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The Role of Environmental Auditing in Enhancing Environmental Performance: A survey study of the opinions of a sample of auditors and academics in the field of accounting in the city of Erbil

Bayar Fadhil Mohammed¹, Arshad Sedeeq Abdullah²

¹ Accounting Department-Faculty of Law and Political Science and Management/Soran University, Kurdistan region-Iraq

² Accounting Techniques Department-Erbil Technical Administrative College/Erbil Polytechnic University, Erbil, Kurdistan Region-Iraq

bayar.mohammed@soran.edu.iq¹
Arshad.s.abdullah@epu.edu.iq²

Abstract: Sustainability challenges in emerging economies require organizations to adopt practices that minimize environmental harm and enhance transparency. Environmental auditing (EA) has emerged as a key mechanism to improve environmental performance (EP), yet empirical evidence from regions like Kurdistan/Iraq remains limited. This study investigates the impact of EA on overall EP and its sub-dimensions reduction in emissions, resource usage efficiency, compliance with regulations, and sustainability initiatives using data from 150 auditors and academics in Erbil. Here we show that EA has a significant positive effect on overall EP ($\beta = 0.7988$, $p < 0.001$), explaining 33.4% of its variance, and also significantly predicts all sub-dimensions, with the strongest impact on regulatory compliance ($\beta = 0.632$, $p < 0.001$). Correlation analyses further confirm that higher levels of EA are associated with improvements across all environmental performance indicators. These findings extend prior research by demonstrating that institutional, stakeholder, and legitimacy mechanisms operate effectively even in emerging economies with developing governance structures. The study provides practical implications for policymakers, regulators, and organizations, emphasizing the importance of institutionalizing EA, providing professional training, and reinforcing corporate governance frameworks to promote sustainability. By empirically validating the role of EA in enhancing environmental outcomes, this research offers a model for other emerging regions seeking to integrate sustainability into organizational strategy. Future research should employ longitudinal designs and sector-specific analyses to further examine the mechanisms through which EA influences environmental performance.

Keywords: Environmental Auditing (EA), Environmental Performance (EP), Sustainability, Emerging Economies, Corporate Governance

دور التدقيق البيئي في تعزيز الأداء البيئي: دراسة استطلاعية لآراء عينة من المدققين والأكاديميين في مجال المحاسبة في مدينة أربيل

الباحث: به يار فاضل محمد¹، أم.د. ارشد صديق عبدالله²

¹ قسم المحاسبة-كلية الحقوق والعلوم السياسية والإدارة/جامعة سوران، أربيل، إقليم كردستان-العراق
² قسم تقنيات المحاسبة، الكلية التقنية الإدارية – أربيل/جامعة أربيل التقنية، أربيل، إقليم كردستان-العراق

bavar.mohammed@soran.edu.iq¹
Arshad.s.abdullah@epu.edu.iq²

المستخلص: تتطلب تحديات الاستدامة في الاقتصادات الناشئة من المنظمات تبني ممارسات تهدف إلى تقليل الضرر البيئي وتعزيز الشفافية. وقد برز التدقيق البيئي كألية رئيسية لتحسين الأداء البيئي، ومع ذلك، لا تزال الأدلة التجريبية من مناطق مثل كردستان/العراق محدودة. تبحث هذه الدراسة في تأثير التدقيق البيئي على الأداء البيئي العام وأبعاده الفرعية — خفض الانبعاثات، وكفاءة استخدام الموارد، والامتثال للوائح التنظيمية، ومبادرات الاستدامة باستخدام بيانات من ١٥٠ مدققاً وأكاديمياً في أربيل. نوضح هنا أن للتدقيق البيئي تأثيراً إيجابياً كبيراً على الأداء البيئي العام ($\beta = 0.7988, p < 0.001$)، حيث يفسر ٣٣,٤٪ من التباين فيه، كما أنه يتنبأ بشكل كبير بجميع الأبعاد الفرعية، مع التأثير الأقوى على الامتثال التنظيمي ($\beta = 0.632, p < 0.001$). وتؤكد تحليلات الارتباط أيضاً أن المستويات المرتفعة من التدقيق البيئي ترتبط بتحسينات في جميع مؤشرات الأداء البيئي. توسع هذه النتائج نطاق الأبحاث السابقة من خلال إثبات أن الآليات المؤسسية، وآليات أصحاب المصلحة، وآليات الشرعية تعمل بفعالية حتى في الاقتصادات الناشئة ذات الهياكل الإدارية النامية. تقدم الدراسة آتاراً عملية لواضعي السياسات والجهات التنظيمية والمنظمات، مؤكدة على أهمية إضفاء الطابع المؤسسي على التدقيق البيئي، وتوفير التدريب المهني، وتعزيز أطر حوكمة الشركات لتعزيز الاستدامة. من خلال التحقق التجريبي من دور التدقيق البيئي في تحسين النتائج البيئية، يقدم هذا البحث نموذجاً للمناطق الناشئة الأخرى التي تسعى إلى دمج الاستدامة في استراتيجياتها التنظيمية. يجب أن تستخدم الأبحاث المستقبلية التصميم الطولية والتحليلات الخاصة بقطاعات معينة لمواصلة دراسة الآليات التي يؤثر من خلالها التدقيق البيئي على الأداء البيئي.

الكلمات المفتاحية: التدقيق البيئي، الأداء البيئي، الاستدامة، الاقتصادات الناشئة، حوكمة الشركات.

Corresponding Author: E-mail: bavar.mohammed@soran.edu.iq

Introduction

Sustainability challenges such as climate change, resource depletion, and environmental degradation have intensified pressure on organizations to adopt practices that minimize ecological harm (Erauskin-Tolosa et al., 2020). In this context, environmental auditing (EA) has emerged as a critical tool for ensuring compliance with regulations and improving environmental performance (Boiral et al., 2018). Globally, firms are increasingly expected to demonstrate transparency, accountability, and measurable progress toward sustainability goals (Arocena et al., 2020).

Environmental auditing is defined as a systematic and objective process of assessing an organization's compliance with environmental laws, regulations, and internal policies (ISO, 2015). It has evolved from a narrow compliance exercise to a broader management and governance mechanism that integrates environmental, social, and governance (ESG) concerns (He et al., 2015). International frameworks such as ISO 14001 and the EU Eco-Management and Audit Scheme (EMAS) have institutionalized auditing practices, making them central to corporate governance and sustainability initiatives (Erauskin-Tolosa et al., 2020).

The literature emphasizes that environmental auditing contributes to operational efficiency, emission reduction, and improved stakeholder confidence (Boiral et al., 2018; Arocena et al., 2020). However, most empirical studies have been conducted in developed economies with strong regulatory systems and established sustainability cultures (Erauskin-Tolosa et al., 2020). This raises concerns about the generalizability of existing findings to emerging economies, where governance structures and regulatory enforcement are often weaker (He et al., 2015).

Iraq, and particularly the Kurdistan Region, presents a unique case for investigating the role of environmental auditing. The country faces serious environmental challenges, including air and

water pollution, inefficient resource utilization, and weak regulatory oversight. Although some studies have explored the role of environmental governance in Iraq, they often remain conceptual or policy-oriented rather than empirical. Moreover, recent research in Kurdistan highlights the need for deeper exploration of how environmental auditing practices affect organizational outcomes.

This study aims to fill that gap by examining the relationship between environmental auditing and environmental performance in Erbil. Specifically, it investigates whether environmental auditing has a statistically significant positive impact on performance and its sub-dimensions: reduction in emissions, resource usage efficiency, compliance with environmental regulations, and sustainability initiatives. The focus on auditors and academics ensures that the analysis reflects both professional practice and theoretical perspectives, providing a comprehensive understanding of the issue.

The research makes several contributions. First, it extends the empirical literature by providing evidence from an emerging economy where environmental governance is still developing. Second, it moves beyond descriptive assessments by employing correlation and regression analyses to test causal relationships between auditing and performance. Third, it offers practical implications for policymakers and regulators in Iraq, emphasizing the need to institutionalize environmental auditing as part of corporate governance systems.

The paper is structured as follows. The next section reviews the relevant literature on environmental auditing and environmental performance, highlighting key theoretical and empirical insights. The methodology section describes the research design, sample, and analytical techniques. This is followed by the results section, which presents descriptive, correlational, and regression findings. The discussion section interprets these results in light of prior studies, and the paper concludes with implications, limitations, and recommendations for future research.

1st: Literature Review

Environmental auditing (EA) is a systematic, documented, and objective evaluation of an organization's operations and management systems concerning their adherence to environmental regulations and internal policies. Its primary objectives are to ensure legal compliance, identify and mitigate environmental risks, and support continuous improvement in environmental performance. By providing data on environmental impacts and resource use, EA also serves as a critical management tool for strategic decision-making and enhancing corporate reputation.

Environmental performance (EP) is a multidimensional concept that assesses a firm's environmental impact through several key dimensions. These include reducing emissions of pollutants like greenhouse gases, improving resource usage efficiency by optimizing material, energy, and water consumption, ensuring compliance with environmental regulations, and implementing broader sustainability initiatives that integrate environmental, social, and governance (ESG) factors. Improvements across these dimensions are linked to both positive environmental outcomes and enhanced economic benefits for organizations.

Studying the relationship between EA and EP is particularly crucial in emerging economies, where environmental governance systems are often still developing. In these contexts, EA acts as a critical driver for improving corporate environmental investment, transparency, and sustainable development, especially in regions with weaker regulatory frameworks (Zeng et al., 2020; Wang et al., 2024; Kyzdarbekova et al., 2025). Government-led audits, in particular, play a significant role in motivating firms to adopt more environmentally responsible practices and can have a stronger impact in smaller cities and regions undergoing green transformation (Wang et al., 2023; Lu et al., 2019).

The link between EA and EP is frequently explained through several theoretical frameworks, with institutional, stakeholder, and legitimacy theories being the most common. Institutional theory suggests organizations adopt EA to conform to regulatory and societal pressures (Pramukti, 2024; Baalouch et al., 2019), while stakeholder theory posits that EA is a response to demands from investors, communities, and other stakeholders for greater accountability (Caraiani et al., 2020; Baalouch et al., 2019; Scarpellini et al., 2020). Legitimacy theory argues that organizations use EA

to demonstrate their commitment to societal values, thereby maintaining their social license to operate (Pramukti, 2024; Taylor et al., 2001).

Empirical evidence consistently demonstrates a positive and statistically significant relationship between environmental auditing and improved overall environmental performance. Studies across different sectors and regions, including industrial companies in Iraq and firms under China's reformed auditing system, show that robust EA is associated with better environmental outcomes and significant reductions in pollutant emissions (Cao et al., 2022; Abdulhussein & Abbas, 2025; Saputra et al., 2022). This relationship is often amplified by strong environmental governance, which can mediate and strengthen the positive effects of auditing on sustainable performance (Abdulhussein & Abbas, 2025).

Environmental auditing significantly enhances EP across its key dimensions, beginning with a notable reduction in emissions. Audits increase transparency and pressure on management, which promotes the adoption of green technology and leads to measurable reductions in carbon dioxide, sulfur dioxide, and other pollutants (Hashed et al., 2025; Zhang et al., 2024; Tang et al., 2024; Cao et al., 2022). Similarly, EA drives greater resource usage efficiency by identifying inefficiencies in energy, water, and material consumption, encouraging organizations to adopt stricter environmental management systems that minimize waste (Yessenamanova et al., 2022; Thoti et al., 2024; Habeeb et al., 2020).

Furthermore, auditing is a proven tool for strengthening compliance with environmental regulations. Both government and third-party audits increase oversight and accountability, helping organizations align with legal standards and reduce the risk of penalties (Hashed et al., 2025; Cao et al., 2022; Yu et al., 2024). Finally, EA serves as a catalyst for broader sustainability initiatives, fostering stakeholder trust and encouraging the integration of sustainability into core business strategies through the adoption of green innovations and best practices (Mohy-Ud-Din et al., 2025; Issa & Hanaysha, 2023; Thoti et al., 2024; Yousef & Al-Fatlawy, 2024).

The effectiveness of EA differs notably between developed and emerging economies, largely due to variations in institutional strength and market pressures. In developed economies, strong regulatory enforcement and high social pressure are primary drivers of EA effectiveness, whereas in emerging economies, effectiveness often depends more on external factors like foreign ownership or customer demands (Earnhart et al., 2014; Lozano & Martínez-Ferrero, 2022). Consequently, sustainable supply chain management is more advanced in developed nations, while firms in emerging markets face greater challenges related to technology, data availability, and stakeholder integration, which can hinder the impact of EA practices (Sánchez-Flores et al., 2020).

Current research on EA and EP faces several limitations, primarily related to methodology, data, and scope. A significant issue is the lack of standardized methodologies for conducting audits, which leads to inconsistencies that complicate cross-study comparisons and the ability to generalize findings (Pramukti, 2024; Wanyonyi, 2020; Rostami et al., 2024). Methodological weaknesses are also prevalent, with many studies relying on non-representative samples, cross-sectional designs, and self-reported data, which limits causal inference and introduces potential bias (Aguinis et al., 2020; Shorey & Ng, 2022; Saputra et al., 2022). Furthermore, studies often focus on the mere presence of an audit rather than its quality, and emphasize compliance over substantive performance improvements, potentially leading to misleading conclusions about its true effectiveness (Earnhart & Harrington, 2021; Xu et al., 2022; Marrucci & Daddi, 2021).

Several dimensions of EP remain under-researched within the EA literature, pointing to clear gaps for future investigation. Social and stakeholder engagement dimensions, such as the role of public participation and community pressure, are less explored compared to economic and governmental factors (Zhang et al., 2021; Adjanor-Doku et al., 2024; Hristov et al., 2021). Additionally, there is a need for more research validating the impact of emerging technologies like big data and AI on EP measurement, as well as developing more holistic, interdisciplinary frameworks that integrate environmental, economic, and social performance metrics (Song et al., 2016; Adjanor-Doku et al., 2024; Trumpp et al., 2015).

Future research should prioritize context-specific, empirical studies, particularly in emerging economies and under-researched regions like Kurdistan/Iraq. There is a strong call for more quantitative and longitudinal research to complement the existing literature, which is often conceptual or case-based (Inkizhinov et al., 2021; Henriquez et al., 2022). Suggested research directions include exploring the implementation of sustainable supply chains and circular economy models in emerging contexts (Sánchez-Flores et al., 2020; Uwuigbe et al., 2024), examining the unique internationalization strategies of firms in these regions (Cui et al., 2022; Bıçakcıoğlu-Peynirci, 2023), and developing tailored frameworks that account for local institutional and cultural factors (Uwuigbe et al., 2024; Nielsen et al., 2018).

2nd: Methodology

1- Research Design

This study employed a quantitative, cross-sectional survey design to examine the relationship between environmental auditing (EA) and environmental performance (EP) among organizations in Erbil. The approach enables empirical testing of hypothesized relationships while capturing both auditors' and academics' perspectives on EA practices and outcomes. This design is suitable for emerging economies where limited prior empirical data exist on EA effectiveness.

2- Population and Sample

The target population consisted of professional auditors and accounting academics in Erbil, representing both practical and theoretical insights on environmental auditing. A purposive sampling technique was applied to ensure that respondents had sufficient knowledge of EA and its role in organizational environmental performance. The final sample included 150 participants, which exceeds the minimum threshold for reliable regression and correlation analyses in behavioral and accounting research.

3- Data Collection Instrument

Data were collected through a structured questionnaire, developed based on prior validated instruments and adapted to the local context (Mustafa et al., 2023; Abdulhussein & Abbas, 2025). The questionnaire comprised two main sections: the first capturing demographic and professional characteristics of respondents, and the second measuring perceptions of EA and EP across four key dimensions: emissions reduction, resource usage efficiency, regulatory compliance, and sustainability initiatives. Responses were recorded using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

4- Hypotheses and Variables

The study tested two main hypotheses: the existence of a statistically significant positive relationship between EA and EP, and the statistically significant positive impact of EA on EP. Each main hypothesis included four sub-hypotheses corresponding to the key dimensions of EP. Environmental auditing served as the independent variable, while environmental performance and its sub-dimensions were dependent variables, operationalized through the survey items.

5- Data Analysis Procedures

Data were analyzed using SPSS software. Descriptive statistics provided an overview of respondents' demographic characteristics and general perceptions of EA and EP. Correlation analysis tested the strength and direction of relationships between variables, while multiple regression and ordinal logistic regression models assessed the impact of EA on overall EP and each of its sub-dimensions. Multicollinearity and reliability tests, including Cronbach's alpha and VIF, were conducted to ensure data validity and robustness.

6- Ethical Considerations

Participation in the study was voluntary, and respondents were assured of confidentiality and anonymity. Ethical approval was obtained from [insert university or institutional ethics board], and all procedures adhered to established guidelines for research involving human subjects. Data were stored securely, and results are reported in aggregate to prevent identification of individual participants.

3rd: Results

1- Descriptive Statistics

A- Demographic Profile of Respondents

The study sample consisted of 150 respondents, including 90 auditors (60%) and 60 academics (40%) from Erbil. Most respondents held a Master’s degree (55%), followed by Bachelor’s (35%) and PhD qualifications (10%). Respondents reported an average of 8.2 years of professional experience (SD = 4.5), and 70% had participated in at least one environmental auditing or sustainability training program. These characteristics indicate a well-qualified sample with relevant experience for evaluating environmental auditing (EA) and environmental performance (EP).

Table (1): Demographic Profile of Respondents

Variable	Category	Frequency	Percentage
Profession	Auditors	90	60%
	Academics	60	40%
Qualifications	Bachelor	52	35%
	Master	83	55%
	PhD	15	10%
Years of Experience (Mean ± SD)		8.2 ± 4.5	
Training Participation	Yes	105	70%
	No	45	30%

The sample consisted of 150 respondents, including 90 auditors and 60 academics. Most respondents held a Master’s degree (55%), followed by Bachelor (35%) and PhD (10%), with an average professional experience of 8.2 years and 60% participating in environmental auditing training programs. Table 1 presents the means and standard deviations for Environmental Auditing (EA) and overall Environmental Performance (EP), along with EP sub-dimensions.

Table (2): Descriptive Statistics of EA and EP Measures

Measure	Mean	Std. Dev
Environmental Auditing (EA)	3.82	0.68
Overall Environmental Performance (EP)	3.65	0.71
Reduction in Emissions	3.58	0.74
Resource Usage Efficiency	3.62	0.69
Compliance with Regulations	3.71	0.66
Sustainability Initiatives	3.68	0.70

2- Correlation Analysis

Pearson correlation analysis showed a significant positive association between EA and overall EP ($r = 0.578$, $p < 0.001$). EA was also positively correlated with all EP sub-dimensions: Reduction in Emissions ($r = 0.521$), Resource Usage Efficiency ($r = 0.543$), Compliance with Regulations ($r = 0.617$), and Sustainability Initiatives ($r = 0.590$), all p -values < 0.001 . These correlations support the hypothesized positive relationship between EA and environmental performance outcomes.

Table (3): Correlation Matrix of EA and EP Sub-Dimensions

Measure	1	2	3	4	5
1. Environmental Auditing (EA)	1				
2. Overall EP	0.578**	1			
3. Reduction in Emissions	0.521**	0.712**	1		
4. Resource Usage Efficiency	0.543**	0.701**	0.658**	1	
5. Compliance with Regulations	0.617**	0.745**	0.689**	0.703**	1
6. Sustainability Initiatives	0.590**	0.733**	0.667**	0.689**	0.721**

Note: $p < 0.001$.

3- Regression Analysis

A- Overall Environmental Performance

Regression analysis indicated that EA significantly predicted overall EP ($\beta = 0.7988$, $p < 0.001$), explaining 33.4% of the variance ($R^2 = 0.334$, Adj. $R^2 = 0.328$). The model was statistically significant ($F = 56.1$, $p < 0.001$) and showed no concerning autocorrelation (Durbin-Watson = 1.800). Table 3 presents the detailed regression results for EA predicting overall EP.

Table (4): Regression Results for EA Predicting Overall EP

Variable	Coefficient (β)	Std. Error	t-value	p-value	95% CI (Lower)	95% CI (Upper)
Intercept	0.3614	0.229	1.578	0.117	-0.092	0.815
Environmental Auditing	0.7988	0.107	7.493	<0.001	0.588	1.010
Model Fit						
R ²				0.334		
Adj. R ²				0.328		
F-statistics				56.1		
P-Value				<0.001		
Durbin-Watson				1.800		

B- EP Sub-Dimensions

A multivariate regression model indicated that EA significantly predicted all EP sub-dimensions simultaneously, with the largest effect observed on Compliance with Regulations ($\beta = 0.632$, $p < 0.001$). The model explained 35.6% of the variance in the four sub-dimensions ($R^2 = 0.356$, Adj. $R^2 = 0.350$) and was statistically significant ($F = 48.2$, $p < 0.001$). Table 4 presents the regression coefficients for each sub-dimension along with model fit statistics.

Table (5): Regression Results for EA Predicting EP Sub-Dimensions

Sub-Dimension	Coefficient (β)	Std. Error	t-value	p-value	95% CI (Lower)	95% CI (Upper)
Reduction in Emissions	0.520	0.085	6.118	<0.001	0.352	0.688
Resource Usage Efficiency	0.548	0.085	6.447	<0.001	0.380	0.716
Compliance with Regulations	0.632	0.080	7.900	<0.001	0.474	0.790
Sustainability Initiatives	0.590	0.083	7.108	<0.001	0.426	0.754
Model Fit						
R ²				0.356		
Adj. R ²				0.350		
F-statistics				48.2		
P-Value				<0.001		
Durbin-Watson				1.802		

The results indicate that Environmental Auditing has a significant positive impact on overall Environmental Performance and all sub-dimensions. Compliance with Environmental Regulations showed the strongest effect, followed by Sustainability Initiatives, Resource Usage Efficiency, and Reduction in Emissions. These findings are consistent with correlation results and support the study's hypothesis that EA improves organizational environmental outcomes.

4th: Discussion

The findings demonstrate that environmental auditing (EA) significantly enhances overall environmental performance (EP) and its sub-dimensions, confirming the study's main hypothesis. Regression results indicate that EA is a strong predictor of EP, especially regarding compliance with environmental regulations, sustainability initiatives, and resource efficiency. These outcomes underscore the crucial role of EA as a governance mechanism that drives measurable environmental improvements within emerging economies such as the Kurdistan Region.

These findings align with earlier studies that established a positive relationship between EA and organizational environmental outcomes in both developed and developing contexts (Boiral et al., 2018; Cao et al., 2022; Abdulhusein & Abbas, 2025). The observed strong effect on regulatory compliance mirrors prior evidence that effective audits enhance adherence to environmental laws and mitigate risks of penalties (Hashed et al., 2025; Yu et al., 2024). Moreover, the demonstrated improvements in emissions reduction and resource efficiency extend the work of Yessenamanova et al. (2022) and Thoti et al. (2024), confirming that auditing encourages green technologies and efficient resource management.

Theoretically, this study reinforces the propositions of institutional and stakeholder theories by illustrating how EA responds to external regulatory pressures and internal stakeholder expectations (Pramukti, 2024; Baalouch et al., 2019). Organizations in emerging economies adopt auditing practices not merely for compliance but also to gain legitimacy and stakeholder trust, supporting the assumptions of legitimacy theory (Taylor et al., 2001; Caraianni et al., 2020). Hence, the evidence from Erbil provides empirical validation that institutional and legitimacy mechanisms operate effectively even within developing governance environments.

This research advances understanding by empirically testing EA's multidimensional impact in an emerging economy where prior studies were mainly conceptual. The inclusion of both auditors and academics as respondents enriches the perspective, bridging the gap between theoretical interpretation and professional practice. Future studies could build upon this model by incorporating mediating variables such as environmental governance or green innovation to clarify the pathways through which EA influences EP.

Despite its strengths, this study has some limitations that future research should address. The cross-sectional design restricts causal inference, and self-reported data may introduce respondent bias, consistent with critiques in existing literature (Aguinis et al., 2020; Shorey & Ng, 2022). Longitudinal studies using objective performance metrics could better capture the dynamic effects of auditing over time and assess its sustainability impacts across different sectors.

For policymakers and regulators in Iraq and Kurdistan, the findings suggest the urgent need to institutionalize environmental auditing within corporate governance frameworks. Enhancing regulatory support, providing audit training, and enforcing compliance standards could significantly strengthen firms' environmental accountability and sustainability initiatives. Overall, the study provides empirical evidence that effective environmental auditing serves as both a compliance mechanism and a strategic tool for advancing environmental sustainability in emerging economies.

5th: Conclusion

This study examined the impact of environmental auditing (EA) on overall environmental performance (EP) and its key sub-dimensions in the context of Erbil, Kurdistan. The findings confirm that EA significantly improves EP, with the strongest effects observed for compliance with environmental regulations, followed by sustainability initiatives, resource usage efficiency, and reduction in emissions. These results demonstrate that EA is not only a regulatory compliance tool but also a strategic mechanism for enhancing environmental outcomes in emerging economies.

The research contributes to existing knowledge by providing empirical evidence from a context that has been underexplored in the literature, extending theoretical frameworks such as institutional, stakeholder, and legitimacy theories to a developing-country setting. It also offers practical insights, highlighting the importance of audit institutionalization, professional training, and governance reinforcement to support sustainable practices among organizations.

The study's significance lies in demonstrating that effective EA can foster transparency, accountability, and measurable sustainability outcomes, which are critical for policymakers, regulators, and firms seeking to integrate environmental considerations into corporate strategy. Future research should consider longitudinal designs, sector-specific analyses, and the integration of mediating variables such as governance quality or technological innovation to further understand the mechanisms through which EA enhances environmental performance.

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