effects

Institutional pressure	Indirect effect	95% bootstrap CI
Low: −1 SD	0.106	[0.061, 0.159]
Mean	0.199	[0.149, 0.254]
High: +1 SD	0.293	[0.222, 0.371]

The indirect effect of environmental auditing on corporate sustainability performance through green innovation is positive and statistically significant across all three levels of institutional pressure, but its magnitude increases substantially as institutional pressure becomes stronger. Under low institutional pressure, the conditional indirect effect is 0.106, indicating a relatively modest transmission of environmental auditing into sustainability performance through green innovation. At the mean level of institutional pressure, the indirect effect increases to 0.199, while under high institutional pressure it reaches 0.293. This pattern suggests that stronger institutional conditions enhance the extent to which audit-generated environmental information is transformed into green innovation and, subsequently, improved sustainability outcomes. The index of moderated mediation is 0.094, with a 95% bootstrap confidence interval ranging from 0.062 to 0.130. Because this confidence interval does not include zero, the moderated mediation effect is statistically significant, providing support for H6. Overall, the findings indicate that institutional pressure influences not only the direct relationship between environmental auditing and green innovation but also the strength of the entire indirect pathway linking environmental auditing to corporate sustainability performance. Thus, the sustainability benefits of environmental auditing become more pronounced when firms operate under stronger regulatory, stakeholder, professional, and competitive pressures.

G. Control Variables

The control variables produce mixed results. Firm size exhibits a small but positive relationship with corporate sustainability performance ($\beta = 0.084$, $p = 0.038$), suggesting that larger firms may benefit from greater financial, technological, and organizational resources that support investment in environmental management systems and green technologies. By contrast, firm age is not significantly associated with corporate sustainability performance ($\beta = 0.026$, $p = 0.441$), indicating that organizational longevity alone does not necessarily translate into stronger sustainability outcomes. ISO 14001 certification is also statistically insignificant after environmental auditing and green innovation are included in the model ($\beta = 0.061$, $p = 0.118$). Export intensity shows a positive but only marginally significant coefficient ($\beta = 0.073$, $p = 0.071$), suggesting that international market exposure may provide some incentive for stronger sustainability practices, although the evidence is not sufficiently strong to confirm a robust effect. The limited explanatory role of ISO 14001 certification is particularly noteworthy because certification primarily indicates the existence of a formal environmental management system, whereas the environmental auditing construct captures the extent to which environmental information, findings, and corrective actions are substantively used in organizational decision-making. Formal certification and substantive environmental management capability should therefore not be treated as equivalent.

H. Robustness Analyses

Several supplementary simulated analyses are conducted to assess the stability of the main findings. First, corporate sustainability performance is decomposed into environmental, economic, and social dimensions. The results show that green innovation has the strongest relationship with environmental performance ($\beta = 0.467$, $p < 0.001$), followed by economic sustainability performance ($\beta = 0.326$, $p < 0.001$) and social sustainability performance ($\beta = 0.291$, $p < 0.001$). This pattern is theoretically plausible because green innovation most directly affects production technologies, resource use, emissions, and waste, while its economic and social benefits may emerge more indirectly. Second, green innovation is separated into green process innovation and green product innovation. The indirect effect of environmental auditing on corporate sustainability performance through green process innovation is $\beta = 0.126$, with a 95% confidence interval of [0.086, 0.173], whereas the corresponding indirect effect through green product innovation is $\beta = 0.073$, with a 95% confidence interval of [0.038, 0.116]. These results suggest that green process innovation represents the stronger mediating mechanism in the manufacturing context. Third, the sample is divided between high-environmental-impact and lower-impact industries, with the environmental auditing–green innovation relationship remaining positive in both groups but becoming stronger among high-impact firms. Fourth, alternative specifications including country and industry fixed effects produce substantively similar coefficients. Finally, predictive assessment indicates that the full model generates lower prediction errors for corporate sustainability performance than a reduced model containing only the control variables. Taken together, these supplementary analyses provide additional support for the stability and robustness of the proposed theoretical mechanism within the illustrative simulation.

5. Discussion

This study examines whether environmental auditing contributes to corporate sustainability performance and, more importantly, explains how and under what conditions this relationship occurs. The simulated empirical results support all six hypotheses and provide a coherent mechanism linking environmental governance practices with sustainable corporate outcomes. Three findings are particularly important. First, environmental auditing is associated with corporate sustainability performance through both direct and indirect pathways, suggesting that auditing contributes not only through stronger compliance, monitoring, and corrective action but also through broader organizational mechanisms. Second, green innovation plays a central mediating role by explaining how audit-generated environmental information can be transformed into improvements in products, processes, and technologies that ultimately enhance sustainability performance. Third,

institutional pressure significantly strengthens this mechanism by increasing firms' incentives to respond substantively to environmental audit findings and invest in green innovation. Taken together, these results provide a more nuanced interpretation of environmental auditing than the traditional view of auditing as a primarily compliance-oriented activity. Instead, environmental auditing can be understood as an organizational learning and governance mechanism whose sustainability value depends on how effectively firms convert audit findings into innovation and on the strength of the institutional environment in which they operate (Masoud, 2025).

The findings provide a more comprehensive understanding of how environmental auditing contributes to corporate sustainability performance. First, the positive direct effect of environmental auditing on sustainability performance (β = 0.221) indicates that auditing can generate organizational benefits beyond formal compliance. Environmental audits can improve regulatory compliance, strengthen environmental information quality, enhance managerial accountability, and support corrective actions even when no technological innovation occurs. This suggests that environmental auditing should be regarded as an important component of internal sustainability governance rather than merely a procedural requirement. At the same time, the stronger relationship between environmental auditing and green innovation (β = 0.485) highlights its role as an organizational learning mechanism. Environmental audits do not simply identify non-compliance; they can also reveal recurring environmental weaknesses, inefficient resource use, and problems embedded in products or production processes. By making these patterns visible, auditing creates knowledge that can support preventive solutions and environmental innovation.

Green innovation, in turn, has a positive effect on corporate sustainability performance (β = 0.411). Cleaner production processes can reduce emissions, energy consumption, water use, and waste, while environmentally improved products may strengthen market opportunities and long-term competitiveness. Green innovation may also generate social benefits through lower environmental risks and stronger relationships with employees and communities. The robustness results further suggest that these effects are strongest for environmental performance, although economic and social benefits also remain relevant.

The mediation results provide further insight into this mechanism. The indirect effect of environmental auditing on sustainability performance through green innovation is 0.199, while the direct coefficient decreases from 0.430 to 0.221 after green innovation is introduced. This partial mediation indicates that environmental auditing generates sustainability value through two complementary pathways. The first is a direct governance pathway involving compliance, monitoring, information quality, and corrective action. The second is an innovation pathway in which audit-generated knowledge is transformed into changes in technologies, production processes, and products. Thus, environmental auditing provides diagnosis, whereas green innovation provides organizational transformation (El Amoumri, 2026).

Institutional pressure further strengthens this process. The relationship between environmental auditing and green innovation increases from 0.257 under low institutional pressure to 0.714 under high institutional pressure. This suggests that firms are more likely to act on audit findings when they face stronger regulatory enforcement, customer requirements, professional expectations, and competitive pressures. Institutional pressure therefore affects not only whether audit information stimulates innovation but also the strength of the entire indirect sustainability pathway. The conditional indirect effect rises from 0.106 under low institutional pressure to 0.293 under high institutional pressure. Overall, the results provide a clear "what–how–when" explanation: environmental auditing improves sustainability performance, green innovation explains how this occurs, and institutional pressure determines when this mechanism becomes stronger.

This study contributes to the literature by repositioning environmental auditing as a sustainability-oriented organizational capability rather than merely a compliance mechanism. Environmental audits generate knowledge about environmental risks, operational inefficiencies, and control weaknesses, thereby supporting pollution prevention, green innovation, and organizational learning. The study further identifies green innovation as the mechanism through which audit-generated knowledge is transformed into improvements in corporate sustainability performance and shows that institutional pressure determines the strength of this relationship. From a managerial perspective, firms should evaluate environmental auditing not only by the number of audits completed but also by whether audit findings lead to corrective actions, technological improvements, and innovation. Policymakers should similarly emphasize audit quality, follow-up mechanisms, credible enforcement, and supportive instruments such as green finance and technology assistance. The study is nevertheless subject to several limitations. The current empirical results are based on simulated data, while a cross-sectional design may also limit causal inference. Future research should therefore employ real and longitudinal data, incorporate objective environmental indicators, examine audit quality in greater detail, and consider country-level institutional differences. Further research could also explore greenwashing, digital environmental auditing, and the interaction between internal environmental auditing and external sustainability assurance.

6. Conclusion

Environmental auditing has traditionally been viewed primarily as a mechanism for assessing environmental compliance, but this study adopts a broader perspective by conceptualizing it as a governance, information, and organizational learning capability. By systematically examining environmental risks, controls, compliance, and information, environmental auditing helps firms identify weaknesses and generate knowledge that can support sustainability improvement (Faieq & Çek, 2024). The findings

suggest that environmental auditing contributes directly to corporate sustainability performance while also promoting green innovation, which partially mediates this relationship. This distinction highlights the diagnostic role of environmental auditing and the transformational role of green innovation. The results further show that institutional pressure strengthens this mechanism, as firms operating under stronger regulatory, stakeholder, and competitive pressures are more likely to translate audit findings into substantive environmental innovation. Consequently, the indirect effect of environmental auditing on sustainability performance through green innovation becomes stronger under higher institutional pressure. These findings are particularly relevant for emerging economies, where rapid industrialization coexists with uneven institutional capacity and technological resources. Strengthening environmental auditing alone may therefore be insufficient unless firms also develop the capability to act on audit findings. Overall, environmental auditing should be viewed not as the end of the environmental governance process, but as an important starting point for organizational learning, green innovation, and sustainable corporate transformation (Simon, 2025).

References

[1] N. Ab Wahab, N. Sahril, A. Amiruddin, Z. Mat Yasin, N. A. Salim, N. A. Rahmat, and N. F. Aziz, "Performance of environmental and energy audit for manufacturing industrial buildings," *Indones. J. Electr. Eng. Comput. Sci.*, vol. 12, no. 2, pp. 534–541, Nov. 2018.

[2] A. S. Abdulhussein and A. A. Abbas, "Environmental governance as a mediating and moderating variable between environmental auditing and sustainable performance," *Found. Manage.*, vol. 17, pp. 7–24, 2025.

[3] H. O. Awa, W. Etim, and E. Ogbonda, "Stakeholders, stakeholder theory and corporate social responsibility (CSR)," *Int. J. Corporate Soc. Responsibility*, vol. 9, Art. no. 8, 2024.

[4] Y. Cai, M. Umair, N. A. Adam, R. Zhang, S. M. Mirzaliev, and C. Chang, "Marketization as a catalyst: Understanding the impact of digital economies on green innovation in mainland China," *Manage. Decis. Econ.*, vol. 46, 2025.

[5] F. Chen, B. Dong, M. Zhang, and Q. Chen, "Government environmental auditing and synergistic governance outcomes: Evidence from Chinese cities," *Sustainability*, vol. 17, 2025.

[6] H. M. Choo, P. Mitchell, P. R. Ebeling, P. Halbout, N. C. Harvey, E. V. McCloskey, A. Mithal, and M. Chandran, "Osteoporosis and fragility fracture burden in Asia Pacific: Key findings from the APCO-IOF Asia Pacific regional audit," *Osteoporos. Sarcopenia*, vol. 12, pp. 77–85, 2026.

[7] M. F. de Jong, "Sustainability reporting: Can we avoid another triumph of hope over experience?" *J. Public Budg., Account. Financial Manage.*, 2025.

[8] A. Eitrem, A. Meidell, and S. Modell, "The use of institutional theory in social and environmental accounting research: A critical review," *Account. Bus. Res.*, vol. 54, no. 6, pp. 775–810, 2024.

[9] A. El Amoumri, "Bridging the diagnosis implementation gap in environmental auditing through a systems perspective from Morocco," *Discov. Sustainability*, vol. 7, Art. no. 12, 2026.

[10] H. T. Faieq and K. Çek, "Enhancing Kurdistan's manufacturing companies' sustainable waste management: A norm activation approach to green accounting, CSR, and environmental auditing oversight," *Heliyon*, vol. 10, Art. no. e35188, 2024.

[11] B. Galleli and L. K. Amaral, "Bridging institutional theory and social and environmental efforts in management: A review and research agenda," *J. Manage.*, vol. 52, pp. 42–93, 2025.

[12] L. Jum'a, Z. Alkalha, and M. Alaraj, "Towards environmental sustainability: The nexus between green supply chain management, total quality management, and environmental management practices," *Int. J. Qual. Reliab. Manage.*, 2024.

[13] Z. Lin, H. Gu, K. Z. Gillani, and M. Fahlevi, "Impact of green work–life balance and green human resource management practices on corporate sustainability performance and employee retention: Mediation of green innovation and organisational culture," *Sustainability*, vol. 16, 2024.

[14] N. Masoud, "Moderating effect of sustainable innovation on internal audit effectiveness and sustainability auditing practices: Evidence from Libya's public sector," *Int. J. Financial Stud.*, vol. 13, 2025.

[15] M. G. Montiel-Hernández, C. C. Pérez-Hernández, and B. C. Salazar-Hernández, "The intrinsic links of economic complexity with sustainability dimensions: A systematic review and agenda for future research," *Sustainability*, vol. 16, 2024.

[16] T. V. Nguyen and T. Q. Nguyễn, "From ESG to value: How green innovation transforms the sustainability trajectory of construction firms," *Eng., Constr. Archit. Manage.*, 2026.

[17] X. Qin, B. Muskat, V. Ambrosini, J. Mair, and Y. Chih, "Green innovation implementation: A systematic review and research directions," *J. Manage.*, vol. 52, pp. 255–282, 2025.

[18] K. Samaha and H. Khlif, "Audit-related attributes, regulatory reforms and timely disclosure: Further evidence from an emerging market," *J. Financial Rep. Account.*, vol. 15, no. 2, pp. 158–179, Oct. 2017.

[19] M. Simon, "System dynamics and environmental constraints: How CEOs are redefining strategy for sustainable corporate transformation," *Stud. Mundi – Econ.*, 2025.

[20] S. K. Singh, M. Del Giudice, R. Chierici, and D. Graziano, "Green innovation and environmental performance: The role of green transformational leadership and green human resource management," *Technol. Forecast. Soc. Change*, vol. 150, Art. no. 119762, Jan. 2020.

[21] N. T. Tran, C. L. Bui, B. T. Dang, H. D. Hoang, and H. T. Nguyen, "Factors affecting the implementation of environmental management accounting - A study of manufacturing enterprises," *Edelweiss Appl. Sci. Technol.*, 2025.

[22] M. Tümmler and R. Quick, "How to detect fraud in an audit: A systematic review of experimental literature," *Manage. Rev. Q.*, vol. 76, pp. 287–332, 2025.

[23] B. Wernerfelt, "A resource-based view of the firm," *Strategic Manage. J.*, vol. 5, no. 2, pp. 171–180, Apr.–Jun. 1984.

[24] M. Wojnarowska, M. Muradin, A. Paiano, and C. Ingrao, "Recycled glass bottles for craft-beer packaging: How to make them sustainable? An environmental impact assessment from the combined accounting of cullet content and transport distance," *Resources*, vol. 14, 2025.

[25] W. Zhang and Y. Wang, "Analysis on key audit matters of manufacturing enterprises — A case study of Qingdao Daneng Environmental Protection Equipment Co., Ltd.," *Asia Pac. Econ. Manage. Rev.*, 2026.