

ENVIRONMENTAL GOVERNANCE AS A MEDIATING AND MODERATING VARIABLE BETWEEN ENVIRONMENTAL AUDITING AND SUSTAINABLE PERFORMANCE

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Abstract: This study aims to determine the impact of environmental governance (EG) as a mediating and moderating variable between environmental auditing (EA) and sustainable performance (SP) in Al-Noura factory, Karbala, Iraq. The impact of environmental auditing upon improving the sustainable performance and the role of EG in increasing the responsibility among the industries were also analyzed. For this study, the authors considered Al-Noura factory, located at Karbala, Iraq, and the data were collected in September 2023 from 183 respondents and analyzed using partial least squares-structural equation modeling (PLS-SEM) technique. The outcomes infer the strong impact of environmental audit on sustainable performance and EG, while the environmental governance's impact on sustainable performance was partially significant. Based on the indirect effect, the study confirmed the mediator role played by EG between environmental auditing and sustainable performance. Based on the study outcomes, policy recommendations have been made for the decision makers at both organizational and government levels.

Keywords: Environmental Auditing, EG, Sustainability, Economic Performance, Sustainable Performance, Iraqi Environmental Policies.

JEL Classification: F64, O13, O44, R11, Q1, Q5, Q56.

1 Introduction

Economic-ecological and social benefits form the basis of high-quality societal development (Xiong, 2022). EA is one of the environmental management programs that is yet to be completely implemented (Shamsadini, et al., 2022) as various factors prevent its successful implementation, such as the effectiveness and reputation of managers, resource optimization at production level, preventing the production of hazardous wastes and emissions, soil and water pollution, energy saving and reducing the environmental impacts, and so on. Environmental auditing (EA) in Iraq gained attention in the recent years owing to an increase in the number of cancerous cases due to high oil production in the country (Flayyih, Jawad and Al-Abedi, 2024). However, poor environmental infrastructure, lack of comprehensive policies, failed commitments, and weak governance systems have failed the initiatives taken by successive Iraqi governments to overcome the environmental issues (Robeil and Fazil, 2024). These issues can be resolved by a government that is committed toward sustainable development, politically stable,

and ready to adopt efficient economic reforms and develop scientific temperament among the public.

Environmental governance strengthens the relationship between EA and sustainable performance in several ways, such as increased accountability, translating the EA results into strategies followed by its implementation, continuous process improvements, and eventually, sustainable performance achievement (Al-Hindawi, 2016). Various researchers (Al-Hindawi, 2016; Xiong, 2022; Korabayev, et al., 2024) opined that EA has multiple benefits such as sustainable economic development, green economy, mitigation of ecological damage, cost saving, tax benefits from adherence to environmental guidelines, and so on. The current study is an attempt to determine the legitimacy of the claims regarding the impact of environment audit upon improving the sustainable performance and how far the EG helps in increasing the responsibility among the industries.

For the current study, the authors considered environmental audit (EA) as the independent variable and sustainable performance (SP) as the dependent variable, while environment guidance (EG) is considered

as a moderator and mediator. For every variable, various dimensions were considered and are given in Table 1, in which the most frequently used measures in assessing the variables under study were collated and tabulated.

The current study focuses on how conducting environmental audits affects the EG to enhance environmental sustainability. It aims to evaluate whether the audit process enhances the internal governance through consolidated environmental governance systems, external governance through enhanced disclosure, and auditing and measurable progress on environmental impact metrics.

Multiple studies have been conducted earlier focusing on Al-Noura factory in Karbala. These studies focused on the technological capabilities and its impact on performance improvement (Jasim Mahdi and Abdulameer, 2021), impact of competitive strategies in productivity upon increasing the performance (Abd al-Abbas, Abdel Hussein and Abd Ali, 2022), and the impact of engineering techniques in improving the productivity (Abd Aalabass, 2021). However, no studies have been conducted so far with these variables, such as EA, SP, and EG. This study aims to fulfil this research gap on the environmental governance or the impact of EA upon the sustainable performance of Al-Noura factory located in Karbala. So, this study is a first-of-its-kind attempt to analyze the impact of EA upon sustainable performance under the purview of environmental governance. The study outcomes can provide knowledgeable insights to policy makers about the importance of EA, sustainable performance, and the influence of environmental governance upon the organizational growth.

2 Literature review

Environment audit is generally conducted to determine the environmental impacts of a firm or an institution and determine how far the operations comply with the regulatory norms. The audit also finds the possible implications and the impact caused by the operations and regular day-to-day functions of the firm/organization upon the environment (Thokchom, et al., 2023). Kadhim, Abd and Kareem (2020) assessed the governmental environmental institutions in Iraq toward their

contribution to achieve various SDGs. However, their study found that the government's environmental institutions failed in taking appropriate initiatives to overcome the challenges faced in the SDGs, such as SDG 6 (clean water and sanitation), 7 (affordable clean energy), 13 (climate action), and 15 (life on land). The challenges were as follows: increasing pollution in both Tigris and Euphrates rivers, increasing the number of nonrenewable energy-based power plants, delayed implementation of the international agreements, and increasing desert lands in Iraq. The study outcomes recommended that the environmental institutions in the government should focus on conducting periodical environmental auditing to overcome the failure of the SDGs. According to Luciano, et al. (2024)'s findings, environmental audit plays a crucial role in identifying the risks, complying with the regulations, continuous enhancements in operational efficiency and business processes, and nurturing a sustainability-oriented organizational culture. However, the study found that the costs associated with the audit may be a drawback for the start-ups. Flayyih, Jawad and Al-Abedi (2024); Al-Humairi, et al., (2024) assessed the mediating role played by the management systems (MS) in the impact caused by EA upon sustainability in Iraqi oil companies. Their study results found that MS has a mediatory role on the relationship between EA and sustainable development. Wang, Wang and Mei (2023) analyzed how far the government environmental auditing has promoted urban green transformation and whether the implementation or the intensity of government environmental auditing makes the impact on ground. The study considered 285 Chinese cities, and the government audits conducted between 2009 and 2020 were analyzed. The outcomes confirmed that the government environmental audit intensity has a strong impact upon urban green transformation, especially in small- and medium-sized cities.

In literature (Mahdi, 2023), the employees working in the Iraqi Ministry of Health were made to undergo an environmental audit program in their respective economic units to assess how far it can help in attaining sustainable development. The study findings confirmed the importance of EA in achieving sustainable development, as it has a remarkable influence on the environmental quality.

Table 1. High Rank of Citations
(Source: Authors' own research)

Name	Type of the variable	Dimensions	Number of questions	Sources
Environmental audit	Independent	Environmental commitment	1–10	(Yu, et al., 2019); (By-ambaa and de Vries, 2020); (Tao, et al., 2022)
		Environmental screening	11–18	
		Environmental financial analysis	19–24	
Environmental governance	Moderator and mediator	Fairness and justice	25–30	(Tan and Geng, 2020) (Amarra, 2019; Kamel, Abdali and Abbas, 2024) (Sidique, 2024) (Ernst, 2019) (Gupta, Boas and Oosterveer, 2020) (Yu, et al., 2022)
		Transparency	31–36	
		The principle of accountability	37–40	
		Share	41–43	
		Evaluation	44–47	
		Effectiveness	48–52	
Sustainable performance	Dependent	Economic performance	53–69	(Wang, et al., 2022; Żywiolek, Rosak-Szyrocka and Abbas, 2022; Denu, Bentley and Duan, 2023)
		Social performance	70–82	
		Environmental performance	83–94	

Thabit (2021) assessed the EA practices followed in the petroleum industries, Iraq, to measure its effectiveness and its impact on reducing the environmental impact of the companies. The study found that the employees were aware of EA processes and its importance in achieving sustainable development. Mashkoor, H. Ali and Al-Kanani (2023) assessed the impact of implementing Green Activity-based Costing (GABC) upon the sustainable development. Their study findings infer that the nongreen costs incurred by the company are about 12.49% of the total indirect costs, which can be prevented if the green ABC is incorporated. Chichan and Alabdullah (2021) assessed the awareness levels of Iraqi industries about the environmental management accounting (EMA) and found that upskilling of the managing account is required so as to understand the EMA and implement it in decision-making processes. Kareem, Al-Hiyali and Hamid (2023) determined the strengths and weaknesses of the environmental indicators toward achieving sustainable development in Iraq and found that desertification, imbalance between food production and consumption, lack of awareness among the public regarding environmental balance, and water scarcity as the primary issues. Due to these drawbacks, the Iraqi environment suffers from the environmental indicators in spite of

the growth that the country has achieved in the recent years. The role played by internal audits in determining the sustainable performance of the companies was evaluated in Alajeli and Wahhab (2022), and it was found that a weak internal audit affects the final audit-report's quality.

In literature (Flayyih, Jawad and Al-Abedi, 2024), the mediating role of management systems (MS) relevant to EA supporting sustainability reports was analyzed in the perspective of mitigation of negative impact of gas emissions from oil firms. The study found that the MS mediates the relationship between EA and sustainable development (SD). In the empirical study that determined the moderating effect of EA upon the economic and ecological development, Xiong (2022) found that the EA process helps not only in economic development but also in the quality of ecological development. The study concluded that the EA has a positive and significant moderating effect on economic development. Environmental commitment to sustainability remains the core issue investigated in literature (Yu, et al., 2019) in which the authors analyzed the relationship between environmental commitment and sustainability under the connection to nature aspect.

The results emphasized the importance of environmental commitment as a catalyst that can bring change in the society.

Geng and He (2021) emphasized that environmental regulation and environmental awareness have a positive impact on environmental governance. Tan and Geng (2020) pointed out the role of EG, while they stated that all the stakeholders involved in an organization must be involved to achieve sustainable performance. It helps in adapting to compromising situations that can negatively impact the company's growth and existence. According to Agrawal, et al. (2022), the term environmental governance not only involves the environmental perspective but also encompasses societal aspects. Sustainable performance corresponds to an organization's capability to maintain and improve its performance on a long-term basis without compromising ability of future generations to meet their own needs. According to Amarra (2019) and Kamel, Abdali and Abbas (2024), sustainable performance involves three dimensions such as economic, environmental, and social considerations in order to achieve the success. Being an administrative process, it enhances the efficiency of employees and their contribution to work completion. Gupta, Boas and Oosterveer (2020) detailed the challenges in developing effective and efficient transparency systems for the environmental governance. Transparency helps in developing more accountability, democratization of the processes, sustainability-oriented decisions, and many more. Furthermore, monitoring, reporting, and verification systems remain vigilant, immediately reporting authorities in case of a breach in environmental policies, regulations, or guidelines. Though the process may be complex and challenging to implement, it provides a multitude of benefits. Environmental governance or otherwise termed as green governance is not limited to any single domain, but it encompasses all the fields since environment is a common umbrella under which the ecosystem functions (Usman, Johl and Khan, 2024). Various studies confirmed that the green governance practices have a positive impact upon financial and nonfinancial performance of the companies. However, Usman, et al. identified the following areas to be lacking in green governance research, such as the lack of conceptual studies, antecedents of green governance, industry-specific and cross-industry

comparisons, cross-country and multicountry studies, and the lack of green governance and environmental performance framework, which requires in-depth exploration by the future researchers.

Various studies (Żywiolek, Rosak-Szyrocka and Abbas, 2022; Terra dos Santos, et al., 2023) have confirmed that sustainable performance has three dimensions, such as economic, environmental, and social. The economic dimension covers profitability, economic growth, cost efficiency, cost management, optimization of resources, innovation, profit and loss, accounting, etc. (El chami, 2021; Girón, et al., 2021; Biekša, et al., 2022). The environmental dimension involves the reduction of waste, emission, and prevention of resource depletion, adherence to eco-friendly practices, conservation of natural resources, and the ecosystem without compromising the policies, values, and the capabilities of the organization (Akanmu, Hassan and Bahaudin, 2020). Social dimension focuses on the well-being of human resources, ethical practices, moral responsibility, value and commitment, labor practices, community development, cultural preservation, integrity and accountability, and social justice. There must be a kind of relationship of integration and interconnection between both the organization's economic performance and its social performance (Wang, et al., 2022; Denu, Bentley and Duan, 2023).

3 Methodology

3.1 Building hypotheses

EA enables the organizations to measure, report, and reduce their environmental footprint by accurately identifying the defects in their operations. This phenomenon heavily facilitates the continuous improvement of sustainable performance though suspicions are raised about its outcomes (Mohaisen, Ibrahim and Hameed, 2023). Based on this, the first hypothesis is as follows:

H1: Environmental Auditing has significant effect on Sustainable Performance,

H1.1: Environmental Auditing has significant effect on Economic Performance,

H1.2: Environmental Auditing has significant effect on Social Performance,

H1.3: Environmental Auditing has significant effect on Environmental Performance.

Environmental governance has become a crucial topic due to climate change. So, EA has emerged as a potentially valuable governance tool to systematically assess, report on, and provide assurance on the environmental performance of organizations. It also promotes transparency and accountability and strengthens EG to drive regulatory compliance (Cao, et al., 2022). According to Li, et al. (2023), EA has a significant impact on EG and contributes to green development and reduce the carbon footprint, and EA plays a crucial role in supporting good governance by enhancing accountability, transparency, and developing legislation. Therefore, EA is closely related to EG and greatly influences it through its various roles and functions. Through these studies, the second hypothesis is as follows:

H2: Environmental Auditing has significant effect on Environmental Governance.

Achieving environmental sustainability has become an urgent necessity for organizations, while the relationship between sustainable performance and EG can be understood through regulatory compliance and risk management, resource efficiency and waste reduction, natural capital and stakeholder management and engagement, and finally, the transparency. In this background, the third hypothesis has been framed focusing on the impact of environmental governance upon sustainable performance and its dimensions such as socioeconomic and environmental performances:

H3: Environmental Governance has significant effect on Sustainable Performance,

H3.1: Environmental Governance has significant effect on Economic Performance,

H3.2: Environmental Governance has significant effect on Social Performance,

H3.3: Environmental Governance has significant effect on Environmental Performance.

There exists a question on whether declaring EG goals actually translates into fundamental shifts in business operations and resource use on the ground. The well-designed EG systems and EA were considered as variables in the current study (Xiong, 2022) mentioned about the role played by environment audit and its

mediatory role in economic and ecological development, while no other study has considered EG as a variable or mediator between environmental auditing and sustainable performance. Through this, the fourth and fifth hypotheses have been developed:

H4: Environmental Governance significantly moderates the relationship from Environmental Auditing to Sustainable Performance,

H5: Environmental Governance significantly mediates the relationship from Environmental Auditing to Sustainable Performance,

H5.1: Environmental Governance significantly mediates the relationship from Environmental Auditing to Economic Performance,

H5.1: Environmental Governance significantly mediates the relationship from Environmental Auditing to Social Performance,

H5.1: Environmental Governance significantly mediates the relationship from Environmental Auditing to Environmental Performance.

3.2 Search model

By reviewing the above hypotheses, the research model has been designed and shown in Figure 1.

3.3 Sample and collection

The current study was conducted at Al-Noura factory, Karbala, Iraq, affiliated with the Iraqi General Cement Company, one of the companies of the Ministry of Industry and Minerals and manufactures calcium carbonate filler, quick and hydrated lime. The data were collected during September 2023 using a self-administered semi-structured questionnaire containing a 5-point Likert scale from 5 to 1. The potential respondents were employees working in various departments such as administrative, technical, production, human resources, marketing, warehouse, and quality departments of the study factory, who were selected through a simple random sample selection technique. The respondents were provided 90 days to complete the survey, and out of the total 450 potential respondents (358 permanent employees and 92 daily-wages), a total of 183 respondents participated in the survey, that is, 40.66% turn-around rate.

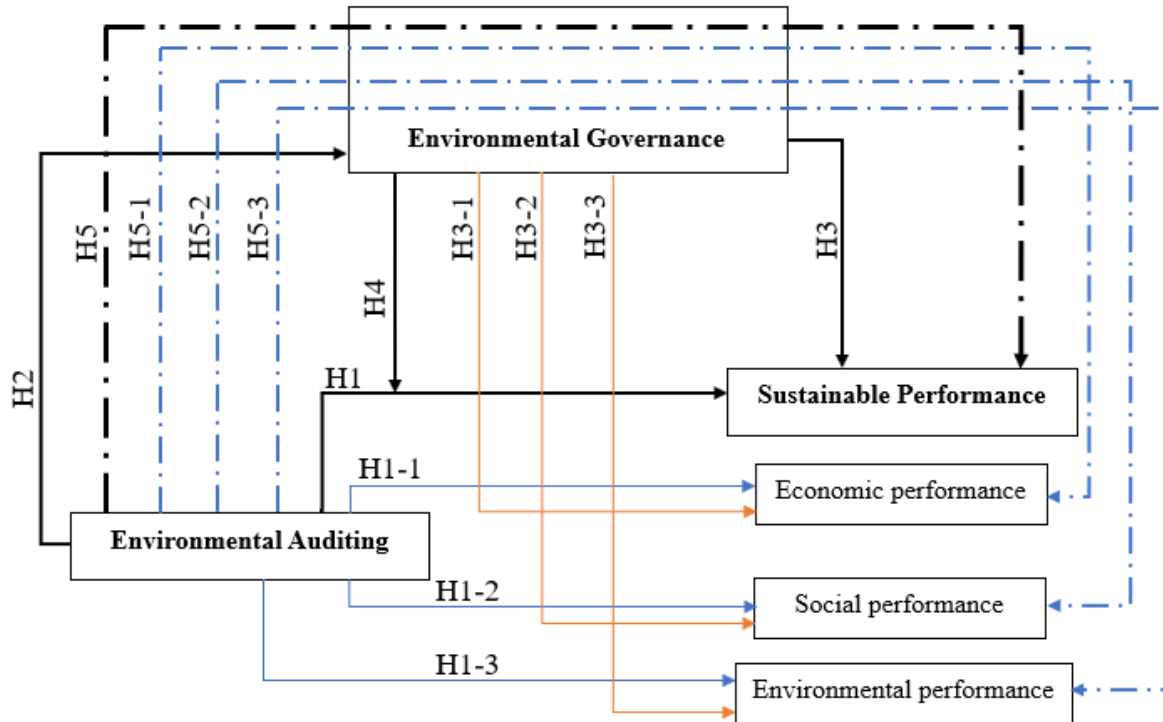


Figure 1. Hypothesis development
(Source: Authors' own research)

Rest of the questionnaires that were partially filled, incomplete, inappropriate, and incorrect details were excluded from the study. The collected data were analyzed using SmartPLS software 3, while Partial Least Squares-Structural Equation Modeling (PLS-SEM) was utilized to determine the study outcomes as per the conceptual model. In order to analyze the measurement model, the authors used internal consistency reliability, convergent reliability, and discriminant validity as proposed in the literature. PLS-SEM helps the researchers to analyze in detail, as well as intricate relationships, test theoretical hypotheses, and understand highly complicated relationships. This feature facilitates in arriving at important conclusions. A wide range of topics can be covered in the PLS-SEM statistical method since it focuses on the correlations between latent variables and observable indicators of those variables (Nallaluthan, et al., 2024). Further, the technique also makes it easy to determine the mediation and moderation analysis and also to analyze the correlations among antecedents, mediators, moderators, and the outcomes (Becker, et al., 2023). Thus, the current study deployed PLS-SEM to analyze the intricate relationships among environmental auditing,

sustainable performance, and environmental governance since each variable has its own subvariables too.

3.4 Result

According to the data presented in Table 2, the reliability indicators of each construct for the current study were found to be more than the threshold value. This indicates that the acceptable internal consistency was checked in all of the constructs. The current study individual item loadings were above 0.4, while as shown in Figure 2 and Table 2, the AVE values for all the items surpassed the needed threshold of 0.4, demonstrating that the constructs utilized in this analysis have sufficient convergent validity.

Table 3 indicates the greatest value of a construct to be 0.757, so the discriminant validity is established as per the HTMT ratio.

Table 2. Measurement model
(Source: Authors' own research)

Item <- Construct	Loadings	CR	AVE
Cut-off	>0.4	>0.6	>0.4
COM1 <- Environmental commitment	0.708	0.841	0.471
COM2 <- Environmental commitment	0.73		
COM3 <- Environmental commitment	0.812		
COM4 <- Environmental commitment	0.646		
COM5 <- Environmental commitment	0.586		
COM6 <- Environmental commitment	0.612		
EXM1 <- Environmental Examination	0.423	0.672	0.423
EXM2 <- Environmental Examination	0.616		
EXM3 <- Environmental Examination	0.843		
FIN1 <- Environmental financial analysis	0.652	0.797	0.569
FIN2 <- Environmental financial analysis	0.834		
FIN3 <- Environmental financial analysis	0.766		
FJ1 <- Fairness and justice	0.447	0.796	0.446
FJ2 <- Fairness and justice	0.765		
FJ3 <- Fairness and justice	0.624		
FJ4 <- Fairness and justice	0.72		
FJ5 <- Fairness and justice	0.735		
TRS1 <- Transparency	0.844	0.829	0.619
TRS2 <- Transparency	0.76		
TRS3 <- Transparency	0.753		
ACC1 <- Accountability principle	0.67	0.8	0.574
ACC2 <- Accountability principle	0.846		
ACC3 <- Accountability principle	0.746		
PRT1 <- Participation	0.751	0.752	0.512
PRT2 <- Participation	0.839		
PRT3 <- Participation	0.518		
EVL1 <- Evaluation	0.411	0.708	0.464
EVL2 <- Evaluation	0.741		
EVL3 <- Evaluation	0.822		
EFF1 <- Effectiveness	0.753	0.768	0.526
EFF2 <- Effectiveness	0.644		
EFF3 <- Effectiveness	0.772		
ECN1 <- Economic performance	0.58	0.843	0.407
ECN2 <- Economic performance	0.462		
ECN3 <- Economic performance	0.614		
ECN4 <- Economic performance	0.667		
ECN5 <- Economic performance	0.563		
ECN6 <- Economic performance	0.731		
ECN7 <- Economic performance	0.768		
ECN8 <- Economic performance	0.664		
SOC1 <- Social performance	0.665	0.847	0.484
SOC2 <- Social performance	0.833		
SOC3 <- Social performance	0.573		
SOC4 <- Social performance	0.672		

Item <- Construct	Loadings	CR	AVE
SOC5 <- Social performance	0.799	0.836	0.521
SOC6 <- Social performance	0.592		
ENV1 <- Environmental performance	0.932		
ENV2 <- Environmental performance	0.585		
ENV3 <- Environmental performance	0.916		
ENV4 <- Environmental performance	0.559		
ENV5 <- Environmental performance	0.496		

Table 3. Discriminant validity
(Source: Authors' own research)

	ACC	ECO	EFF	EXM	COM	FIN	ENV	EVL	FJ	PRT	SOC	TRS
ACC	-	-	-	-	-	-	-	-	-	-	-	-
ECO	0.489	-	-	-	-	-	-	-	-	-	-	-
EFF	0.176	0.129	-	-	-	-	-	-	-	-	-	-
EXM	0.218	0.231	0.369	-	-	-	-	-	-	-	-	-
COM	0.403	0.475	0.253	0.335	-	-	-	-	-	-	-	-
FIN	0.151	0.182	0.307	0.471	0.226	-	-	-	-	-	-	-
ENV	0.35	0.486	0.206	0.231	0.503	0.069	-	-	-	-	-	-
EVL	0.332	0.433	0.28	0.245	0.471	0.204	0.552	-	-	-	-	-
FJ	0.404	0.328	0.169	0.249	0.581	0.21	0.503	0.524	-	-	-	-
PRT	0.36	0.247	0.428	0.446	0.208	0.285	0.159	0.255	0.237	-	-	-
SOC	0.462	0.498	0.259	0.175	0.37	0.136	0.757	0.521	0.423	0.188	-	-
TRS	0.557	0.333	0.17	0.292	0.422	0.115	0.433	0.539	0.551	0.267	0.58	-

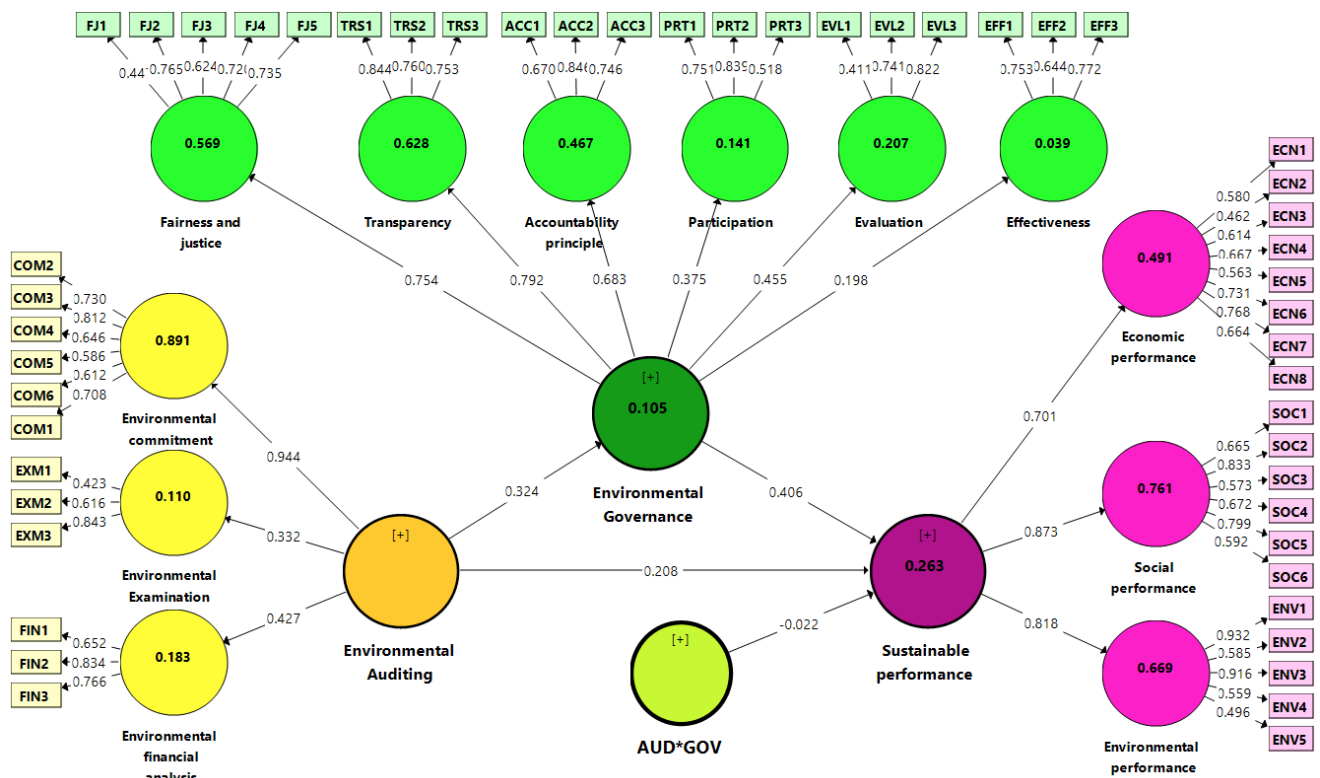


Figure 2. Hypothesis development
(Source: Authors' own research)

Table 4. Descriptive statistic
(Source: Authors' own research)

Construct	Code	M	SD	Skewness	Kurtosis
Environmental commitment	COM	3.706	0.768	-0.359	-0.511
Environmental examination	EXM	3.934	0.579	0.110	-0.807
Environmental financial analysis	FIN	4.084	0.682	-0.123	-1.197
Fairness and justice	FJ	3.773	0.751	-0.842	0.830
Transparency	TRS	3.665	0.984	-0.887	0.149
Accountability principle	ACC	3.634	0.882	-0.029	-0.916
Participation	PRT	3.752	0.640	0.293	-1.045
Evaluation	EVL	2.854	0.723	0.289	-0.182
Effectiveness	EFF	4.093	0.540	-0.468	-0.344
Economic performance	ECN	3.894	0.637	-0.359	-0.698
Social performance	SOC	3.806	0.762	-0.392	-0.907
Environmental performance	ENV	3.989	0.677	-0.699	-0.418
Environmental auditing	AUD	3.908	0.449	-0.053	-0.009
Environmental governance	GOV	3.628	0.430	0.017	-0.814
Sustainable performance	SUS	3.896	0.540	-0.512	-0.848

M = mean; SD = standard deviation

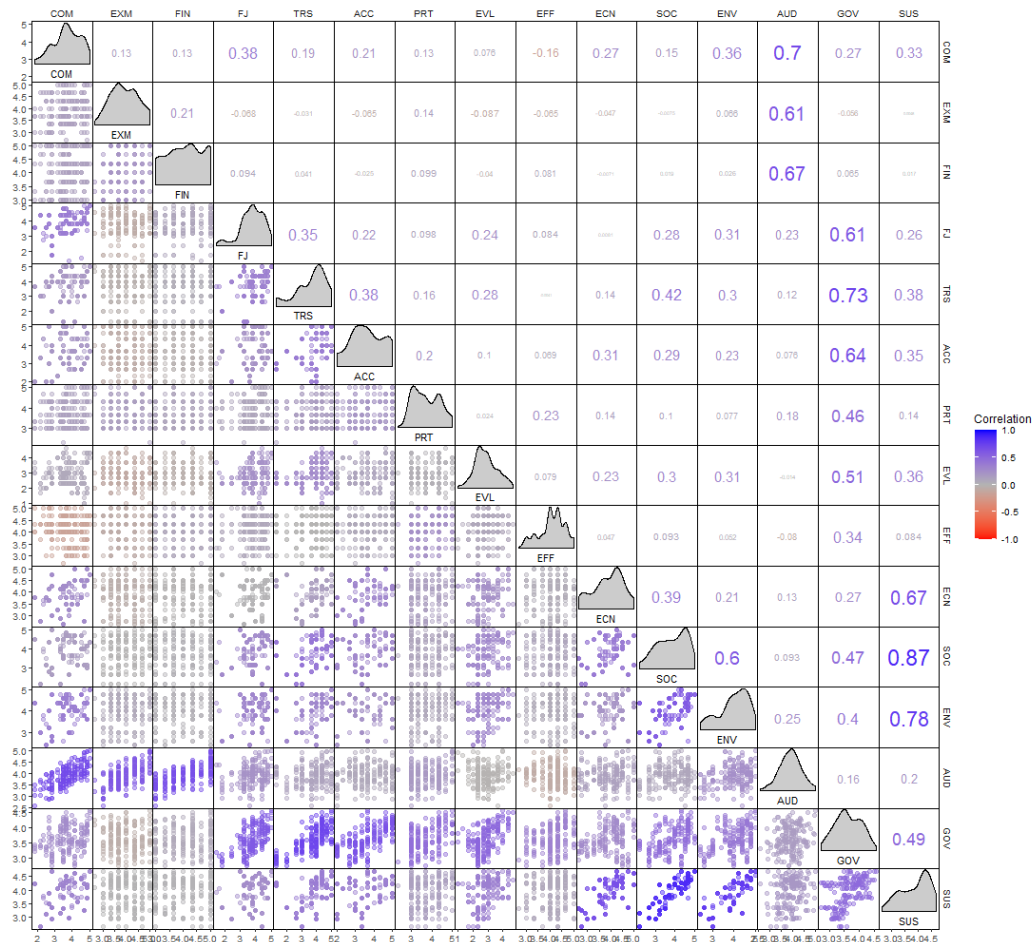


Figure 3. Visualization of scatter plots, distributions, and correlations
(Source: Authors' own research)

4 Descriptive statistics and multiple correlations

Table 4 shows the mean (M) and standard deviation (SD) in addition to skewness and kurtosis values, while the latter two were within the acceptable range. In general, Skewness measures how symmetrical the distribution is, and a perfect skewness is zero while Hair, et al. and Bryne mentioned that the data are considered to be normal, if the skewness is between -2 and +2, while the kurtosis value should be between -7 and +7. In general, standard deviation (SD) denotes how spread out a set of values are, surrounding the mean value while low SD values are in close proximity to the mean value, while high SD values are spread at a wider range. EA had a higher mean ($M=3.908$) compared to sustainable performance ($M= 3.896$) and environmental governance ($M= 3.628$). However, the environmental governance achieved the least variability ($SD= 0.430$), while sustainable performance attained the highest variability ($SD= 0.540$). Table 4 demonstrates that the values of skewness and kurtosis for the constructs were within the acceptable range.

Pearson product-moment correlation coefficient was utilized in this study to ascertain the extent of the association among the stated constructs as well as the direction of the association. Figure 3 shows the scatterplots for each pair of numeric variables considered for the study. The right side represents the Pearson correlation coefficients. The variable distribution with the fitted normal curve was placed on the diagonal. The results indicate the presence of a significant positive relationship between environmental auditing and both the factors such as environmental governance ($r(183)=.163, P<0.05$) and sustainable performance ($r(183)=.199, P<0.01$), respectively. However, the environmental governance has a significant positive relationship with sustainable performance ($r(183)=.494, P<0.001$).

5 The Structural Model

Path coefficients, collinearity diagnostics, coefficient of determination (R^2), effect size (f^2), predictive relevance (Q^2), and global goodness-of-fit criteria were utilized in this study to analyze the structural model. Table 5 shows the path coefficients and the relevant

outcomes of hypothesis testing, while Figure 4 shows the structural model for the main hypothesis.

Prior to assessing the structural model, the collinearity across constructs was explored (Table 6) using variance inflation factors (VIF), and all the values were determined to be less than the threshold of 5 (Hair, et al., 2021). For the current experiment, 2000 bootstrapped samples were employed for the sample observations to evaluate the significance of path coefficients. The entire estimates of the structural equation model are shown in Figures 4 and 5.

As per Table 5, H1 shows that environmental auditing has positive and significant effect on Sustainable performance ($\beta = 0.208, t = 2.279, p < 0.05$). For its sub-hypotheses, environmental auditing has also positive effect on both economic performance ($\beta = 0.41, t = 1.976, p < 0.05$) and environmental performance ($\beta = 0.264, t = 3.286, p < 0.001$), while it has no effect on social performance ($\beta = 0.114, t = 1.04, p > 0.05$). Moreover, H2 shows that environmental auditing has positive and significant effect on environmental governance ($\beta = 0.324, t = 4.256, p < 0.001$). Further, H3 shows that environmental governance has positive and significant effect on sustainable performance ($\beta = 0.406, t = 5.909, p < 0.001$). For its subhypotheses, environmental governance has also positive effect on both social performance ($\beta = 0.472, t = 7.132, p < 0.001$) and environmental performance ($\beta = 0.324, t = 4.741, p < 0.001$), while it has no effect on economic performance ($\beta = 0.033, t = 0.164, p > 0.05$).

Furthermore, the moderation analysis of environmental governance on the relationship from environmental auditing to sustainable performance was not significant since P-value is greater than 0.05 ($\beta = -0.022, t = 0.332, p > 0.05$), so the fourth hypothesis is rejected. Additionally, the mediation analysis yielded a statistically significant indirect effect from environmental auditing to sustainable performance by mediating environmental governance since P-value is less than 0.05 ($\beta = 0.131, t = 3.349, p < 0.001$), so the fifth hypothesis is accepted. For its subhypotheses, environmental auditing has also statistically significant indirect effect on social performance by mediating environmental governance since P-value is less than 0.05 ($\beta = 0.231, t = 4.449, p < 0.001$).

Table 5. Descriptive statistic
(Source: Authors' own research)

H	Path	B	t-value	P-value	95% BCCI		Remark
					LB	UB	
Direct effect							
H1	Environmental auditing -> Sustainable performance	0.208	2.279	0.023	0.029	0.391	Supported
H1.1	Environmental auditing -> Economic performance	0.41	1.976	0.048	-0.59	0.601	Supported
H1.2	Environmental auditing -> Social performance	0.114	1.04	0.299	-0.139	0.282	Not supported
H1.3	Environmental auditing -> Environmental performance	0.264	3.286	0.001	0.098	0.417	Supported
H2	Environmental auditing -> Environmental governance	0.324	4.256	0	0.129	0.443	Supported
H3	Environmental governance -> Sustainable performance	0.406	5.909	0	0.257	0.531	Supported
H3.1	Environmental governance -> Economic performance	0.033	0.164	0.87	-0.44	0.331	Not supported
H3.2	Environmental governance -> Social performance	0.472	7.132	0	0.346	0.583	Supported
H3.3	Environmental governance -> Environmental performance	0.324	4.741	0	0.158	0.43	Supported
Moderating role							
H4	AUD*GOV -> Sustainable performance	-0.022	0.332	0.74	-0.143	0.12	Not supported
Indirect effect (mediating role)							
H5	Environmental auditing -> Environmental governance -> Sustainable performance	0.131	3.349	0.001	0.058	0.206	Supported
H5.1	Environmental auditing -> Environmental governance -> Economic performance	0.016	0.153	0.878	-0.245	0.17	Not supported
H5.2	Environmental auditing -> Environmental governance -> Social performance	0.231	4.449	0	0.143	0.304	Supported
H5.3	Environmental auditing -> Environmental governance -> Environmental performance	0.158	3.665	0	0.062	0.225	Supported

BCCI=bias-corrected confidence intervals; LB= lower bound; UB=upper bound

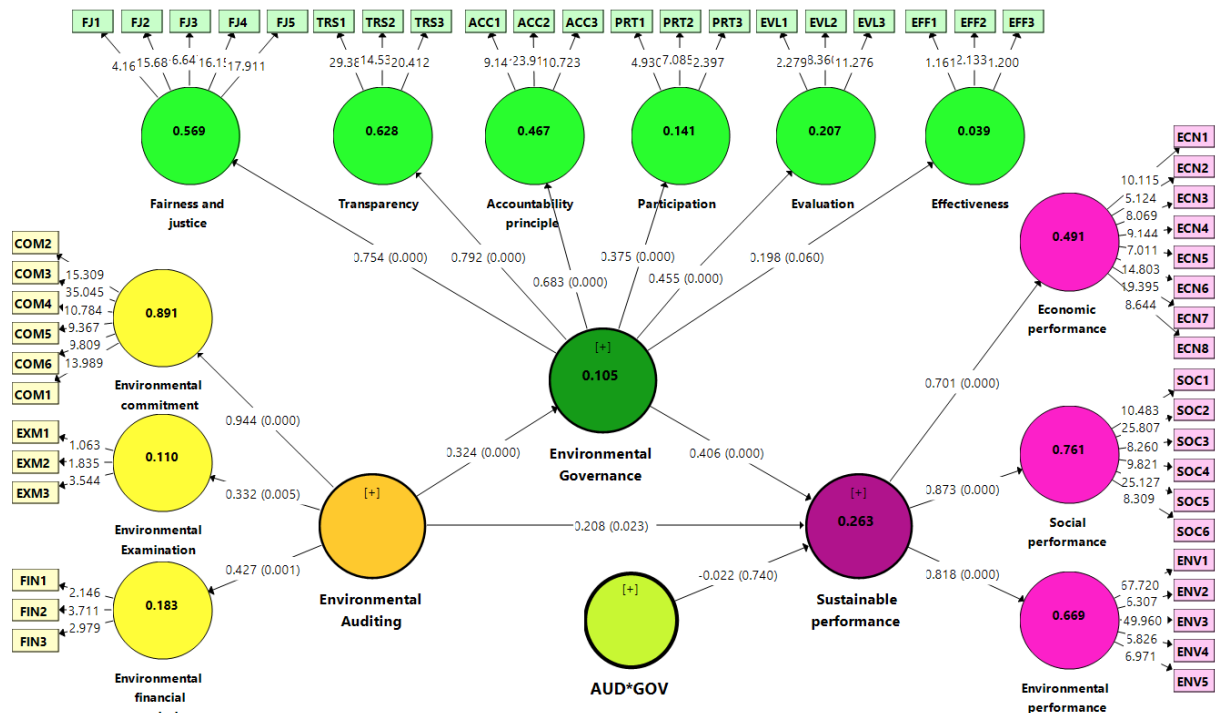


Figure 4. Structural model (main hypothesis)
(Source: Authors' own research)

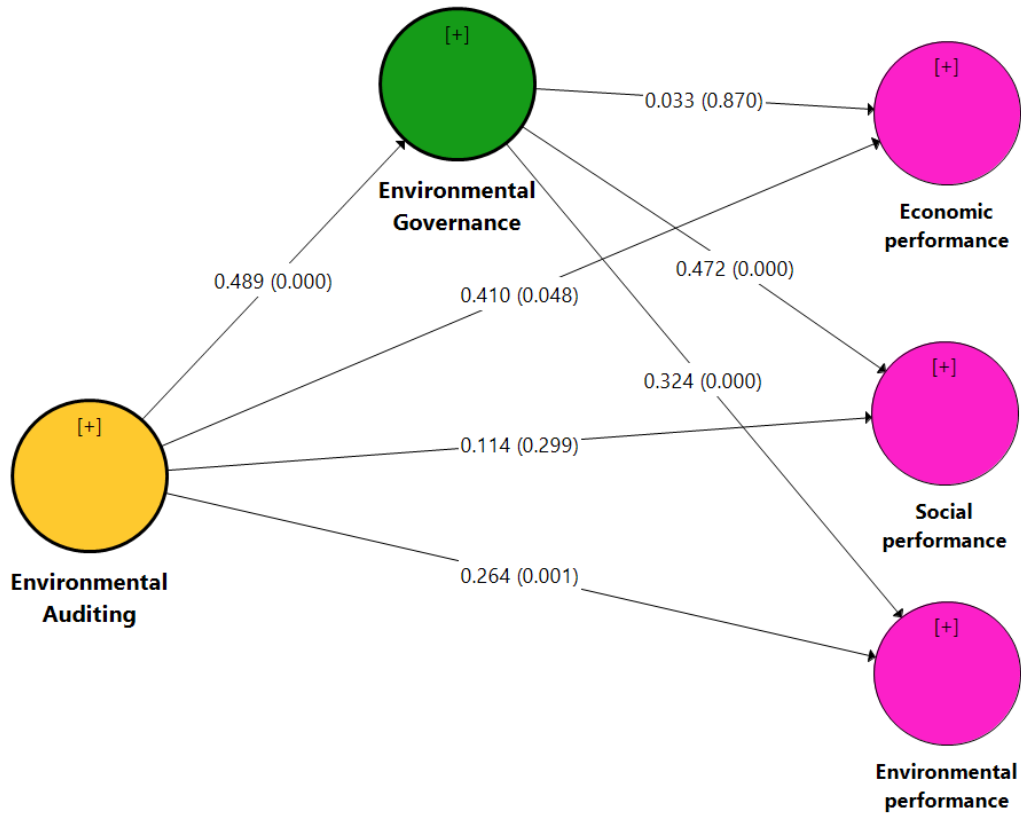


Figure 5. Structural model (subhypothesis)
(Source: Authors' own research)

Table 6. Summary of mediation analysis
(Source: Authors' own research)

Independent	Mediator	Dependent	Direct Effect	Indirect Effect	Mediation
Environmental auditing	Environmental governance	Sustainable performance	Significant	Significant	Partial
Environmental auditing	Environmental governance	Economic performance	Significant	Insignificant	No
Environmental auditing	Environmental governance	Social performance	Insignificant	Significant	Full
Environmental auditing	Environmental governance	Environmental performance	Significant	Significant	Partial

Also, environmental auditing also has a statistically significant indirect effect on environmental performance by mediating environmental governance since P-value is less than 0.05 ($\beta = 0.158$, $t = 3.665$, $p < 0.001$).

However, environmental auditing has no statistically significant indirect effect on economic performance by mediating environmental governance since P-value is greater than 0.05 ($\beta = 0.016$, $t = 0.153$, $p > 0.05$). According to Nitzl, Roldan and Cepeda (2016), if the direct effect is not significant and indirect effect is

significant, full mediation has occurred; if both direct and indirect effects are significant, partial mediation has occurred. A summary of mediation analysis findings is given in Table 6.

The values of f^2 (Effect Size) should be higher than 0.02 (Hair, et al., 2021). Figure 6 visualizes the effect size for the constructs, while as shown in the figure, all the F^2 values of the supported hypotheses were higher than 0.02, confirming the presence of an effect (Table 7).

Table 7. Structural model assessment f^2
(Source: Authors' own research)

	f ²	VIF	R ²	R ² Adj.	Q ²
Cut-off	>0.02	<5	>0.1		>0
Main hypotheses					
Environmental auditing -> Sustainable performance	0.052	1.124	0.263	0.251	0.07
Environmental governance -> Sustainable performance	0.2	1.119			
AUD*GOV -> Sustainable performance	0.001	1.007			
Environmental auditing -> Environmental governance	0.117	1	0.105	0.1	0.017
Subhypotheses					
Environmental auditing -> Economic performance	0.157	1.314	0.183	0.173	0.052
Environmental governance -> Economic performance	0.001				
Environmental auditing -> Environmental governance	0.314	1	0.239	0.235	0.034
Environmental auditing -> Environmental performance	0.071	1.314	0.258	0.25	0.12
Environmental governance -> Environmental performance	0.108				
Environmental auditing -> Social performance	0.014		0.288	0.28	0.116
Environmental governance -> Social performance	0.238				

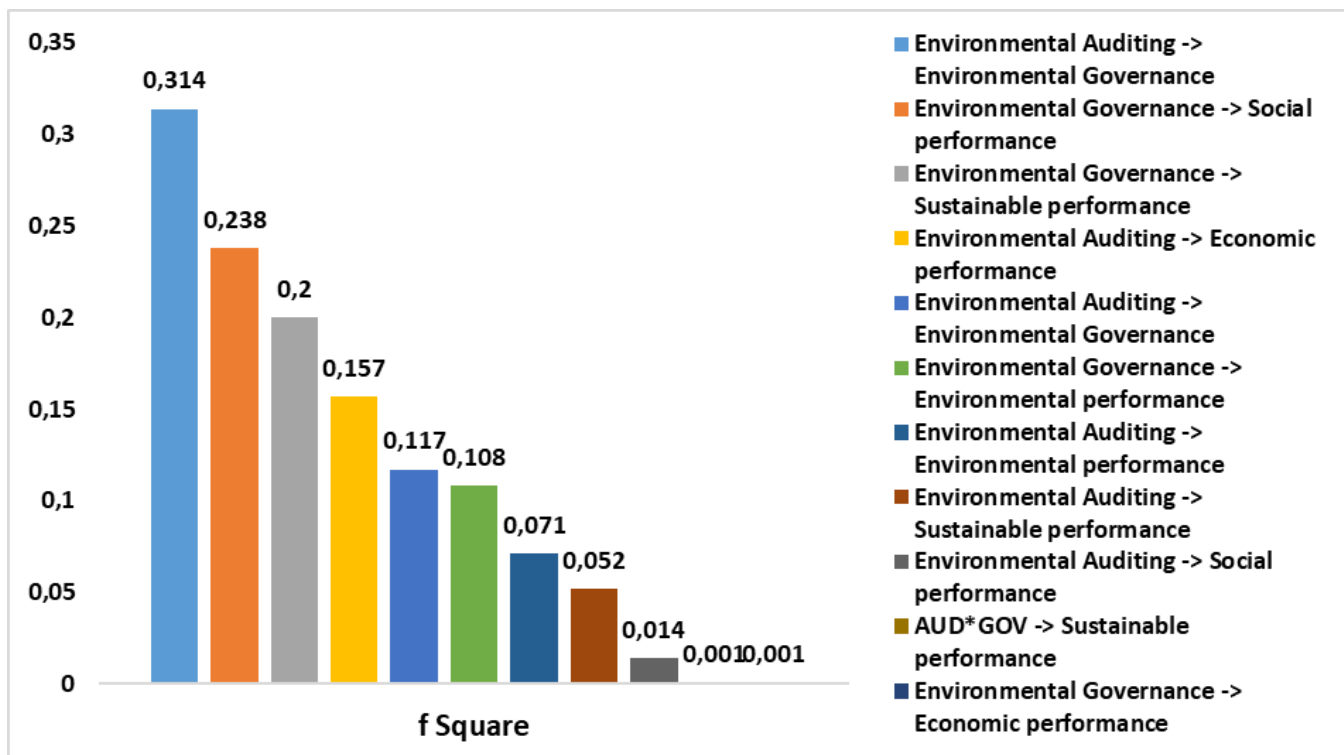


Figure 6. Visualization of effect size
(Source: Authors' own research)

The coefficient of determination (R^2), also known as R^2 value assessment, concluded that all the values were above the threshold of 0.10. The results indicated that 26% of the variation in sustainable performance can be explained by the variation in EA and environmental governance.

About 11% of the variation in EG can be explained by the variation in EA. For the subhypotheses, there were about 18% of the variation in economic performance which can be explained by the variation in both EA and EG; 26% of the variation in environmental performance can be explained by the variation in both EA

and EG; and 29% of the variation in social performance can be explained by the variation in both EA and EG. In this work, cross-validated redundancy (Q2) was employed to assess the impact of latent variables. Table 7 shows the Q2 values for the current study, which are greater than zero which proves the model's predictive relevance.

6 Discussion

Iraq has the potential to meet the sustainable development objectives with sincere adherence to government's plans and programs and its sectoral strategies (Gaudt and Badrawi, 2021). However, the study outcomes infer that various hypotheses were not met, for instance, H 1.2. This might be attributed to the presence of weak compliance with environmental laws, regulations and policies, and the presence of weakness in social performance. This finding is in line with the literature (Azimi, Rahman and Nghiem, 2023). Ward, et al. (2020) mentioned that it is crucial to bring the communities and the respective ecosystems to achieve a common goal, while it is not a new phenomenon, especially in drafting public policies. Community engagement greatly benefits the common cause of achieving environmental performance. Wang, Wang and Mei (2023) found that the government environmental audit has a significant impact on urban green transformation, while it is prevalently effective in small- and medium-sized cities. So, the Iraqi government should take proactive environmental audits from time to time so as to create awareness and increase urban green transformation. This opinion was supported by Chai, et al. (2022) as well since the authors found that the government environmental auditing enhances the structure of the manufacturing industry, especially in state-owned enterprises. Being an Iraqi state-owned factory, it is important for Al-Noura factory to undergo government environmental auditing to contribute toward sustainable performance.

Next, Hypothesis H3.1 corresponds to the weak relationship of influence between environmental governance and economic performance. This might be attributed to the perception among the organizational decision makers that the EG practices may increase the costs incurred upon organizational functioning. While the economic performance is often a short-sighted one,

the environmental performance is targeted at a long-time horizon as per Ifada and Jaffar (2023). The relationship between EG and economic performance is often indirect and is influenced by various factors such as risk management, resource efficiency, strength of the commercial relationship, and ease of access to markets. While it is simple to determine the costs pertaining to economic performance, it is challenging to determine the environmental performance as it is a lengthy process. This finding is in line with the literature (Wang and Ye, 2020) in which the authors analyzed the costs involved in EG in the transportation industry. While the existing models considered only the pollution aspect, this study considered multiple elements including the costs related to carbon emissions, mitigation methods, and so on. As mentioned by Usman, Johl and Khan (2024), the impact of environmental governance upon the overall performance of the firms is yet to be explored in many country-specific, industry-specific studies. The current study is a first-of-its-kind while there is scope for improvement in future, covering multiple types of industries and regions in Iraq so as to have a comprehensive view of the sustainability aspects.

The fourth hypothesis (H4) exhibited an inverse effect of the modifying variable upon the relationship between EA and sustainable performance. This might be attributed to regulatory burdens, noncompliance, conflicts between EG and sustainability goals, and so on. The bureaucratic obstacles, people's unwillingness, political instability, and biased-approaches in Iraq are also among the complex barriers that hinder the implementation of sustainability initiatives that aligns with (Gök and Sodhi, 2021). It is important for the industries in Iraq to work in cohesion with the governments to overcome the obstacles that hinder the implementation of sustainability practices while the policymakers should ease the processes involved in environment audits so as to increase the compliance. The fifth hypothesis (H5.1) was too weak to consider due to turbulent relationship between EA and economic performance. The economic performance of firms tends to be directly influenced by market conditions, technological advancements, and consumer preferences, while it is pertinent to merge the EG practices into the organizational EA processes so as to overcome these challenges and achieve sustainable economic performance.

Shamsadini, Askari Shahamabad and Shahamabad (2022) analyzed a total of 17 factors (segregated into cause and effect factors) that helped in identifying the factors that help or prevent the successful implementation of EA. Such a comprehensive study should be conducted in Iraqi setting so as to determine the factors that help in the successful implementation of EA for sustainable growth. The policy makers should be exposed with and aware of the EA process and its impact on sustainable performance. So, awareness and training programs must become a part of their induction programs to ensure EG in place. Further, the governments must standardize the existing protocols, identify the loopholes present in the existing system for EG, frame new policy guidelines, and monitor the firm's adherence levels so as to report their environmental performance to all the stakeholders of the organization. These are crucial practical implications that form the crux of the study findings. The current study has its own limitations such as considering a single factory in Karbala, Iraq, which means that the study findings cannot be generalized for the rest of the organizations in the country or other MENA region countries. So, the future studies must include a significant number of factories across Iraq to generalize the study findings for the country. The future studies must approach a wide range of target audience including the board of directors, policy makers, environmental audit agencies, government authorities, NGOs, and the international statutory bodies so as to gain an in-depth understanding about the importance of environmental auditing in achieving sustainable performance.

7 Conclusion

The current study is a first-of-its-kind attempt to fulfil the research gap in analyzing the mediatory and moderator role of environmental governance between environmental auditing and sustainable performance in Iraqi firms. This study focused on the impact of conducting environmental audits upon environmental government that in turn boosts the environmental sustainability and sustainable performance. In Iraq, the environmental institutions have taken various initiatives to fulfil the sustainable development goals, though the development is negligible. In this background, this study analyzed the impact of environmental audit in a major factory based at Karbala, Iraq. The

study findings confirmed the significant impact of environmental auditing upon sustainable performance with a mediatory effect from the environmental governance. While the indirect effect of EA upon economic performance remains insignificant, its direct effect upon economic and environmental performance is significant. Instead of a customary practice, the Iraqi companies must include environmental auditing and sustainable performance as a part and process of their vision and mission in order to achieve sustainable growth. The study findings provided knowledgeable insights for practitioners, employees, decision makers in the organizations, governments, and the policy makers. In the future, robust decision-making EA practices and guidelines should be analyzed in multiple settings to achieve sustainable performance.

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