International Review of Management and Marketing

ISSN: 2146-4405

available at http: www.econjournals.com

International Review of Management and Marketing, 2026, 16(6), 362-371.

Green Innovation and its Impact on Cosmetic Accounting: Insights from Corporate Sustainability in Gulf Economies

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Received: 23 March 2026 **Accepted:** 19 July 2026 **DOI:** https://doi.org/10.32479/irmm.24115

ABSTRACT

This research explores the interplay between green innovation, sustainability, and cosmetic accounting in GCC companies based on 938 firm-year observations (2010-2024). Using stakeholder and institutional theories, it suggests firms pursue green practices to boost legitimacy and preserve financial performance to meet stakeholders' expectations. The findings are robust to controls for endogeneity, and to other measures of sustainability. Findings show the significant role of industry-based regulation on sustainability. The research shows green innovation has both positive and negative implications: driving environmental improvement but potentially facilitating "green washing." Governments must mandate uniform sustainability reporting, and companies need to embed sustainability into their strategies. The study is limited by differences in sustainability measures and geographical location, and offers opportunities for further research.

Keywords: Green Innovation, Cosmetic Accounting, Sustainability Index, Financial Reporting, GCC Firms
JEL Classifications: M41, Q56, M14, O31

1. INTRODUCTION

Sustainable business practices and green innovation play a significant role in the economic and corporate transformation in the gulf cooperation council (GCC) countries, especially given the environmental and social challenges. Governments, investors, and businesses increasingly understand that sustainable development mandates companies to incorporate social and environmental sustainability into their business and financial strategies (Bala et al., 2024; Al-Baghdadi et al., 2021). Green innovation, which involves adopting environmentally friendly technologies and processes that minimize environmental impact, boosts competitiveness and accountability, and is often incorporated into sustainability indicators like the corporate sustainability index (CSI) (Hao et al., 2023; Alkaabi and Nobanee, 2019; Zarco-Soto et al., 2021).

However, little research has explored the relationship between accounting practices, such as cosmetic accounting, and green innovation. Cosmetic accounting is the practice of distorting financial statements to show positive results without economic benefit (Owen et al., 1997; Al-Sraheen et al., 2019). This may stem from concerns regarding corporate reputation and regulatory obligations, and can have implications for stakeholder perceptions and sustainability efforts (Bala et al., 2024; Dai and Zhu, 2024).

This research fills this void by investigating the impact of green innovation on cosmetic accounting in GCC companies and the moderating effect of sustainability reporting. Using stakeholder and institutional theories, it suggests that companies with higher levels of green innovation may still involve in cosmetic accounting to signal their social responsibility and influence investors (Al-Baghdadi et al., 2021). The GCC region is significant as it has on-going economic

transition and regulatory changes for sustainability disclosure (Kasayanond et al., 2019; Riyadh et al., 2020).

This research is significant as it connects green innovation and cosmetic accounting, offers empirical insights from the GCC region, considers the role of sustainability disclosure, and has implications for policymakers, investors and managers.

2. THEORETICAL BACKGROUND AND HYPOTHESIS FORMULATION

2.1. Green Innovation and Cosmetic Accounting

A theoretical understanding of cosmetic accounting via green innovation can be developed using stakeholder theory and earnings management. Green innovation can be interpreted as a strategic strategy that affects firms' financial management and reporting practices, potentially aiding cosmetic accounting to project a positive environmental profile (Barney, 1991; Owen et al., 1997). Adoption of green technologies (e.g., sustainable production and processes) boosts firm legitimacy, but also creates opportunities for managers to hide economic realities to improve environmental performance (Abdurrahman et al., 2022; Afsah et al., 2021).

The link between green innovation and cosmetic accounting is intricate, influenced by institutional, governance and regulatory factors (Al-Baghdadi et al., 2021; Hao et al., 2023). Existing research indicates companies with high environmental innovation capabilities might engage in symbolic compliance to meet stakeholder expectations without performance enhancement (Kasayanond et al., 2019; Maama and Appiah, 2019), which could undermine true accountability (Sudarminto and Harto, 2023; Trivellas et al., 2020). This is particularly prevalent in less developed settings with lower reporting quality (Zarco-Soto et al., 2021; Buchholz et al., 2020). Evidence indicates governance and sustainability controls influence cosmetic accounting (Chien et al., 2021; He et al., 2019; Hendratama and Huang, 2021; Lu et al., 2021), but sustainability indices can either restrict or facilitate cosmetic accounting (Riyadh et al., 2020).

From this research, we propose the following hypothesis:
H_1: Green innovation has a positive effect on cosmetic accounting.

2.2. The Sustainability Index as a Moderator in the Relationship between Green Innovation and Cosmetic Accounting

Here we explore the moderating role of the sustainability index in the green innovation-cosmetic accounting nexus. Drawing on stakeholder theory and accounting research, the sustainability index not only captures a firm's pursuit of environmental and social sustainability but also affects how the firm strategically manages its disclosure to shape stakeholder perceptions and practices to legitimise its green innovation (Barney, 1991; Owen et al., 1997). In a world of heightened stakeholder scrutiny of environmental assertions, the moderating role is significant.

Stakeholder theory suggests firms with high sustainability scores are more consistent with expectations around environmental, social and governance practices (Freeman and Phillips, 2002). Positive sustainability performance scores boost legitimacy and trust among investors, regulators and communities, generating reputational capital and access to resources (Afsah et al., 2021; Lu et al., 2021). But companies can engage in green innovation while practising cosmetic accounting to achieve positive financial results (Al-Sraheen et al., 2019; Maama and Appiah, 2019).

The sustainability index also represents valuable, and hard-to-copy, organisational capabilities, such as integrated management systems and a sustainability-focused culture (Alkaabi and Nobanee, 2019). Although these capabilities support green innovation, they also add complexity to financial reporting, which opens opportunities for cosmetic accounting (e.g., selective disclosure or income smoothing) (Kasayanond et al., 2019; Sudarminto and Harto, 2023).

This moderating effect occurs for three reasons. First, sustainability ratings boost firm reputation and investor trust, enabling access to capital for innovation, but also pressures to smooth earnings (Trivellas et al., 2020; Zarco-Soto et al., 2021; Bala et al., 2024). Second, sustainability integration improves operational efficiency but can involve flexible accounting practices that may support cosmetic accounting (Buchholz et al., 2020; Riyadh et al., 2020; He et al., 2019). Third, sustainability leaders better respond to regulatory reforms, but regulatory complexity can encourage cosmetic accounting to reduce regulatory costs (Chien et al., 2021; Hao et al., 2023).

The sustainability index is a concrete, measurable form of CSR and, as such, is a moderator and not a mediator (Hendratama and Huang, 2021; Al-Baghdadi et al., 2021; Lan et al., 2025). The empirical evidence shows its impact on innovation and cosmetic accounting (Bala et al., 2024; Owen et al., 1997). As such, it affects firms' integration of sustainability and financial reporting.

Thus, we propose the following hypothesis:
H_2: The impact of green innovation on cosmetic accounting is greater for firms that have a sustainability index.

3. RESEARCH METHODS AND DATA OVERVIEW

3.1. Sample Design and Selection

We obtain a sample of 938 firm-year observations (Table 1, Panel A), from an initial sample of 2,147 observations of listed GCC firms in the Bloomberg ESG over the period 2010-2024 (Table 1, Panel A). We removed 1,209 observations that have insufficient financial information to ensure the accuracy of the key variables, cosmetic accounting and green innovation. The sample has sufficient statistical power (power > 0.80).

Panel B shows the industry distribution across 11 industry sectors, where the largest sectors are materials (24%), consumer discretionary (14%), financials (13%) and industrials (12%). Other industries, including health care (8%), real estate (9%) and energy (6%) are adequately represented; utilities (0%),

Table 1: Summary of sampling method and participant distribution

Panel A – Sample selection	
Details	
Firm-year observations available in the database	2,147
Less: Firm-year observations with insufficient financial data	−1,209
Firm-year observations in final sample	938
Panel B – Sample breakdown by industry	
Industry	**Obs.**	**Share of total sample (%)**
Communication Services	32	3
Consumer Discretionary	129	14
Consumer Staples	50	5
Energy	58	6
Financials	125	13
Health Care	78	8
Industrials	115	12
Information Technology	41	4
Materials	221	24
Real Estate	85	9
Utilities	4	0
Total	938	100
Panel C – Sample breakdown by year		
Year	**Obs.**	**Share of Total Sample (%)**
2010	5	1
2011	17	2
2012	18	2
2013	25	3
2014	45	5
2015	50	5
2016	49	5
2017	56	6
2018	58	6
2019	63	7
2020	68	7
2021	68	7
2022	157	17
2023	190	20
2024	69	7
Total	938	100
Panel D – Sample breakdown by country		
Country	**Obs.**	**Share of Total Sample (%)**
Bahrain	94	10
Kuwait	107	11
Oman	132	14
Qatar	157	17
Saudi Arabia	234	25
United Arab Emirates	214	23
Total (gulf countries)	938	100

Sample selection (described in Panel A) begins with a total of 2,147 firm-year observations and ends with 938 observations after excluding 1,209 due to insufficient financial information. Panel B disaggregates the 938 data by ICB industrial classification. Panel C classifies the 938 observations by year and Panel D by Gulf Cooperation Council (GCC) countries, where all panels are reweighted to have a common total of 938 observations

communication services (3%) and information technology (4%) are under-represented.

In Panel C, the time distribution reveals a strong focus on recent years, such as 2022 (17%) and 2023 (20%), suggesting a growth in the number of sustainability reports in the GCC, while the earlier years (2010-2014) are underrepresented.

Panel D shows the geographic distribution, with Saudi Arabia (25%) and the UAE (23%) being the most represented, followed by Qatar (17%), Oman (14%), Kuwait (11%) and Bahrain (10%). Overall, the sample is well represented across industries, years and countries, facilitating analysis.

3.2. Operational Definitions of Key Variables

Our research explores the impact of environmental innovation on cosmetic accounting, with macro- and micro-level sustainability factors as moderators. The main dependent variable, cosmetic accounting (COSA), reflects income smoothing and is a dummy variable calculated as the ratio of income variability to sales variability over the last three years (Bala et al., 2024; Owen et al., 1997). 1 suggests potential cosmetic accounting if income variability is less than sales.

The main independent variable, environmental innovation score (EIS), measures firm environmental innovation with an index combining Bloomberg ESG data, such as eco-product revenue, green R&D, and environmental patents (Hao et al., 2023; Khan et al., 2021a).

At the macro level, sustainability context (SUS_INDEX) includes GDP per capita, carbon emissions (reversed), and income inequality (reversed) to reflect sustainability context (Kasayanond et al., 2019). At the micro level, ESG score (ESGS) and CSR strategy score (CSRS) capture sustainability and CSR strategy integration, respectively (Almnadheh et al., 2025; Abdurrahman et al., 2022; Alkhouri and Suwaidan, 2023; Cajias et al., 2014).

The controls are firm size, leverage, profitability, liquidity, sales growth, and capital expenditure (Khan et al., 2021a). We include industry and year fixed effects (2010-2024) to account for industry and time differences, respectively (Trivellas et al., 2020; Chien et al., 2021). We winsorize all variables and conduct various robustness tests for multicollinearity and heteroskedasticity to ensure our empirical findings are robust (Maama and Appiah, 2019).

3.3. Model Framework

We include industry and year fixed effects to account for industry and time variation. Sectors include 11 industry dummies (ICB classification), and years are 2010-2024 to account for regulatory reforms and macroeconomic influences (Trivellas et al., 2020; Chien et al., 2021). The primary explanatory variable, environmental innovation score (EIS), captures firms' green innovation efforts through Bloomberg ESG data, such as green patents, green R&D and green product revenue (Hao et al., 2023).

We use firm fixed-effects models to control for unobserved firm heterogeneity, with clustered standard errors at the firm level to account for heteroskedasticity and autocorrelation (Bala et al., 2024; Al-Baghdadi et al., 2021). To evaluate H_1, we estimate:

$$COSA_{it} = \beta_0 + \beta_1 EIS_{it} + \beta_2 FS_{it} + \beta_3 DR_{it} + \beta_4 ROE_{it} + \beta_5 LR_{it} + \beta_6 SG_{it} + \beta_7 CER_{it} + INDUSTRY + YEAR + \varepsilon_{it} \quad (1)$$

To test H_2, the Sustainability Index (SUS_INDEX)—combining GDP per capita, inverted CO_2 emissions, and inverted Gini index—is introduced with its interaction term:

$$COSA_{it} = \beta_0 + \beta_1 EIS_{it} + \beta_2 SUS\_INDEX_{it} + \beta_3 (EIS_{it} \times SUS\_INDEX_{it}) + Controls + INDUSTRY + YEAR + \varepsilon_{it} \quad (2)$$

All variables are mean centered to reduce multicollinearity (Abdurrahman et al., 2022). Diagnostic tests confirm model validity (VIF <5; Wooldridge P > 0.10). Endogeneity is addressed using IV estimation with lagged EIS and industry R&D intensity (Rounaghi, 2019). Robustness checks support the stability of results.

4. RESULTS

4.1. Descriptive Profile of the Dataset

Descriptive statistics in Table 2 for 938 firm-year observations give an overview of the variables. COSA (the dependent variable) has a mean of 0.226, implying that 22.6% of firms engage in income smoothing, but a median of zero implies a skewed distribution. Sustainability (SUS_INDEX) and environmental innovation (EIS) have high dispersion, indicating diversified sustainability strategies. ESG and CSR scores also have high variability, reflecting differences in firm engagement.

Financial statistics show mixed results: firm size (FS) is relatively consistent, but profitability (ROE), debt ratio (DR) and sales growth (SG) are more varied. The minimum negative values of ROE, SG, liquidity (LR) and capital expenditure (CER) reflect financial stress. In summary, the statistical measures reveal an interplay between sustainability, innovation and cosmetic accounting in the GCC firms.

4.2. Correlation Matrix and Interpretation

Table 3 shows Pearson correlation coefficients for the key variables in 938 firm-year observations in the GCC. The Sustainability Index (SUS_INDEX) is positively associated with environmental innovation score (EIS) and firm size (FS) (0.428 and 0.562, P < 0.01), suggesting that firms engaged in more environmental innovation and of larger size operate in more sustainability focused environments (Kasayanond et al., 2019).

SUS_INDEX has a weak negative association with COSA (−0.091, P < 0.05), implying that cosmetic accounting is less likely in firms with better sustainability environment. However, EIS is not directly correlated with COSA (0.016, P > 0.10), suggesting the need for multiple regression to identify indirect or moderating effects (Hao et al., 2023).

Firm size (FS) is negatively related to COSA (−0.137, P < 0.01), suggesting that larger firms are less likely to smooth income due to better corporate governance (Bala et al., 2024). Controls such as DR, ROE, LR, SG and CER are weakly or negatively correlated. VIFs are <5, indicating no multicollinearity.

4.3. Empirical Results from the Regression Analysis

Table 4 presents the results of four usual regression models of the smallest squares (OLS) (Aiken and West, 1991), which test the effect of the EIS score on COSA, and the moderation effect of the SUS_INDEX. Then, model (1) indicates that EIS has no significant impact on COSA (0.003, t = 0.24). But once the other variables are introduced (2) the influence of EI becomes positive and significant (0.041, t = 3.98). income. The company size and

Table 2: General descriptive statistics of the complete sample

Variable	Mean	Standard deviation	Min	P25	Median	P75	Max
COSA	0.226	0.418	0.00	0.00	0.00	0.43	1.00
SUS_INDEX	42.115	19.358	6.01	27.913	41.209	55.733	87.744
EIS	18.278	25.634	0.00	0.00	0.00	27.104	92.183
FS	9.362	0.931	5.981	8.754	9.23	9.782	12.016
DR	0.467	0.241	0.003	0.291	0.449	0.611	0.955
ROE	0.068	0.197	-0.731	0.007	0.061	0.139	0.832
LR	0.099	0.152	-0.039	0.01	0.046	0.121	1.199
SG	0.587	0.541	-0.322	0.158	0.493	0.801	2.874
CER	0.184	0.692	-1.157	-0.041	0.059	0.241	4.481
ESGS	46.203	19.732	6.103	30.011	44.95	60.784	91.556
CSRS	39.841	32.916	0.00	4.102	36.203	69.014	97.884

This table reports descriptive statistics for the firm-level variables across a sample of 938 firm-year observations. Definitions of all variables are provided in Table 9. Standard deviation=standard deviation. P25 and P75 refer to the 25th and 75th percentiles, respectively

Table 3: Correlation coefficients among variables

Variables	SUS_INDEX	EIS	COSA	FS	DR	ROE	LR	SG	CER	VIF
SUS_INDEX	1									2.63
EIS	0.428	1								2.81
COSA	−0.091	0.016	1							1.74
FS	0.562	0.493	−0.137	1						3.09
DR	0.226	0.095	0.034	0.287	1					1.61
ROE	0.081	0.144	−0.069	0.125	−0.032	1				1.24
LR	−0.118	−0.042	0.059	−0.141	−0.132	0.075	1			1.21
SG	0.097	0.031	0.011	−0.049	0.181	0.197	0.022	1		2.08
CER	−0.063	−0.051	−0.072	0.014	0.019	−0.052	−0.043	−0.086	1	1.11

Table 3 presents Pearson's correlation coefficients among the key variables, based on a sample of 938 firm-year observations. The Variance Inflation Factor (VIF) values, shown in the last column, are calculated for independent variables used in the baseline regression models. For variable definitions, see Table 9

Table 4: Output of ordinary least squares regression model

Variables	(1)	(2)	(3)	(4)
EIS	0.003	0.041***	0.054***	0.018
	(0.24)	(3.98)	(3.55)	(1.34)
SUS_INDEX				0.591***
				(12.11)
EIS×SUS_INDEX				0.010**
				(2.11)
FS		14.782***	14.943***	4.608***
		(7.54)	(6.11)	(3.72)
DR		−8.425	−8.221	−10.537***
		(−1.38)	(−1.48)	(−3.81)
ROE		−2.937	−4.721**	−2.263**
		(-0.76)	(−2.01)	(−2.08)
LR		2.893**	5.312**	6.781**
		(2.31)	(2.75)	(2.10)
SG		3.019*	6.804***	2.703**
		(1.62)	(3.15)	(2.25)
CER		−1.701**	−1.402*	−0.538*
		(−2.18)	(−1.89)	(−1.87)
Intercept	0.124***	−116.284***	−128.901***	−44.207***
	(7.92)	(−7.11)	(−5.43)	(−3.89)
Year fixed effects	No	No	Yes	Yes
Industry fixed effects	No	No	Yes	Yes
R^2	0.002	0.254	0.439	0.527
Obs.	938	938	938	938

This table presents the results of OLS regressions estimating the effect of environmental innovation score (EIS) on cosmetic accounting (COSA) and tests the moderating role of the SUS_INDEX. All models use robust standard errors clustered by firms, and t-statistics are reported in parentheses. Superscripts *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Variable definitions are available in Table 9

its square are positively significant and firm size is positively associated with COSA, which suggests that larger companies are more likely to be involved in COSA whereas ROE is negatively associated with COSA, which means that more profitable firms are less likely to smooth income.

The addition of year and industry fixed effects in model (3) makes the effect of EIS (0.054, t = 3.55) and inspections more significant, with an increase in the explanatory power (r^2 = 0.439). Model (4) contains the SUS_INDEX and the interaction of EIS and SUS_INDEX to test for moderating effects. Both SUS_INDEX (0.591, t = 12.11) and the EIS interaction term (0.010, t = 2.11) are positive and significant, which means that firms with a higher sustainability index will enhance the positive relationship between environmental innovation and cosmetic accounts. This implies that sustainability practices do not have to lead to the mass murder of profits, but in certain situations companies could engage in such practices and combine them with environmental innovation.

The control variables of the model (4) are still consistent with the former models. The Effect of DR is now significantly negative (−10,537, t = −3.81) implying that firms with higher debt are less likely to engage in cosmetic accounting, perhaps due to closer scrutiny by creditors. The model has a wide range of strictures, with R-square of 0.527 for the model (4). These results give insights into nuanced, where eco-sustainability and environmental development together influence financial reporting in the Gulf region; transparent nuanced eco-instruments for cosmetic accounting with changing sustainability standards.

Table 5. Output of Ordinary Least Squares Regression Model

Variables	(1)	(2)	(3)	(4)
EIS	0.003	0.041***	0.054***	0.018
	(0.24)	(3.98)	(3.55)	(1.34)
SUS_INDEX	-	-	-	0.591***
				(12.11)
EIS×SUS_INDEX	-	-	-	0.010**
				(2.11)
FS	-	14.782***	14.943***	4.608***
		(7.54)	(6.11)	(3.72)
DR	-	-8.425	-8.221	-10.537***
		(-1.38)	(-1.48)	(-3.81)
ROE	-	-2.937	-4.721**	-2.263**
		(-0.76)	(-2.01)	(-2.08)
LR	-	2.893**	5.312**	6.781**
		(2.31)	(2.75)	(2.10)
SG	-	3.019*	6.804***	2.703**
		(1.62)	(3.15)	(2.25)
CER	-	-1.701**	-1.402*	-0.538*
		(-2.18)	(-1.89)	(-1.87)
Intercept	0.124***	-116.284***	-128.901***	-44.207***
	(7.92)	(-7.11)	(-5.43)	(-3.89)
Year fixed effects	No	No	Yes	Yes
Industry fixed effects	No	No	Yes	Yes
R^2	0.002	0.254	0.439	0.527
Obs.	938	938	938	938

This table shows the results of OLS regressions predicting Cosmetic Accounting (COSA) from Environmental Innovation Score (EIS) and includes tests for the moderating influence of the SUS_INDEX. A dash ("-") means that the variable was not used as part of the model specification. Robust standard errors clustered at the firm-level are used in all models, and t-statistics are presented in parentheses. The asterisk * is used for statistical significance at 10% of the data, double asterisk ** at 5% and triple asterisk *** at 1% levels. The definitions of variables are found in Table 2

4.4. Robustness Analysis

Table 5 shows the results of the two-phase Heckman, (1979) model, which corrects the potential biases of the sample selection due to the presence of information on sustainability index. The first stage (DSUS) predicts the likelihood of the firm publishing sustainability index data using the probit model, where controls influence positively in the publication. The second stage estimates the impact of the score of EIS, SUS_INDEX and an interaction term on COSA, which includes the inverse mills ratio (IMR) to adjust for preloaded selection. The findings in models (2) and (3) confirm the findings that SUS_INDEX and the interaction term moderately affect the COSA (0.584, t = 5.88 and 0.008, t = 2.07, respectively). EIS is positive and significant in an unadjusted model (model 2) but loses its significance as IMR (model 3) is introduced. Control variables behave as expected: the firm size is positively related with COSA, DR, and negatively with ROE. IMR coefficients are significant, which shows that sample selection distortion exists and is eliminated in the second phase. The overall fit of the model is remarkably improved by including the controls and correction: the pseudo r^2 is 0.298 in the first stage and r^2 is 0.551 in the second stage. These results demonstrate that failure to correct the distortion of sample selection would have resulted in incorrect estimates and confirm the main results about the impact of measures of sustainability and cosmetic accounting in Gulf companies.

Table 6 shows the two-stage least squares regression (2SLS) to address the endogeneity issues in EIS, SUS_INDEX and COSA (Stock and Yogo, 2005). Panel A presents in detail the regression in the first stage, where two instrumental variables (average value of the company and the year EIS and SUS_INDEX was first measured) are powerful predictors of endogenous regressors with high f-statistics (521.20 and 278.34) and high correlations (0.64-0.84). The test for weak identification rejects the hypothesis of zero instruments. Panel B describes second stage, where EIS positively and significantly impacts COSA when estimated alone (0.071, t = 3.61) but its significance is reduced including the SUS_INDEX and the interaction term. The SUS_INDEX continues to be highly significant (0.558, t = 11.46), the interaction EIS and SUS_INDEX is positive and significant (0.012, t = 2.65), enhancing the moderating effect of the innovation and cosmetic accounting link. The models include control variables and fixed effects. The R^2 values (0.462 and 0.551) suggest a good fit of the model. These findings demonstrate the robustness of the key results and confirm that endogeneity does not consider the positive association between sustainability procedures, green innovation and cosmetic accounting practices in the GCC.

Table 7 reports each of the robustness checks using alternative measures of sustainability to test its effect on COSA and the score of EIS. In Panel A, the sustainability index is replaced with ESG (ESGS) score, and in Panel B, it is replaced with CSR (CSRS) strategy. Both representatives have strong positive and significant impacts on COSA (ESG: 0.679, t = 12.75; CSRS: 0.314, t = 10.78), suggesting that firms with better sustainability measures are more likely to engage in cosmetic accounting activities. Crucially, EIS × ESG interaction (0.021, t = 1.82) and EIS × CSRS (0.029, t = 2.41) are significant or slightly significant, suggesting that

Table 6. Robustness Analysis: Heckman's Model for Selection Bias

Variables EIS	First Stage (1) DSUS	Second Stage (2) COSA	Second Stage (3) COSA
SUS_INDEX	-	0.039*** (3.64)	0.012 (1.08)
	-	-	0.584*** (5.88)
EIS×SUS_INDEX	-	-	0.008** (2.07)
FS	1.152*** [5.91]	40.712*** (4.82)	26.213*** (3.62)
DR	-0.526 [-1.37]	-21.980*** (-3.49)	-19.511*** (-3.55)
ROE	-0.391 [-1.43]	-17.822*** (-3.91)	-14.201*** (-3.27)
LR	0.699** [2.31]	18.947*** (3.41)	17.406*** (3.61)
SG	0.578*** [3.74]	20.300*** (4.62)	14.385*** (3.48)
CER	-0.089 [-1.23]	-3.832*** (-3.42)	-2.516** (-2.31)
IMR	-	38.904*** (3.94)	30.117*** (3.38)
Intercept	-9.387*** [-5.42]	-408.651*** (-5.08)	-279.842*** (-3.87)
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Pseudo R^2/R^2	0.298	0.463	0.551
Obs.	2,740	938	938

Model 1 is the first stage of the Heckman (1979) two stage model using a probit regression with the dependent variable (DSUS) coded as 1 if sustainability index-related data are available, and 0 if not. The second-stage OLS regressions are shown in Models 2 and 3, which include the Inverse Mills Ratio (IMR) to control for possible selection bias. The dash ("-") means that the variable was not specified in the model. Robust at-firm clustered standard errors are used in all regressions, as well as year and industry fixed effects. T-statistics are written in parentheses, z-statistics in brackets and are significant at 1%, 5%, and 10% respectively. The definitions of variables are explained in Table 2

the moderating influence of sustainability on the link between innovation and COSA holds across different measures. EIS is consistently positively related to COSA with significance levels at 10% and 5% in all models. The use of control variables and fixed effects confirms the significance of the results (R^2 of 0.53-0.55). In summary, the results provide evidence of the main model and confirm the relationship between environmental innovations, sustainability and cosmetic accounting, despite different measures of sustainability.

Table 8 shows additional ruggedness tests that examine the potential confounding effect of the COVID-19 pandemic, and address current concerns about causality with lagged independent variables. Models (1) and (2) drop pandemic years, revealing that EIS still has a positive and significant impact on COSA in model (1) (0.056, t = 3.42), but the meaning of COVID in model (2). Models (3) and (4) introduce one-year lagged EIS (EIST-1) to address the potential endogeneity of EIS; the findings remain consistent with the baseline model, where EIS and the interaction between EIS and SUS_INDEX have a positive impact on COSA (EIS: 0.058, t = 3.98; interaction: 0.017, t = 2.37). SUS_INDEX is highly significant in all models. This time, all control variables, year and industry fixed effects are included. The R^2 values vary

from 0.48 to 0.57, suggesting a consistent explanatory power. These findings validate the main results and show that the reported positive relationships between environmental innovation, sustainability and cosmetic accounting are not contaminated by the pandemic effects or pre-borne simultaneity. Hence, it applies to different time and causal scenarios in GCC firms.

Table 7: Robustness analysis: Alternative sustainability indicators

Panel A: ESG score (ESGS) as a first alternative		
Variabl=COSA	**(1)**	**(2)**
EIS	0.027**	0.033*
	(2.12)	(1.69)
ESGS		0.679***
		(12.75)
EIS×ESGS		0.021*
		(1.82)
Intercept	−69.421***	−84.197***
	(−5.08)	(−3.54)
Other controls	Yes	Yes
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
R^2	0.528	0.547
Obs.	938	938
Panel B: CSR strategy score (CSRS) as a second alternative		
Variable=COSA	**(1)**	**(2)**
EIS	0.025**	0.035*
	(2.05)	(1.74)
CSRS	0.314***	
	(10.78)	
EIS×CSRS	0.029**	
	(2.41)	
Intercept	−66.508***	−81.726***
	(−4.94)	(−3.67)
Other controls	Yes	Yes
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
R^2	0.532	0.548
Obs.	938	938

This table presents robustness tests examining the relationship between green innovation (EIS) and cosmetic accounting (COSA) using two alternative proxies for the Sustainability Index: ESG score (ESGS) in Panel A and CSR strategy score (CSRS) in Panel B. All models are estimated using ordinary least squares (OLS) with robust standard errors clustered at the firm level and include year and industry fixed effects. Significance levels are denoted by *, **, and *** for 10%, 5%, and 1%, respectively. Variable definitions are provided in Table 9, and the total number of observations is 938

5. DISCUSSION

The research offers convincing evidence of the interaction of environmental innovation and sustainability in the ITES JBs in the GCC, and therefore explains the effects of environmental innovation and sustainability on financial reporting. The results, backed up by descriptive statistics, correlation, regression analysis and robustness tests (Tables 3-8) show that there are sophisticated strategic practices in the GCC sustainable financial markets.

Descriptive statistics COSA happens in 22.6% of the 938 fixed annual observations (Table 9) so that while firms mostly defer income termination, others use these strategies to external influence. This finding also confirms Bala et al. (2024) who report that cosmetic accounts are a convenient way of enhancing legitimacy while not altering the financial facts.

The sustainability index with the environmental innovation score (0.428**, P = 0.10) shows that lack of a fixed linear relationship that may be due to changes in the level of uptake of ESG within the GCC sectors (other funds vs. funds) or a corporate choice of legitimacy over transparency (Owen et al., 1997). This confirms the role of regression models for small effects.

The regression analysis (Table 4) shows while EIS is not a direct strong predictor of COSA (e.g., $\beta = 0.039$, $P < 0.01$ in Table 5, model 2), the interaction (EIS × SUS_INDEX) boosts the positive relationship ($\beta = 0.008$, $P < 0.05$ in Table 5, model 3). Economically, a one standard EIS increase in EIS (12.3 points) raises the likelihood of COSA by around 0.48 percentage points in high SUS_INDEX, a significant impact on GCC sustainability markets. This interaction effect suggests that firms can adopt green innovation strategies to increase their legitimacy and at the same time engage in cosmetic accounts, in line with the theory of legitimacy (Owen et al., 1997) and Bala et al.'s (2024) study on

Table 8: Additional Analyses: Robustness to COVID-19 and Simultaneous Causality

Variable= COSA	Addressing COVID-19 pandemic		Addressing simultaneous causality (t−1)	
	(1)	**(2)**	**(3)**	**(4)**
EIS	0.056***	0.014	0.058***	0.030*
	(3.42)	(0.76)	(3.98)	(1.79)
SUS_INDEX		0.654***		0.602***
		(11.12)		(5.26)
EIS×SUS_INDEX		0.019***		0.017**
		(3.42)		(2.37)
Intercept	−139.264***	−52.143***	−142.211***	−54.867**
	(−5.40)	(−4.05)	(−5.12)	(−2.43)
Other controls	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
R^2	0.48	0.56	0.49	0.57
Obs.	552	552	386	386

This table presents robustness checks for the relationship between Green Innovation (EIS) and Cosmetic Accounting (COSA). Models (1) and (2) exclude years affected by COVID-19, while Models (3) and (4) employ lagged independent variables (EISt–1) to mitigate potential simultaneous causality. All regressions are estimated using ordinary least squares (OLS) with robust standard errors clustered at the firm level and include year and industry fixed effects. Significance levels are indicated by *, **, and *** for the 10%, 5%, and 1% levels, respectively. Variable definitions are provided in Table 9

Table 9: Operational definitions of variables

Variable	Abbreviation	Definition
Cosmetic accounting	COSA	The difference in the coefficient deviation of income (CVI) is divided by the difference in the coefficient variation of sales/revenue (CVS). If a corporation's CVI/CVS quotient is more than/equal to 1, a corporation is perceived to have smoothed income and otherwise is 0.
Sustainability index	SUS_INDEX	Composite indicator based on: (1) GDP per Capita (GDP_PC), measured as real GDP per person in constant US dollars; (2) CO_2 Emissions per Capita (CO2_PC), measured as annual metric tons of CO_2 emissions per person; and (3) GINI_INDEX, a measure of income inequality represented by the Gini coefficient (ranging from 0 to 1, where 0 indicates perfect equality and 1 indicates perfect inequality).
Environmental innovation score	EIS	Environmental innovation score, showing a firm's ability to minimize environmental costs and customer burden by creating new markets through new technologies and eco-products.
ESG score	ESGS	ESG score, reflecting a firm's performance in environmental, social, and governance (ESG) dimensions.
CSR strategy score	CSRS	CSR strategy score, reflecting a firm's integration of economic, social, and environmental dimensions into its daily decision-making processes.
Firm size	FS	Firm size, measured by total assets or market capitalization.
Debt ratio	DR	Ratio of total debt to total assets, indicating the proportion of a firm's assets financed by debt.
Return on equity	ROE	Profitability, measured as net income divided by shareholders' equity.
Liquidity ratio	LR	Liquidity, measured as current assets divided by current liabilities.
Sales growth	SG	Annual percentage change in net sales.
Capital expenditure ratio	CER	Capital expenditure is divided by total assets, indicating investment in long-term assets.
Industry dummy	INDUSTRY	A dummy variable that takes a value of 1 if a firm belongs to a specific industry, 0 otherwise.
Year dummy	YEAR	A dummy variable for the years included in the study (except the benchmark year).

All continuous variables are winsorized at the 1st and 99th percentiles to deal with outlier effect. More diagnostic checks—including multicollinearity tests, heteroskedasticity test (using Breusch-Pagan test) and alternative specifications of EIS-rated variables—are conducted to verify the robustness of the results

strategic behavior in emerging markets. An interaction effect can represent the response of GCC firms to the pressure of the parties where green innovations can be used as a signalling to counter the scrutiny of income (Al-Baghdadi et al., 2021).

Control variables provide additional knowledge. The negative relationship between the debt ratio (DR) and COSA ($\beta = -19.511$, $P < 0.01$ in Table 5, model 3) implies that creditors' oversight in the resources of the GCC constrains cosmetics accounting (Alkaabi and Nobanene, 2019). Likewise, ROE has a negative effect on COSA ($\beta = -14{,}201$, $P < 0.01$), implying that profitable firms have less interest in managing earnings (Trivellas et al., 2020). FS also observes a negative link to COSA ($\beta = 26{,}213$, $P < 0.01$), due to better management in the larger firms of the GCC region (Bala et al., 2024).

These results are confirmed by robustness tests (Tables 5-8). The Heckman (Table 5) addresses the selection bias because of the missing ESG data, with a significant inverse mill ratio (IMR, $P < 0.01$) showing distortion, but similar EIS and EIS × ESG effects after correction. The 2SLS (Table 6) corrects for endogeneity with valid instruments (average EIS, EIS 1st year; $F > 19.93$), and supports the significant EIS coefficient ($\beta = 0.071$, $P < 0.01$). The use of alternative proxies for sustainability (ESGS, CSRS; Table 7) result in similar moderation effects (e.g., $\beta = 0.021$, $P < 0.10$ for EIS × ESG), confirming the robustness of SUS_INDEX as moderator (Alkhouri and Suwaidan, 2023). Except for the COVID-19 years and the use of delayed EIS (Table 8), it has significant coefficients (e.g., $\beta = 0.056$, $P < 0.01$) and eliminates time anomalies or endogeneity (Afsah et al., 2021; Latan et al., 2018).

A further possibility may be weak administration and governance structures that prevent cosmetic accounting or the pressure of stakeholders resulting in the destruction of green innovation and earnings. Negative correlations SUS_INDEX-COSA indicate that the transparency of sustainability accounts works as external administration, but poor independence on the board or high concentration of ownership in GCC firms can still pave the way for opportunistic conduct (Al-Baghdadi et al., 2021). These arguments are partially addressed by controlling for size of firm and industry effects, but future research should address the management aspects.

These insights are important for GCC politicians and firms. Green innovation used strategically, along with cosmetic accounting, means that government authorities should conduct mandatory ESG audits and reporting standards to ascertain genuine sustainability practices. Tax or public awards for good financial reporting could also minimise income extermination. Firms should embed sustainability into the fundamental structures of management and move beyond a superficial implementation of the law to meet stakeholders' expectations (Hao et al., 2023).

Limitations include possible measurement biases in ESG-based indicators (e.g., SUS_INDEX, EIS), due to change in assessment approaches, offset by using Bloomberg and Refinitiv data for cross-validation (Maama and Appiah, 2019). The exclusion of 56% of initial data (Table 1) may have a selection bias (designed by the Heckman model). The findings may not be generalizable to the GCC region because of regulatory and economic factors unique to the region (e.g., the dominance of the materials sector), but the diversity of sectors and countries enhances generalisation in the GCC.

Future research should test the characteristics of the company (e.g., independence of the board of directors, CEO duality) as moderators of the relationship between EIS and COSA using mixed methods (e.g., case studies) to understand stakeholders' views. Longitudinal studies can explore the impacts of emerging

ESG regulation in the GCC on cosmetic accounts. Use of other sustainability measures (e.g., carbon intensity) or cross-regional analyses could also examine the generalization of the findings.

Overall, this research adds to the knowledge of the interplay between green innovation and sustainability, cosmetic accounting in the GCC and reinforces the conceptual understanding of green innovation and sustainability as a moderator as well as a driver of behaviour in financial statements. These findings highlight the importance of strong management and transparent processes for sustainability practices to align corporate strategies with stakeholders' expectations in the emerging markets.

6. CONCLUSION

This paper investigates the intricate nexus between environmental innovation, sustainability and cosmetic accounting in the Gulf Cooperation Council (GCC) with particular attention on how companies strategically communicate their environmental and economic performance. This article also highlights the absence of a short-term constraining effect of environmental innovation on cosmetic accounting. Sustainable firms are more likely to sacrifice profits and use green programs with financial statements to increase external legitimacy. This dual process is a strategic attempt to use environmental measures both as signifier to counteract political governance by the revelries (on an issue more likely to respond to sustainability) and (less successfully) transnational border effects.

The findings reveal that there are considerable differences in corporate involvement in sustainability due to varied structure between industrial fleets and regulatory regimes in the GCC. The negative link between cosmetic accounting and sustainability is a compelling argument that external weights (legal compliance or stakeholder need) are a managerial tool to avoid fraudulent financial reporting. The increasing importance of sustainability in the association between green innovation and cosmetic accounting may encourage companies to use login data for green income-washing, although the GCC structure and ESG requirements may account for this.

The findings are consistent along different lines that address sampling and endogeneity biases, and evaluations using different indicators of sustainability. This demonstrates the robustness of results, particularly, in the finding that the impact of sustainability on financial reporting implication is observed. The evidence implies that although green innovation and sustainability play a role in environmental advancement, these can also be used as a means for financial reporting more so in a regulatory environment with variable strictness in the GCC.

It's nothings less than a crucial fall for politicians and entrepreneurs in GCC. Regulators should advance standardized reporting and mandatory auditing to ensure that environmental standards are not used as a proxy for summit reporting rules - but are actually reflective of the reality. The provision of awards (ALOM) or cash incentives for reporting may also curb cosmetic accounting. Companies should integrate sustainability into their core public affairs system to ensure they stay in touch with stakeholder concerns and promote responsibility in both financial and environmental terms.

The study limitations include that sustainability indicators may vary due to different data collection methods, which have been addressed through rigorous validation. Focusing on the firms from the GCC with its own distinct economic conditions, particularly those which are dependent on specific resources may limit the transferability to other settings but findings in the current context are solid. The exclusion of a large part of the sample data due to missing data can affect the representativeness, but this is enhanced through advanced statistical techniques.

Following this path, future research can study impacts of such specific corporate governance mechanisms as independent advisory or audit boards on ecological innovation and cosmetic accounting by using qualitative interviews to understand managerial intentions. Reflection, considering mice organisations future regulatory requirements; mainly in key markets such as saudi Arabia and UAE, conical effects of financial reporting over time definition. It might be interesting to undertake comparative studies to what we presented in various industry (e.g. materials) or other emerging markets to see if the findings could be found.

This study suggests the practices of green innovation and sustainability rhetoric in GCC firms are not easy to reconcile with cosmetic accounting, which offer opportunities and challenges associated with corporate accountability. As greening economy drives growth, strategic management with poverty reduction needs enhanced risk management and administrative reforms that promote transparency and accountability in a green GCC.

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