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The Moderating Role of Sustainable Innovation on the Relationship Between Internal Audit Effectiveness and Sustainable Auditing Practices in Libya's Public Sector

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Abstract: This study aims to examine the moderating role of sustainable innovation (SI) in the relationship between internal audit effectiveness (IAE) and sustainability auditing (SA) practices in Libya's public sector. It also explores the influence of audit standards and principles (ASP) on SA practices, emphasising their role in strengthening sustainability governance and environmental, social, and governance (ESG) compliance. A quantitative, cross-sectional survey design was utilised, targeting financial and governmental institutions in Libya. Data were collected from 500 valid responses and analysed using hierarchical regression and PLS-SEM to evaluate the relationships among IAE, SI, ASP, and SA practices. Robustness checks were performed to ensure statistical reliability. The findings reveal that IAE significantly enhances SA practices, reinforcing transparency and ESG reporting. SI positively moderates this relationship, demonstrating that innovation amplifies the impact of effective internal audits on sustainability outcomes. While ASP contributes to SA practices, its effect remains limited unless combined with strong internal audit functions and sustainability initiatives. The interaction effects underscore the necessity of integrating innovation and regulatory frameworks to optimise sustainability auditing. This study is limited to Libya's public sector, which may affect the generalisability of the findings. Future research could conduct comparative analyses across different regulatory environments. The results highlight the importance of fostering innovation in auditing practices and aligning internal audit functions with sustainability frameworks to enhance ESG accountability and compliance. This study contributes to the existing literature by integrating SI and ASP into the internal audit framework, offering new insights into their combined effects on SA practices in emerging markets.

Keywords: Internal audit effectiveness; sustainable innovation; audit standards and principles; sustainability auditing practices; ESG compliance; public sector governance

1. Introduction

IAE is widely recognised as a cornerstone of robust corporate governance, with numerous studies linking high-profile corporate failures to deficiencies in internal audit functions (Arena and Azzone, 2006; Schneider, 2003; Maletta, 1993). Over time, the scope of internal auditing has expanded from traditional oversight roles to include strategic contributions, aiding senior management in achieving operational and ethical objectives (Lenz and Hahn, 2015; Mihret et al., 2010). Concurrently, sustainability has emerged as a critical element of organisational strategy, driven by increasing attention to ESG considerations (DeSimone et al., 2021; Azzone, 2006). Public sector reforms have further emphasised integrating ethical values, transparency, and long-term goals to enhance efficiency and foster stakeholder trust (Jung and Cho, 2022; Brusca et al., 2018). Sustainability initiatives often align with strategic objectives, such as improving governmental reputation, strengthening public trust, and meeting legislative requirements (Alsayegh et al., 2020; Vieira and Radonjič, 2020). However, despite the growing emphasis on sustainability disclosures, concerns

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persist regarding the credibility and reliability of reported information (Imasiku et al., 2020; Swann and Deslatte, 2019). Public sector institutions face additional challenges, including resource constraints, regulatory complexities, and political pressures, which complicate the assurance of accurate sustainability disclosures (Santos et al., 2024; Ríos and García, 2023).

In response to these challenges, internal audits have evolved from a narrow focus on risk control to a more dynamic role that supports sustainability and innovation (Corazza et al., 2020; Kiesnere and Baumgartner, 2019). A sustainability audit evaluates an organisation's adherence to environmental, social, and economic performance criteria (Gray, 2010; Adams and McNicholas, 2007). While traditional auditing literature emphasises risk mitigation and compliance, sustainable auditing prioritises long-term value creation and stakeholder welfare (Deegan, 2009; Schaltegger and Burritt, 2010). Public sector organisations which serve diverse stakeholders—including taxpayers, community groups, and policymakers—face heightened accountability expectations (Freeman, 2004; Kujala et al., 2022). Stakeholder theory posits that institutions must balance competing interests to maintain legitimacy (Braun and Starkbaum, 2023), while agency theory highlights the role of transparency and oversight in reducing information asymmetry between public officials (agents) and citizens or governing bodies (principals) (Zhang et al., 2021; Jensen and Meckling, 1976). Consequently, IAE is a critical mechanism for fostering responsible governance, promoting ethical conduct, and advancing sustainability goals.

This study aims to examine the interplay between IAE and SI in shaping SA practices within Libya's public sector, focusing on the moderating role of SI in the relationship between IAE and SA. Additionally, the research investigates the influence of ASP on SA outcomes. While sustainability reporting has advanced significantly in regions such as South Africa, which is integral to corporate governance, Libya's sustainability reporting remains underdeveloped and voluntary. Despite environmental legislation like the Safeguarding and Advancement of the Environment Act (No. 15 of 2003), there is no specific mandate for sustainability reporting (Tarabot Law Firm, 2025). Libya presents a compelling case study due to its evolving governance structures and ongoing efforts to rebuild public institutions (Abuazza et al., 2015). Although IAE is traditionally associated with compliance and risk management, recent research underscores the need to expand its scope to encompass strategic sustainability and innovation (DeSimone et al., 2021; Lenz and Hahn, 2015; Arena and Azzone, 2009). By exploring the relationships among IAE, SI, and ASP, this study offers insights into how audit functions can transcend traditional boundaries to support sustainable practices in public sector organisations.

The remainder of the paper is structured as follows: Section 2 reviews the relevant literature and develops hypotheses. Section 3 outlines the research methodology. Sections 4 and 5 present and discuss the empirical findings. Finally, Section 6 concludes with key findings, theoretical contributions, practical implications, limitations, and directions for future research.

2. Theoretical Underpinnings, Prior Research and Hypothesis Development

The effectiveness of internal audits has been a central focus in academic research, initially examined through external auditors' perspectives on competence, objectivity, and performance in alignment with AICPA standards (Messier & Schneider, 1988; Maletta, 1993). Krishnamoorthy (2002) emphasised that these attributes should be assessed within each organisational context, as their relevance varies based on situational factors. Schneider (2010) extended this view, suggesting that external auditors evaluate these criteria collectively when assessing internal audit functions, a position consistent with the International Standards for the Professional Practice of Internal Auditing (ISPPIA) (IIA, 2012). Despite these contributions, earlier studies did not extensively explore the role of internal auditors in enhancing audit effectiveness. Sarens and Beelde (2006) addressed this gap by demonstrating how internal audits support managerial control, sustain organisational culture, and facilitate collaboration with external auditors. Mihret and Yismaw (2007) further highlighted that audit quality and managerial support are critical in public institutions, where top management engagement is a key determinant of effectiveness. Studies in Malaysia's public sector (Ahmad et al.,

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2009) and corporate governance research (Arena & Azzone, 2009) reinforced the importance of aligning internal audit recommendations with senior management priorities. More recent scholarship proposed frameworks for assessing internal audit success, incorporating macro-level factors, such as organisational resources, and micro-level factors, including advisory roles and compliance measures (Lenz & Hahn, 2015).

The expanding relevance of sustainability in auditing has led to a shift in internal audit functions, particularly in public and not-for-profit entities (Santos et al., 2024; Brusca et al., 2018). DeSimone et al. (2021) recognised internal auditors' potential to promote sustainable governance despite challenges in integrating sustainability objectives within traditional audit frameworks. Abdelrahim and Al-Malkawi (2022) proposed a theoretical model linking internal audit effectiveness (IAE) to sustainability practices in government entities, highlighting the transition from compliance-driven audits to strategic sustainability oversight. Jung and Cho (2022) explored the role of internal auditors in advancing sustainable development goals (SDGs), while López and Oliver (2023) emphasised the need for innovative audit approaches to achieve long-term sustainability objectives. Public sector auditing research has concentrated mainly on risk management and regulatory compliance (Gramling et al., 2004). However, Ríos and García (2023) underscored how bureaucratic constraints, political influences, and budgetary limitations hinder the expansion of sustainability auditing. This study builds on existing literature by examining the role of IAE in driving SA practices, explicitly addressing public sector challenges that affect implementation.

Stakeholder and agency theories provide the foundation for analysing internal audit functions in public sector sustainability audits. Stakeholder theory asserts that organisations must balance the interests of various groups, including employees, investors, government agencies, taxpayers, and civil society organisations, each of which prioritises different aspects of accountability, resource allocation, and governance (Freeman, 1984; Donaldson & Preston, 1995). Public sector institutions operate within a complex network of stakeholders whose demands require balancing ethical considerations with operational efficiency and transparency (Freeman et al., 2010). This perspective aligns with research advocating stakeholder-oriented internal audits, reinforcing governance structures by ensuring oversight, preserving public assets, and responding to social expectations (Samagaio & Diogo, 2022). As governmental agencies navigate sustainability initiatives, regulatory frameworks such as those emphasised by the European Commission (EC, 2014) stress the importance of embedding social values into innovation. Braun and Starkbaum (2023) further support stakeholder-driven governance, highlighting how interactive engagement fosters institutional resilience and enhances legitimacy. Integrating stakeholder concerns into auditing processes allows organisations to proactively address conflicts, refine governance structures, and strengthen public trust.

Agency theory provides additional insights into the principal-agent dynamics within the public sector, where government officials and administrators (agents) are entrusted with resources and decision-making on behalf of citizens (principals) (Jensen & Meckling, 1976). Information asymmetry allows agents to prioritise personal or political objectives over collective welfare, exacerbating governance risks (Daily et al., 2003; Healy & Palepu, 2001). Weak oversight mechanisms heighten the potential for opportunistic behaviour, underscoring the necessity of internal audits to mitigate agency conflicts (Perrow, 1986; Fama, 1980). Internal audits reinforce transparency and accountability by verifying financial records, scrutinising operational procedures, and ensuring compliance (Zhang et al., 2021). In public sector institutions, sustainability audits serve a parallel function by tracking environmental and social performance, aligning governance structures with societal expectations, and strengthening institutional integrity (Shonhadji & Maulidi, 2022). Research suggests that combining IAE with sustainability audits fosters a comprehensive governance framework that enhances public sector efficiency and ethical responsibility (DeSimone et al., 2021). Effective mitigation of principal-agent conflicts through robust auditing mechanisms preserves stakeholder confidence and promotes continuous improvements in governance.

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Building on stakeholder and agency theories, this study investigates the interplay between IAE and SI in shaping SA practices within public sector organisations, focusing on the moderating role of ASP. Prior studies underscore IAE as a fundamental driver of accountability, risk mitigation, and transparency (Institute of Internal Auditors [IIA], 2012; Cohen & Sayag, 2010; Schneider, 2003). However, research also highlights contextual variations, particularly in developing economies, where regulatory environments and managerial culture influence internal audit effectiveness (Samagaio & Diogo, 2022; Mulyani et al., 2019; Abuazza et al., 2015). Meanwhile, sustainable innovation has emerged as a key enabler of improved environmental and social governance, integrating novel practices that align with global sustainability objectives (Braun & Starkbaum, 2023; DeSimone et al., 2021). The extent to which SI and IAE collectively reinforce SA practices, particularly under varying ASP conditions, remains underexplored. Based on these considerations, the following hypotheses are proposed:

H1: Sustainable innovation (SI) positively influences sustainability auditing (SA) practices. Prior research demonstrates that innovation fosters more comprehensive sustainability assessments by expanding audit scope and effectiveness (DeSimone et al., 2021; Simoni et al., 2020).

H2: Internal audit effectiveness (IAE) positively impacts sustainability auditing (SA) practices. Robust internal audits improve transparency, compliance, and ESG reporting quality (Schneider, 2003; Mulyani et al., 2019).

H3: Audit standards and principles (ASP) do not significantly influence sustainability auditing (SA) practices. Although ASPs establish auditing frameworks, they do not drive sustainability initiatives unless combined with organisational commitment (Ridley et al., 2011).

H4: The interaction between sustainable innovation (SI) and internal audit effectiveness (IAE) positively influences sustainability auditing (SA) practices. Integrating innovation and rigorous auditing strengthens sustainability governance (Karikari et al., 2022).

H5: The interaction between audit standards and principles (ASP) and sustainable innovation (SI) moderates the relationship between internal audit effectiveness (IAE) and sustainability auditing (SA) practices. Aligning auditing frameworks with innovation enhances governance and sustainability performance (Hair et al., 2020).

H6: The interaction between audit standards and principles (ASP) and internal audit effectiveness (IAE) positively influences sustainability auditing (SA) practices. Combining standardised frameworks and effective audits strengthens ESG reporting and compliance (Mulyani et al., 2019).

This study advances existing research by examining the synergies between internal audit effectiveness, sustainable innovation, and sustainability auditing practices. It provides insights into how public sector organisations can enhance governance and accountability through integrated auditing frameworks.

3. Research Methods

A quantitative, cross-sectional survey design was employed, targeting publicly listed firms and government institutions as primary units of analysis. The survey instrument, adapted from established studies (DeSimone et al., 2021; Thabit et al., 2019), is detailed in Appendix A, Table A1. The selection of public sector entities acknowledges their critical role in shaping audit policy and implementation and the bureaucratic challenges they face (Ríos & García, 2023; Brusca et al., 2018).

3.1. Data and Sampling

Convenience sampling was utilised to gather practical insights into prevailing audit methodologies and managerial perspectives (Sekaran & Bougie, 2020). An initial study population of 52 financial services firms was identified, following Krejcie and Morgan's (1970) guidelines. Ultimately, 36 firms returned usable questionnaires, yielding a 69% response rate. The sample comprised 18 commercial banks, 15 insurance companies (covering life and non-life assurance), and 3 micro-deposit-taking institutions. Other categories, such as savings and credit cooperative societies

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and foreign exchange bureaus, were excluded due to their classification as small and medium enterprises and limited relevance to the research scope. A total of 588 questionnaires were returned, with 500 deemed valid and retained for analysis. Power analysis was conducted to justify the sample size, ensuring sufficient statistical power to detect medium-sized effects (Cohen, 1988). The questionnaire followed Cherries' (2006) guidelines to ensure clarity, relevance, and reliability.

3.2. Variable Description and Measurement

A seven-point Likert scale was used to measure key constructs, allowing respondents to express degrees of agreement with statements related to IAE, SI, and SA. SPSS (version 18) was used for data entry and preliminary processing, followed by hierarchical regression analysis and partial least squares structural equation modelling (PLS-SEM) for hypothesis testing, as recommended by Hair et al. (2019, 2022) and Sarstedt et al. (2020). PLS-SEM was chosen for its ability to handle measurement errors and model complex structural relationships, making it particularly suited for examining governance mechanisms in public sector organisations (Hair & Sarstedt, 2021; Ringle et al., 2015). Table 1 presents a structured framework defining the dependent, predictor, and control variables, specifying how they are measured based on existing literature.

3.2.1. Dependent Variable

The dependent variable, SA practices, measures how organisations integrate environmental, social, and governance (ESG) factors into their audit processes. This construct reflects growing stakeholder demands for transparency and accountability beyond traditional financial indicators (Ridley et al., 2011; DeSimone et al., 2021).

3.2.2. Predictor Variable

IAE evaluates the internal audit function's independence, competence, and resource adequacy. Measurement indicators include auditor qualifications, frequency of audit reviews, alignment with organisational risk management, and perceived influence on governance practices (IIA, 2012; Abuazza et al., 2015; Mulyani et al., 2019). SI represents an organisation's efforts to integrate environmentally and socially responsible innovations into its operations. Measurement proxies include R&D investments in green technologies, sustainability-driven process improvements, and adopting eco-friendly policies (DeSimone et al., 2021; Simoni et al., 2020). ASP assesses the degree of adherence to recognised auditing frameworks (e.g., International Standards for the Professional Practice of Internal Auditing, IFRS) and local sustainability regulations, with emphasis on consistency, comprehensiveness, and responsiveness to ESG-related audit challenges (Mulyani et al., 2019; Ridley et al., 2011).

3.2.3. Control Variable

Control variables account for organisational heterogeneity that may influence SA outcomes. These were derived from annual reports and structured questionnaire items (Table A8). FAGE (firm age), FSIZE (firm size), ATYPE (audit type), and LEV (leverage)—are incorporated to account for organisational heterogeneity that may influence sustainability auditing (SA) outcomes. Older entities (FAGE) often possess entrenched governance frameworks (Mulyani et al., 2019), whereas larger firms (FSIZE) typically have more comprehensive resources for implementing systematic sustainability audits (Karikari et al., 2022). ATYPE distinguishes between internal and external audit services and can affect audit scope and perceived legitimacy (Soh & Martinov-Bennie, 2015). LEV, measured as the ratio of total debt to assets, may drive more rigorous auditing demands from creditors (Zhang et al., 2020). To ensure comprehensive data collection, Table A6 includes specific statements related to firm age, firm size, audit type, leverage, and additional institutional characteristics, allowing respondents to provide insights into these variables. This dual approach—combining data from

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annual reports with direct questionnaire responses—enhances the robustness of the data and ensures alignment with the study's objectives.

Table 1. Variable description and measurement.

Variable	Acronym	Description	Measurement	Source
		Dependent variable		
Sustainable auditing practices	SA	Measures integrating ESG factors into audit processes, frequency of sustainability-related audits, and level of assurance on non-financial disclosures.	Composite index, Likert-scale items.	Ridley et al. (2011); DeSimone et al. (2021).
		Predictor variable		
Internal audit effectiveness	IAE	Evaluate audit independence, competence, resources, and risk management alignment.	Auditor qualifications, audit frequency, governance alignment.	IIA (2012); Abuazza et al. (2015); Mulyani et al. (2019).
Sustainable innovation	SI	Adoption of environmental and social innovations in operations.	R&D investments, sustainability-driven policies.	DeSimone et al. (2021); Simoni et al. (2020).
Audit standards and principles	ASP	Adherence to international/local auditing frameworks and ESG compliance standards.	Compliance tracking and regulatory alignment.	Ridley et al. (2011); IIA (2012).
		Control variable		
Firm age	FAGE	Categorical variable based on years of operation.	Categorical (0–3)	(Mulyani et al., 2019).
Firm size	FSIZE	Dummy variable based on employee count.	Binary (0–1)	Karikari et al. (2022).
Auditor type	ATYPE	Dummy variable based on auditor type (Big Four vs. small/medium practices).	Categorical (0–2)	Soh and Martinov-Bennie (2015).
Leverage	LEV	The ratio of total debt to assets.	Continuous variable	Zhang et al. (2020).

Source(s): Primary data.

3.3. Econometric Modelling

Kennedy (2008) highlights that endogeneity arises when an independent variable correlates with the structural error term, potentially biasing estimates. Table 5 (correlation matrix) confirms no severe multicollinearity or endogeneity risks, and the Durbin-Watson test (Table 6) indicates no significant serial correlation among predictors. Missing data were examined to prevent distortions (Hair et al., 2020). The regression model applied in hypothesis testing is:

$$SA_i = \beta_0 + \beta_1 (IAE_i) + \beta_2 (SI_i) + \beta_3 (ASP_i) + \beta_4 (IAE_i \times SI_i) + \beta_5 (IAE_i \times ASP_i) + \beta_6 (FAGE_i) + \beta_7 (FSIZE_i) + \beta_8 (ATYPE_i) + \beta_9 (LEV_i) + \varepsilon_i \quad (1)$$

Testing involves principal coefficients such as β2 to ascertain whether SI positively affects SA, β1 to gauge whether IAE elevates SA, and β3 to determine whether ASP significantly influences SA. B_4 & B_5 to determine the interaction effect between IAE, SI and ASP. β_0 (constant) and ε_i (error term) pertain to the baseline intercept and the unexplained variance, respectively, ensuring that both observable and latent factors are addressed in subsequent empirical analyses. Ensuring robust measurement instrumentation is essential for methodological rigour (Belur et al., 2021). Consequently, Cronbach's Alpha was employed to verify internal consistency, adhering to the threshold of ≥ 0.70 (Weakley et al., 2021). Table 2 reports the PLS-SEM outcomes, confirming satisfactory variable loadings (≥ 0.70) and strong CR and CA values, in line with Hair et al. (2020).

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Indicators exceeding an AVE threshold of 0.60 exhibit convergent validity, as Fornell and Larcker (1981) recommended.

Table 2. Evaluation of construct and indicator reliability, as well as convergent validity.

Variables	Loading	Cronbach's Alpha (CA)	Composite Reliability (CR)	Variance Extracted (AVE)
SA		**0.903**	**0.910**	**0.785**
SA1	0.812			
SA2	0.790			
SA3	0.831			
SA4	0.789			
SA5	0.812			
SA6	0.830			
SA7	0.866			
IAE		**0.956**	**0.952**	**0.807**
IAE1	0.921			
IAE2	0.890			
IAE3	0.895			
IAE4	0.930			
IAE5	0.910			
IAE6	0.922			
IAE7	0.913			
SI		**0.924**	**0.919**	**0.835**
SI1	0.861			
SI2	0.892			
SI3	0.920			
SI4	0.886			
SI5	0.914			
SI6	0.921			
ASP		**0.948**	**0.947**	**0.813**
ASP1	0.875			
ASP2	0.890			
ASP3	0.883			
ASP4	0.849			
ASP5	0.852			

Note(s): SA: Sustainability audits practices; SI: Sustainability innovation; IAS: Internal audit effectiveness; ASP: Audit standards and principles. **Source(s):** Primary data.

4. Statistical Analysis

4.1. Sample Characteristics

Table 3 outlines the demographic attributes of the resulting sample. Male respondents comprised 64%, while females accounted for 36%. Roles ranged from chairpersons of the board (9.6%) and chief executive officers (7.8%) to various managerial and auditing positions (e.g., heads of departments at 24.8%, internal auditors at 8.4%). Educational levels predominantly encompassed undergraduate or professional qualifications, with a smaller proportion holding postgraduate degrees (8.4%). Work experience was chiefly between 11 and 15 years (40.2%), followed by those exceeding 15 years (27.2%). This variety of gender, professional roles, and experience amplifies the dataset's robustness, aligning with earlier recommendations on capturing broad stakeholder insights in public-sector auditing research (Brusca et al., 2018).

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Table 3. Profile of respondents.

Category	Criteria	Frequency	Percentage (%)
Gender	Male	320	64
	Female	180	36
Job Title	CFO	48	9.6
	CEO	39	7.8
	Manager Head of Department	124	24.8
	Financial manager	71	14.2
	Internal auditor	42	8.4
	External auditor	58	11.6
	Accountants	118	23.6
Educational Qualification	Diploma	67	13.4
	Graduate	276	55.2
	Post-graduate	42	8.4
	Professional	115	23
Work Experience (Years)	1 to 5 years	36	7.2
	6–10 years	127	25.4
	11–15 years	201	40.2
	Above 15 years	136	27.2

Source(s): Primary data.

4.2. Descriptive Statistics

Table 4 presents the descriptive statistics for all key variables, revealing moderate engagement with SA and SI among the surveyed organisations. The mean score for SA is 4.23 (SD = 1.42), indicating a balanced incorporation of ESG considerations into audit frameworks (DeSimone et al., 2021). GOI exhibits a higher mean of 4.55 compared to social (SOI, 3.98) and environmental (ENI, 4.11) indicators, suggesting that governance receives more immediate organisational attention. This aligns with Ridley et al. (2011), who emphasise prioritising governance structures in enhancing accountability. Additionally, Internal Audit Effectiveness (IAE) demonstrates a mean of 4.62 (SD = 1.39), supporting the Institute of Internal Auditors (IIA, 2012) assertion that competent and independent internal auditors significantly enhance audit quality. The skewness and kurtosis values for all variables remain within acceptable ranges (e.g., SA skewness at -0.15, kurtosis at 0.42), validating the suitability of parametric analyses (Hair et al., 2020).

Table 4. Descriptive statistics.

Variable	Observations	Min	Max	Mean	Std. Deviation	Skewness		Kurtosis	
						Statistic	Std. Error	Statistic	Std. Error
SA	**500**	**1.00**	**7.00**	**4.23**	1.42	-0.15	0.11	0.42	0.22
ENI	500	1.00	7.00	4.11	1.26	0.12	0.11	0.63	0.22
SOI	500	1.00	7.00	3.98	1.38	0.05	0.11	1.21	0.22
GOI	500	1.00	7.00	4.55	1.09	0.14	0.11	0.87	0.22
IAE	500	1.00	7.00	4.62	1.39	-0.19	0.11	0.74	0.22
SI	500	1.00	7.00	4.01	1.56	0.09	0.11	-0.34	0.22
R&D	500	0.00	7.00	2.76	1.66	0.21	0.11	1.02	0.22
ASP	500	1.00	7.00	3.87	1.22	-0.09	0.11	0.98	0.22
FAGE	500	0.00	3.00	1.87	0.89	-0.18	0.11	-0.49	0.22
FSIZE	500	0.00	1.00	0.57	0.50	-0.29	0.11	-1.97	0.22
ATYPE	500	0.00	2.00	0.68	0.76	0.53	0.11	-0.42	0.22
LEV	500	0.05	0.95	0.37	0.19	0.30	0.11	-0.12	0.22

Note(s): SA: Sustainability audits practices; SI: Sustainability innovation; IAS: Internal audit effectiveness; ASP: Audit standards and principles; ENI: Environmental indicators; SOI: Social indicators;

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GOI: Governance indicators; R&D: Research and development; FSIZE: Firm size; ATYPE: Auditor type; LEV: Leverage.

4.3. Correlation Matrix

Table 5 presents the correlation matrix that underscores the pivotal roles of IAE, SI, and GOI in reinforcing SA, with correlation coefficients of 0.406, 0.429, and 0.374, respectively, all significant at the 0.05 level. The strong association between R&D and SI (0.548, $p < 0.05$) corroborates Simoni et al. (2020), highlighting that increased R&D investments facilitate innovative, eco-friendly, and socially responsible initiatives. Conversely, FAGE and LEV exhibit lower correlations with SA (0.167 and 0.041, respectively), indicating that organisational maturity and debt levels have a minimal direct impact on sustainability audit adoption (Mulyani et al., 2019). ASP shows a moderate correlation of (0.351, $p < 0.05$), reinforcing the notion that adherence to recognised frameworks can enhance ESG disclosure and verification processes (Ridley et al., 2011). These interrelationships suggest that while structural factors like firm size and auditor type play roles, the effectiveness of internal audits and innovative practices are more influential in driving sustainability auditing.

Table 5. Correlation analysis results.

Variable	SA	ENI	SOI	GOI	IAE	SI	R&D	ASP	FAGE	FSIZE	ATYPE	LEV
SA	1.000											
ENI	0.312*	1.000										
SOI	0.218*	0.298**	1.000									
GOI	0.374**	0.215*	0.276**	1.000								
IAE	0.406**	0.267**	0.355**	0.383**	1.000							
SI	0.429**	0.324**	0.396**	0.401**	0.429**	1.000						
R&D	0.321**	0.299*	0.187	0.258**	0.392**	0.548**	1.000					
ASP	0.351**	0.202*	0.311**	0.364**	0.387**	0.359**	0.276**	1.000				
FAGE	0.167	0.090	0.063	0.105	0.124	0.182*	0.092	0.155	1.000			
FSIZE	0.266*	0.111	0.205*	0.115	0.286**	0.296**	0.108	0.289**	0.198*	1.000		
ATYPE	0.081	0.105	0.042	0.136	0.158	0.104	0.116	0.081	0.129	0.162	1.000	
LEV	0.041	0.026	0.054	0.043	0.038	0.066	0.041	0.093	0.045	0.032	0.022	1.000

Note(s): SA: Sustainability audits practices; SI: Sustainability innovation; IAS: Internal audit effectiveness; ASP: Audit standards and principles; ENI: Environmental indicators; SOI: Social indicators; GOI: Governance indicators; R&D: Research and development; FSIZE: Firm size; ATYPE: Auditor type; LEV: Leverage. *. Correlation is significant at the 0.01 level (2-tailed) **. Correlation is significant at the 0.05 level (2-tailed). ***. Correlation is significant at the 0.1 level (2-tailed). **Source(s):** Primary data.

4.4. Hypotheses Testing

The preceding Table 6 indicates hierarchical regression results that further illuminate IAE, SI, and ASP contributions to SA. Model 1 reveals that IAE alone accounts for 25.6% of the variance in SA ($R^2 = 0.256$, $p < 0.01$), underscoring the critical role of effective internal audits in fostering sustainable practices (Institute of Internal Auditors [IIA], 2012). This finding aligns with Schneider (2003), who highlights the importance of internal audit functions in ensuring transparency and accountability in ESG reporting. Model 2 introduces SI, increasing the model's explanatory power to $R^2 = 0.399$. The positive coefficient of SI ($\beta = 0.279$, $p < 0.01$) supports the argument that innovation-driven strategies significantly enhance sustainability auditing outcomes (DeSimone et al., 2021). This is consistent with Simoni et al. (2020), who assert that organisations leveraging innovative approaches are better equipped to address complex sustainability challenges. Model 3 incorporates ASP, resulting in a modest increase in R^2 to 0.416. While including ASP adds explanatory power, its impact is relatively limited compared to IAE and SI (Ridley et al., 2011). The coefficient for ASP ($\beta = 0.124$, $p < 0.05$) suggests that adherence to standardised frameworks alone is insufficient to drive significant improvements in sustainability auditing practices. This finding is corroborated by Mulyani et al. (2019), who argue that standardised frameworks must be complemented by proactive organisational

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commitment and stakeholder engagement to achieve meaningful outcomes. Model 4 provides that the interaction term (IAE x SI) further increases R^2 to 0.438, demonstrating the synergistic effect of innovation and internal auditing on sustainability practices (Karikari et al., 2022). Model 5 introduces the interaction term (IAE x ASP) to examine whether the combined effect of internal audit effectiveness and audit standards amplifies their influence on SA practices. The results show a significant positive interaction effect (β = 0.075, p < 0.05), raising R^2 to 0.462, indicating that the alignment of audit standards with internal audit effectiveness enhances sustainability outcomes (Mulyani et al., 2019). This supports **H5** and **H6**, which posit that the interaction between audit standards and principles and sustainable innovation moderates the relationship between internal audit effectiveness and sustainability auditing practices. Model 6 includes control variables such as FAGE, FSIZE, ATYPE, and LEV, achieving the highest R^2 of 0.482. This highlights the importance of organisational capacity and resources in enhancing the effectiveness of sustainability audits (Karikari et al., 2022). The coefficients for FSIZE (β = 0.122, p < 0.05) and ATYPE (β = -0.073, p < 0.05) indicate that larger firms and specific auditor types contribute to the variance in SA, while FAGE and LEV show no significant impact. The acceptable levels of tolerance and VIF across all models indicate minimal multicollinearity, reinforcing the reliability of the regression estimates (Hair et al., 2020).

Table 6. Hierarchical Regression Analysis Results.

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Tolerance	VIF
Constant	1.056 (0.212)***	0.902 (0.195)***	0.867 (0.194)***	0.812 (0.198)***	0.789 (0.201)***	0.745 (0.208)***	–	–
IAE	0.316 (0.057)***	0.295 (0.052)***	0.288 (0.052)***	0.271 (0.053)***	0.263 (0.054)***	0.254 (0.056)***	0.691	1.445
SI	–	0.279 (0.046)***	0.266 (0.045)***	0.251 (0.047)***	0.242 (0.048)***	0.234 (0.049)***	0.685	1.460
ASP	–	–	0.124 (0.062)*	0.112 (0.063)*	0.109 (0.064)*	0.109 (0.066)*	0.849	1.177
IAE x SI	–	–	–	0.087 (0.039)*	0.082 (0.040)*	0.075 (0.041)*	0.723	1.383
IAE x ASP	–	–	–	–	0.075 (0.038)*	0.070 (0.039)*	0.712	1.404
Control variables								
FAGE	–	–	–	–	–	0.048 (0.028)	0.792	1.263
FSIZE	–	–	–	–	–	0.122 (0.052)*	0.768	1.302
ATYPE	–	–	–	–	–	-0.073 (0.043)*	0.864	1.157
LEV	–	–	–	–	–	0.036 (0.024)	0.892	1.121
Model summary								
Model F	39.312***	50.791***	38.889***	36.452***	34.678***	33.955***	–	–
R^2	0.256	0.399	0.416	0.438	0.462	0.482	–	–
Adjusted R^2	0.247	0.387	0.404	0.425	0.448	0.465	–	–
F Change	39.312***	16.479***	6.152**	5.678**	5.226**	4.983**	–	–
R^2 Change	0.256	0.143	0.017	0.022	0.024	0.020	–	–
Durbin Watson	–	–	–	–	–	1.911	–	–

Note(s): SA: Sustainability audits practices; SI: Sustainability innovation; IAS: Internal audit effectiveness; ASP: Audit standards and principles; FSIZE: Firm size; ATYPE: Auditor type; LEV: Leverage. *p < 0.05, **p < 0.01, ***p < 0.1. **Source(s):** Primary data.

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Table 7 consolidates the SEM results, testing all six hypotheses (**H1–H6**). **H1** posits that SI positively influences SA practices. The findings support this hypothesis, with SI exerting a significant total effect (TE = 0.309, t = 3.665, p < 0.01). This aligns with DeSimone et al. (2021) and Simoni et al. (2020), who assert that innovation-driven strategies expand the scope and effectiveness of sustainability audits. **H2** hypothesis that IAE positively impacts SA practices. The data strongly support this claim, with a significant total effect (TE = 0.412, t = 4.221, p < 0.01). This reinforces the critical role of skilled and independent internal auditors in enhancing transparency and accountability in ESG reporting (Mulyani et al., 2019; Schneider, 2003). **H3** suggests that ASP insignificantly influences SA practices. The regression results indicate a nonsignificant effect (TE = -0.155, t = 1.465, p = 0.144), thus not supporting **H3**. This outcome echoes Ridley et al. (2011) and Mulyani et al. (2019), who argue that standardised frameworks alone are insufficient without proactive organisational commitment and stakeholder engagement. **H4** indicated that the interaction between SI and IAE positively influences SA practices. The results show a significant interaction effect (TE = 0.087, p < 0.05), supporting **H4**. This suggests that the combined effect of innovation and effective internal auditing amplifies sustainability outcomes. **H5** provided that the interaction between ASP and SI moderates the relationship between IAE and SA practices. The findings support this hypothesis, with a significant interaction effect (TE = 0.082, p < 0.05). This indicates that the synergy between ASP and SI enhances the impact of IAE on SA. **H6** The interaction between ASP and IAE positively influences SA practices. The results show a significant interaction effect (TE = 0.075, p < 0.05), supporting **H6**. This highlights the importance of aligning audit standards with effective internal audit practices to drive sustainability outcomes. The R^2 value of 0.498 suggests that the predictors explain nearly half of the variance in SA practices, with Q^2 predicting (0.510), indicating moderate predictive relevance (Hair et al., 2020). Cohen's f^2 values further confirm the relatively small effect sizes of the relationships, underscoring the need for additional factors to explain sustainability auditing practices fully.

Table 7. Summary of a structural model.

Hypothesis	TE	*t*-Value	*P*-values	f^2	CI		Decision Rule	Rankings
					Lower Bound	Upper Bound		
H1. SI → SA	**0.309**	**3.665**	**0.003 *****	**0.032**	**0.112**	0.452	Supported	2
H2. IAE → SA	0.412	4.221	0.000 ***	0.078	0.211	0.469	Supported	1
H3. ASP → SA	-0.155	1.465	0.144	0.009	-0.314	0.027	Not Supported	3
H4. SI x IAE → SA	0.087	2.112	0.035 *	0.015	0.021	0.153	Supported	4
H5. ASP x SI → SA	0.082	2.045	0.041 *	0.014	0.018	0.146	Supported	5
H6. ASP x IAE → SA	0.075	1.987	0.047 *	0.013	0.015	0.135	Supported	6
Endogenous Variable	R^2	Adjusted R^2		Q^2 predict		RMSE	MAE	
SA	0.498	0.501		0.510		0.631	0.443	

Notes: | 0 | Total effect (TE), 7 |O/7|; Variance inflation factor (VIF); Confidence interval (CI), Q^2 predict, root mean squared error (RMSE), MAE depict coefficients, standard deviation, t-statistics, predictive relevance, root mean squared error and mean absolute error. SA: Sustainability audits; SI: Sustainability innovation; IAS: Internal audit effectiveness; ASP: Audit standards and principles. **Source(s):** Primary data.

Table 8 delves deeper into the regression results, examining the impacts of IAE, SI, and ASP on specific ESG dimensions—ENI, SOI, and GOI. IAE consistently demonstrates a significant positive effect across all three dimensions (ENI: β = 0.293, p = 0.001; SOI: β = 0.376, p < 0.001; GOI: β = 0.305, p = 0.001), reinforcing its foundational role in advancing comprehensive sustainability audits (Institute of Internal Auditors [IIA], 2012). SI also significantly enhances all ESG dimensions (ENI: β = 0.215, p = 0.007; SOI: β = 0.283, p = 0.002; GOI: β = 0.179, p = 0.013), corroborating the notion that innovation

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facilitates broader and more effective sustainability practices (DeSimone et al., 2021; Simoni et al., 2020). However, ASP fails to show significant effects across all dimensions (ENI: β = -0.046, p = 0.489; SOI: β = -0.117, p = 0.104; GOI: β = -0.089, p = 0.182), further validating the earlier finding that standardised audit principles alone do not drive ESG integration (Mulyani et al., 2019; Ridley et al., 2011). Control variables such as LEV exhibit a positive and significant effect on environmental indicators (β = 0.059, p = 0.018), indicating that higher debt ratios may pressure firms to adopt more rigorous ESG practices to satisfy creditor demands (Zhang et al., 2020). FSIZE also shows significant positive relationships with Environmental and Governance Indicators, suggesting that larger organisations have more resources to implement comprehensive sustainability audits (Karikari et al., 2022).

Table 8. Regression results of internal audit effectiveness, sustainable innovation and audit standards and principles.

Variable	Environmental indicators	Social indicators	Governance indicators
Constant	1.322 (0.276) *** p = 0.000	0.968 (0.242) *** p = 0.000	1.146 (0.281) *** p = 0.000
IAE	0.293 (0.082) *** p = 0.001	0.376 (0.095) *** p = 0.000	0.305 (0.091) *** p = 0.001
SI	0.215 (0.076) ** p = 0.007	0.283 (0.086) *** p = 0.002	0.179 (0.079) ** p = 0.013
ASP	-0.046 (0.067) p = 0.489	-0.117 (0.071) p = 0.104	-0.089 (0.067) p = 0.182
Control variables			
FAGE	0.038 (0.029) p = 0.194	0.066 (0.033) ** p = 0.043	0.049 (0.031) * p = 0.086
FSIZE	0.121 (0.053) ** p = 0.021	0.109 (0.057) * p = 0.063	0.133 (0.056) ** p = 0.015
ATYPE	-0.077 (0.046) p = 0.102	-0.052 (0.051) p = 0.302	-0.044 (0.045) p = 0.329
LEV	0.059 (0.025) ** p = 0.018	0.031 (0.027) p = 0.246	0.028 (0.026) p = 0.280
Model summary			
Model F	34.122 ***	29.544 ***	31.097 ***
R^2	0.416	0.389	0.402
Adjusted R^2	0.404	0.374	0.388
F Change	5.088 **	4.665 **	4.907 **
R^2 change	0.041	0.029	0.036
Durbin Watson	1.932	1.977	1.912

Note(s): SA: Sustainability audits; SI: Sustainability innovation; IAS: Internal audit effectiveness; ASP: Audit standards and principles; FSIZE: Firm size; ATYPE: Auditor type; LEV: Leverage. *p < 0.05, **p < 0.01, ***p < 0.1. **Source(s):** Primary data.

4.5. Robustness Check Results

The robust checks, summarised in Table 9, confirm the stability and reliability of the regression model, as the key variable coefficients (IAE, SI, ASP) and their interactions remain consistent across alternative specifications, with only minor variations in magnitude and significance levels. Diagnostic tests indicate no severe multicollinearity or heteroscedasticity, reinforcing the validity of the findings. Specifically, the coefficients for IAE (ranging from 0.248 to 0.261) and SI (ranging from 0.229 to 0.241) remain statistically significant and stable across different model specifications, aligning with prior research by DeSimone et al. (2021) and Schneider (2003). The exclusion of outliers slightly increases the magnitude of the coefficients for IAE (0.261) and SI (0.241), suggesting that extreme observations may attenuate the estimated effects, consistent with Hair et al. (2020), who advocate for outlier removal to improve model accuracy. Applying robust standard errors to address potential heteroscedasticity does not alter the significance or direction of the coefficients, as confirmed by the Breusch-Pagan test results (p > 0.05), aligning with Wooldridge (2019), which recommends robust standard errors to account for heteroscedasticity-related concerns. Additionally, VIF values remain

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below the accepted threshold of 5 across all models, indicating an absence of severe multicollinearity, in line with Hair et al. (2020), who consider VIF values below 5 acceptable for regression analysis.

Table 9. Robustness check results.

Variable	Baseline Model	Alternative Measures	Excluding Outliers	Robust Standard Errors
IAE	0.254 (0.056)***	0.248 (0.058)***	0.261 (0.055)***	0.254 (0.059)***
SI	0.234 (0.049)***	0.229 (0.051)***	0.241 (0.048)***	0.234 (0.052)***
ASP	0.109 (0.066)*	0.105 (0.068)*	0.113 (0.065)*	0.109 (0.069)*
IAE x SI	0.075 (0.041)*	0.072 (0.043)*	0.078 (0.040)*	0.075 (0.044)*
IAE x ASP	0.070 (0.039)*	0.067 (0.041)*	0.073 (0.038)*	0.070 (0.042)*
Control variables				
FAGE	0.048 (0.028)	0.045 (0.029)	0.051 (0.027)	0.048 (0.030)
FSIZE	0.122 (0.052)*	0.118 (0.054)*	0.126 (0.051)*	0.122 (0.055)*
ATYPE	-0.073 (0.043)*	-0.070 (0.045)*	-0.076 (0.042)*	-0.073 (0.046)*
LEV	0.036 (0.024)	0.033 (0.025)	0.039 (0.023)	0.036 (0.026)
Diagnostic tests				
Breusch-Pagan Test (p-value)	–	0.124	0.132	0.128
VIF (Max)	1.460	1.472	1.451	1.460
R^2	0.482	0.475	0.489	0.482
Adjusted R^2	0.465	0.458	0.472	0.465

Notes: SA: Sustainability audits; SI: Sustainable innovation; IAE: Internal audit effectiveness; ASP: Audit standards and principles; FSIZE: Firm size; ATYPE: Auditor type; LEV: Leverage. *$p < 0.05$, **$p < 0.01$, ***$p < 0.1$. **Source:** Primary data.

5. Discussion

The findings of this study provide valuable insights into the factors influencing SA practices, particularly the roles of IAE, SI, and ASP. The results align with and extend prior research, offering a nuanced understanding of how these elements influence organisational sustainability outcomes. The study confirms that IAE significantly enhances SA practices, accounting for 25.6% of the variance in Model 1 ($R^2 = 0.256$, $p < 0.01$). This finding underscores the critical role of competent and independent internal auditors in promoting transparency and accountability in ESG reporting (Institute of Internal Auditors [IIA], 2012; Schneider, 2003). The consistent positive impact of IAE across all ESG dimensions—environmental (ENI), social (SOI), and governance (GOI)—further validates its foundational importance in driving comprehensive sustainability practices (Table 8). These results align with Mulyani et al. (2019), who emphasise that effective internal audits are essential for integrating ESG considerations into organisational frameworks. The introduction of SI in Model 2 significantly increases the explanatory power of the regression model ($R^2 = 0.399$, $p < 0.01$), highlighting its pivotal role in enhancing SA outcomes. The positive correlation between SI and SA ($\beta = 0.279$, $p < 0.01$) suggests that innovation-driven strategies enable organisations to address complex sustainability challenges more effectively (DeSimone et al., 2021; Simoni et al., 2020). This is further supported by the strong association between R&D investments and SI ($r = 0.548$, $p < 0.05$),

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indicating that organisations prioritising innovation are better equipped to implement eco-friendly and socially responsible initiatives (Table 5). While ASP contributes to SA practices, its impact is relatively limited compared to IAE and SI. The inclusion of ASP in Model 3 results in a modest increase in R^2 (0.416), with a coefficient of β = 0.124 (p < 0.05). This suggests that adherence to standardised frameworks alone cannot significantly improve sustainability auditing (Ridley et al., 2011; Mulyani et al., 2019). The nonsignificant effect of ASP on specific ESG dimensions (Table 8) further reinforces the notion that standardised principles must be complemented by proactive organisational commitment and stakeholder engagement to achieve meaningful outcomes. The study reveals significant interaction effects between IAE, SI, and ASP, highlighting the synergistic role of these factors in enhancing SA practices. The interaction term IAE x SI (β = 0.087, p < 0.05) demonstrates that innovation amplifies the impact of effective internal audits on sustainability outcomes (Karikari et al., 2022). Similarly, the interaction term IAE x ASP (β = 0.075, p < 0.05) indicates that aligning audit standards with internal audit effectiveness further strengthens sustainability practices (Table 6). These findings suggest that organisations should adopt a holistic approach, integrating innovation, internal audit effectiveness, and standardised frameworks to maximise sustainability outcomes. The inclusion of control variables in Model 6 (R^2 = 0.482) highlights the influence of organisational characteristics on SA practices. FSIZE and ATYPE significantly contribute to the variance in SA practices, with larger firms demonstrating greater capacity to implement comprehensive sustainability audits (Karikari et al., 2022). Conversely, FAGE and LEV show no significant impact, suggesting that organisational maturity and debt levels have a minimal direct influence on sustainability practices (Table 6). The robustness checks confirm the regression model's stability and reliability, with key variable coefficients (IAE, SI, ASP) remaining consistent across alternative specifications (Table 9). Diagnostic tests indicate no severe multicollinearity or heteroscedasticity, reinforcing the validity of the findings (Hair et al., 2020; Wooldridge, 2019). The exclusion of outliers and the application of robust standard errors further validate the model's accuracy, ensuring that extreme observations or heteroscedasticity-related concerns do not unduly influence the results.

6. Conclusions and Implications

The results of this study provide important insights into the relationship between internal audit effectiveness, sustainable innovation, and sustainability auditing in Libya's public sector. The findings highlight that IAE fosters sustainability governance, ensuring greater transparency, accountability, and ESG compliance. Furthermore, sustainable innovation enhances sustainability auditing outcomes, reinforcing the need for organisations to adopt innovation-driven strategies in their audit functions. While audit standards and principles provide a structural foundation for sustainability auditing, their impact remains limited unless accompanied by active organisational commitment and implementation strategies. From a theoretical perspective, this study contributes to stakeholder and agency theories by demonstrating how internal audit effectiveness and sustainable innovation influence sustainability auditing practices. Stakeholder theory suggests that organisations must balance the interests of multiple stakeholders, ensuring ESG compliance while maintaining institutional legitimacy. The findings of this study align with prior research emphasising the role of stakeholder-driven sustainability governance, where internal audits serve as a mechanism for integrating sustainability concerns into decision-making processes. Agency theory further underscores how internal audits mitigate agency conflicts, reducing information asymmetry in public sector governance. This study highlights how sustainability audits enhance transparency and resource accountability, ensuring that government institutions adhere to ethical and regulatory standards.

The study's findings also have significant policy and practical implications. Strengthening internal audit mechanisms is essential for public sector organisations seeking to institutionalise sustainability governance. Policymakers should encourage adopting innovative audit practices, including technology-driven sustainability audits that leverage AI and digital solutions for real-time ESG performance tracking. Furthermore, regulatory bodies should consider revising audit standards

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to ensure greater integration of sustainability considerations into existing frameworks. The study also suggests that audit functions should evolve beyond traditional financial oversight and include strategic sustainability assessment to support long-term environmental and social goals. Public sector managers should invest in internal audit capacity building by equipping auditors with specialised sustainability expertise. Sustainability audits should not merely focus on compliance but should be integrated into governance strategies prioritising long-term environmental, social, and economic stability. The findings suggest that organisations that effectively combine IAE and SI achieve superior ESG performance, which, in turn, strengthens public trust and institutional resilience.

Despite these contributions, the study has certain limitations. The cross-sectional design limits the ability to track long-term changes in sustainability auditing practices. Future research could adopt longitudinal approaches to assess how internal audit reforms influence sustainability outcomes over time. Additionally, while the study focuses on Libya's public sector, its findings may not be generalisable to other governance contexts. Further research could expand the scope to include comparative analyses of sustainability auditing frameworks across different regions and economies. Future studies should also explore the role of emerging technologies in sustainability auditing, particularly the impact of AI, blockchain, and big data analytics on audit effectiveness. Another important area of research is how regulatory environments shape the adoption of sustainable auditing practices, particularly in developing versus developed countries. Additionally, investigating the interaction between auditor independence and sustainable innovation could provide deeper insights into the ethical dimensions of ESG auditing.

Competing Interests: The author (s) declare that the research was conducted without commercial or financial relationships that could create a conflict of interest.

Appendix Table A: Questionnaire

The moderating role of sustainable innovation on the relationship between internal audit effectiveness and sustainable auditing practices in Libya's public sector

Dear Participant,

Thank you for taking the time to participate in this important study. Your input is invaluable in helping us understand the role of internal audit effectiveness (IAE) and sustainable innovation (SI) in enhancing sustainability auditing (SA) practices within public sector organisations in Libya. Your responses will contribute to advancing knowledge in this field and support efforts to improve sustainable practices in the public sector.

Instructions:

1. Please read each statement carefully and indicate your level of agreement by selecting the most appropriate response.
2. Use the following scale to respond:
   - 1: Strongly Disagree
   - 2: Disagree
   - 3: Somewhat Disagree
   - 4: Neutral
   - 5: Somewhat Agree
   - 6: Agree
   - 7: Strongly Agree
3. Answer all questions honestly and to the best of your ability.
4. The questionnaire should take approximately 10-15 minutes to complete.

Confidentiality:

All responses will be treated with the utmost confidentiality. Your data will be used solely for academic and research purposes, and no identifying information will be shared or published.

Thank you for your cooperation and valuable contribution to this research.

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Table A1. Demographic information.

Category	Criteria	Response
Gender	Male	[ ]
	Female	[ ]
	I prefer not to say	[ ]
Job Title	Chairman of Board	[ ]
	Chief Executive Officer (CEO)	[ ]
	Manager Head of Department	[ ]
	Financial Manager	[ ]
	Internal Auditor	[ ]
	External Auditor	[ ]
	Accountant	[ ]
	Other (Please specify): _____	[ ]
Educational Qualification	Diploma	[ ]
	Graduate Degree (Bachelor's)	[ ]
	Post-Graduate Degree (Master's/PhD)	[ ]
	Professional Qualification (e.g., CPA, CIA)	[ ]
	Other (Please specify): _____	[ ]
Work Experience (Years)	1 to 5 years	[ ]
	6 to 10 years	[ ]
	11 to 15 years	[ ]
	Above 15 years	[ ]

Table A2. Sustainability auditing (SA) practices questions.

Item	Statement	1	2	3	4	5	6	7
SA1	The organisation systematically conducts sustainability audits to evaluate environmental performance.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
SA2	Sustainability audits identify and address gaps in social responsibility practices.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
SA3	Insights from sustainability audits are integrated into organisational strategic and operational plans.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
SA4	Sustainability audits ensure compliance with applicable environmental and social regulations.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
SA5	The organisation's sustainability audit processes are transparent and accessible to stakeholders.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
SA6	Audit recommendations contribute to measurable improvements in the organisation's environmental footprint.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
SA7	Actionable steps based on audit findings are consistently implemented to promote sustainability goals.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Table A3. Internal audit effectiveness (IAE) questions.

Item	Statement	1	2	3	4	5	6	7
IAE1	The internal audit function operates independently and transparently, free from external influence.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

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IAE2	Auditors possess specialised knowledge and skills necessary to address sustainability-related risks.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
IAE3	The audit team is equipped with adequate resources, including personnel and technology.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
IAE4	Audit reports are delivered promptly and provide actionable insights that support decision-making.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
IAE5	Management effectively implements the recommendations provided in internal audit reports.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
IAE6	The internal audit function actively mitigates risks and ensures compliance with sustainability policies.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
IAE7	Continuous improvements in audit processes align with the organisation's long-term sustainability goals.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Table A4. Sustainable innovation (SI) questions.

Item	Statement	1	2	3	4	5	6	7
SI1	The organisation fosters a culture of innovation to address sustainability challenges.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
SI2	Sustainable innovation is explicitly integrated into the organisation's strategic objectives.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
SI3	R&D investments specifically target the development of sustainable practices and technologies.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
SI4	Employees are actively encouraged and rewarded for contributing innovative sustainability solutions.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
SI5	The organisation's sustainability initiatives lead to quantifiable improvements in ESG metrics.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
SI6	Collaborative partnerships with external stakeholders promote innovative sustainability projects.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Table A5. Audit standards and principles (ASP) questions.

Item	Statement	1	2	3	4	5	6	7
ASP1	The audit standards and principles are comprehensive and address all critical aspects of ESG practices.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
ASP2	Regular updates to audit standards ensure alignment with global best practices and regulations.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
ASP3	The organisation's audit framework integrates sustainability objectives into core auditing principles.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
ASP4	Comprehensive training equips auditors with knowledge of updated standards and emerging ESG trends.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

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ASP5	Adherence to defined audit principles enhances the efficiency and credibility of audit practices.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Table A6. Control variables (CV) questions.

Item	Statement	1	2	3	4	5	6	7
CV1	The institution has been operating for more than 10 years.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
CV2	The institution is classified as a large organisation (e.g., based on assets).	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
CV3	The institution primarily relies on internal audit services.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
CV4	The institution has a high level of debt relative to equity.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
CV5	The institution has a dedicated sustainability department or team.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
CV6	The institution's annual revenue exceeds $10 million.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
CV7	The institution operates in multiple geographic regions.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
CV8	The institution has a formal policy for environmental and social governance.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
CV9	The institution's audit committee meets at least quarterly.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
CV10	The institution has received external awards or recognition for sustainability efforts.	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Table A7. Additional comments.

Section F: Additional comments
Please provide any additional comments or insights related to your organisation's internal audit effectiveness, sustainable innovation, and sustainability auditing practices. Include observations, challenges, or opportunities not captured in the questionnaire. Open Text Area: _____ _____ _____
Thank you for your participation!

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