

# Influence of Environmental, Social, and Governance Practices on Financial Performance of Listed Pharmaceutical Firms in Nigeria: Moderating role of Technological Innovation

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## Abstract

## Review Article

This paper aims to assess the effect of environmental, social, and governance (ESG) practices on the financial performance of listed pharmaceutical firms in Nigeria, while also investigating the moderating role of technological innovation. Employing descriptive statistics and panel regression, the firms' financial statements, sustainability reports, and annual reports covering the years 2009–2024 serve as the basis for the research. Return on Assets (ROA) was used as a proxied for financial performance, ESG practices were evaluated through content analysis, and technological innovation was measured by investment in research and development (R&D). The analysis indicated that ESG practices significantly and positively influence ROA and the interaction between ESG practices and investment in R&D showed a significant positive contribution to financial performance. However, leverage negatively affects ROA, while firm size and age show insignificant influence. These findings suggest that sustaining ESG initiatives, alongside robust R&D commitments, can strengthen the financial outcomes and long-term competitiveness of pharmaceutical companies, and maintain prudent debt management to reduce financial loss.

**Keywords:** environmental, social and governance practices, financial performance, technological innovation, pharmaceutical firms.

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## I. Introduction

Financial performance is critical for organizations because it represents how efficiently resources are used to generate profit, and this is especially significant for pharmaceutical firms facing high operating costs, rivalry, and rigorous regulations. In recent years, firms are expected to go beyond profit-making, as investors, regulators, and the public increasingly assess Environmental, Social, and Governance (ESG) activities. Studies such as Fu

and Li (2023) and Ogboi et al. (2024) claim that ESG boosts financial performance by creating trust, attracting investors, and decreasing risks, while disagreements exist, particularly in developing nations where ESG adoption is still emerging. Research by Ugbam and Okoro (2017) and Kong et al. (2023) also underlines the pharmaceutical sector's critical role in public health and economic development. Through waste reduction, improved medication safety, and improved communication, technological



innovation further improves the ESG impact. However, little is known about how technology effects the ESG financial performance relationship in Nigeria, where pharmaceutical enterprises still struggle to integrate ESG effectively despite increased worldwide demand.

The Nigerian pharmaceutical industry is vital to both economic stability and public health, but it is under increasing pressure to maintain financial success while satisfying growing demands for reliable Environmental, Social, and Governance (ESG) practices (Wikipedia contributors, 2025). The industry works in a difficult environment that is marked by economic instability, environmental degradation, and social injustice (Nwankwo & Mba, 2020). According to Oluwagbemiga et al. (2023), ESG integration is crucial for competitiveness and long-term sustainability since Nigerian pharmaceutical companies must deal with changing market conditions, regulatory obstacles, and growing expectations for corporate social responsibility. Akinlo (2022) contends that adopting ESG principles is crucial for enhancing sector resilience. However, technological advancements that could strengthen financially viable ESG practices such as sustainable production methods, energy-efficient systems, digitalized quality control, and research into eco-friendly drug formulations remain inconsistently implemented across Nigeria's pharmaceutical industry (Adejoro, 2025). This discrepancy restricts firms' capacity to reap ESG benefits. The Active Pharmaceutical Ingredient (API) plant at Emzor Pharmaceutical, which aims to lessen dependency on imports, is a prime example. Although scheduled for completion in early 2024, the project has encountered recurrent delays caused by finance issues, macroeconomic uncertainty, and regulatory complications (BusinessDay, 2025; Adejoro, 2025).

International studies (Agarwal et al., 2023; Fu & Li, 2023; Hazbi & Mounir, 2023; Kong et al., 2023) have studied the link between company outcomes and ESG practices, typically integrating technological innovation as a mediating or moderating factor. In contrast, Nigerian research such as Agu and Amedu (2018), Igbinovia and Agbadua (2023), Umanah and Akpan (2024), Ogboi et al. (2024), and Ubandawaki (2024) depend on earlier datasets

from 2012–2020 and do not use technological innovation as a moderator. As a result, they ignore current legislative changes and ESG advancements. This study tackles these gaps by investigating ESG effects on financial performance in Nigerian pharmaceutical enterprises, embracing technological innovation during 2009–2024.

The study would aid pharmaceutical stakeholders in making informed decisions by defining how ESG practices influence financial performance, thereby enhancing sustainability and profitability in Nigeria's pharmaceutical sector. To attain this goal the following objectives were developed;

- i. To investigate the relationship between ESG practices and financial performance of listed pharmaceutical firms in Nigeria.
- ii. To evaluate the moderating effect of technological innovation on the relationship between ESG practices and the financial performance of listed pharmaceutical firms in Nigeria.

## II. Literature review

In this section, the concepts of financial performance and ESG are examined, followed by a study of the relevant theoretical viewpoints. The study finishes with an appraisal of prior studies on the variables reviewed.

### 2.1 Financial Performance

Financial performance demonstrates management's accountability to shareholders by indicating how effectively organizational resources are employed to achieve desired goals. It is typically defined as the extent to which a corporation fulfills its financial objectives and is examined using various financial measures and indicators (Agu & Amedu, 2018). According to Fu and Li (2023), financial performance encompasses a company's capacity to generate income, control expenditures, and employ resources efficiently to maximize shareholder value. As a crucial component of company success, it illustrates the effectiveness of strategic decisions, operational efficiency, and resource allocation. Return on Assets (ROA) is one of the most popular metrics used to assess financial performance because of its

comprehensiveness (Kong et al., 2023). ROA, which is determined by dividing net income by total assets, gauges a company's profitability in relation to its assets. This ratio demonstrates how well a corporation converts its asset base into profits (Agu & Amedu, 2018).

## 2.2 Environmental, Social and Governance

Environmental, Social, and Governance (ESG) symbolizes a business commitment to social welfare and long-term stakeholder sustainability, guiding a firm's decision-making on social responsibility, governance, and environmental performance (Zhao et al., 2018). ESG techniques entail incorporating environmental, social, and governance factors into organizational operations and strategy processes (Ademi & Klungseth, 2022). Environmental practices address a company's impact on the natural ecosystem, including pollution, resource depletion, and climate change (Zhao et al., 2018). Eco-friendly activities such as sustainable supply chains and reduced greenhouse gas emissions assist avoid risks and generate new opportunities (Velte, 2017). Through initiatives like encouraging inclusiveness, defending labor rights, and assisting with community development, social practices concentrate on relationships with workers, clients, and communities (Zhao et al., 2018). Governance encompasses leadership structures, ethical standards, openness, and processes like as board composition and audits, which promote accountability and long-term sustainability (Zhao et al., 2018).

## 2.3 Technological Innovation

More people are realizing how important technology innovation is as a driver of economic growth, sustainability, and social advancement. It also helps businesses maintain their competitiveness, increase productivity, and generate new opportunities (Mgbada et al., 2024). Additionally, it is a broad notion that includes concepts, channels, methods, processes, goods, and services that are developed or innovated into a corporate organization to improve transaction ease, efficiency, and profitability (Akinyele et al., 2019). Therefore, technical innovation is the process of bringing

new or improved technologies, products, or services that promotes efficiency, productivity and competitiveness.

## 2.4 Empirical Review on Related Studies on ESG and Financial Performance

Agu and Amedu (2018) looked into how sustainability reporting affected the profitability of Nigerian pharmaceutical companies that were listed between 2012 and 2017, employing an ordinary least squares regression approach. Their results showed that economic disclosures exerted a negative and insignificant influence on return on assets (ROA), while environmental and social disclosures had a positive but insignificant effect on ROA. In addition, environmental disclosures were found to negatively affect return on equity (ROE), whereas economic and social disclosures demonstrated a positive yet insignificant effect on both ROE and net profit margin. Israel and Patrick (2020) used data from 13 industrial firms in Nigeria from 2010 to 2018 and explored how advanced technology influenced firm performance and its relationship with labour costs. Israel and Patrick (2020) conducted a study using data from 13 industrial firms in Nigeria spanning from 2010 to 2018, employing regression analysis to examine the association between technology and corporate performance. Evidence from the study showed that technological advancement positively influenced firm performance, while an overreliance on labor resources had a negative effect, highlighting the importance of technological integration for improved operational outcomes. However, the study of Agu and Amedu (2018) did not capture technology in their work. Agarwal et al. (2023) analysed the relationship between ESG and financial performance in Indian pharmaceutical companies from 2011 to 2020 utilising The MTB ratio serves as a stand-in for the dependent variable. The study applied the panel data method and established that ESG initiatives are negatively and significantly associated with financial performance. However, when competition was introduced as a moderator, ESG exerted a significant positive effect on financial performance, suggesting that competitive market pressures can amplify the financial advantages of ESG adoption. However, they diverged from Agu and Amedu (2018) by demonstrating that

this relationship turned significantly positive when competition was introduced as a moderating factor, implying that external pressures can unlock ESG's potential benefits.

Igbinovia and Agbadua (2023) investigated the effect of ESG reporting on value-based performance among listed manufacturing firms in Nigeria between 2017 and 2021, using descriptive statistics, correlation, and regression analysis. The results indicated that ESG reporting, on its own, had no significant influence on firm value. However, when moderated by firm advantage (defined as profitability less capital cost), ESG reporting exerted a significant positive effect on value-based performance. This implies that ESG disclosures enhance firm valuation only when they contribute to profitability, either by strengthening public perception or by lowering financing costs. Like Agarwal et al. (2023) their results suggest that ESG effectiveness depends on specific contextual or internal firm conditions. The effect of ESG on financial performance in Chinese A-share listed companies was investigated by Fu and Li (2023) from 2015 to 2021, incorporating digital transformation as a moderating factor, and control variables include firm size, debt level, operating leverage, firm age, cash holding level, equity restriction ratio, executive compensation, and regional development level by applying regression analysis. The results showed that ESG exerted a positive and statistically significant influence on financial performance, and digital transformation strengthened this effect, however, the impact weakened over time. Additionally, ESG exert positive and significant impact on private sector firms, particularly those situated in the eastern region, and polluting industries. This aligns with Israel and Patrick's (2020) earlier emphasis on technological enhancement and contrasts with the limited standalone ESG effects observed in the Nigerian context by Agu and Amedu (2018) and Igbinovia and Agbadua (2023). Kong et al. (2023) examined how technological innovation moderates the relationship between Firm value and ESG performance in developing and least developed nations. Applying PMG and GMM estimators to secondary data from 78 pharmaceutical businesses (2009–2022), the study found that

while governance performance had no discernible impact on firm value, environmental and social aspects of performance had a favorable impact. Furthermore, it was discovered that technological innovation strengthened the positive correlation between firm value and ESG performance, highlighting the significance of this link in promoting efficiency and sustainable business practices. Because they both endorsed the beneficial role of ESG, this study is therefore consistent with that of Fu and Li (2023).

Hazbi and Mounir (2023) explored the mediating role of technological innovation between ESG practices and environmental performance in Morocco's publicly listed firms using PLS-SEM. The findings showed that ESG practices drive technological innovation, which enhances environmental performance by improving energy efficiency, waste management, and the development of eco-friendly products. Their findings underscore the mediating role of innovation, consistent with Fu and Li (2023) and Kong et al. (2023)'s conclusion that technology enhances the effectiveness of ESG. Umanah and Akpan (2024) assessed the effect of ESG disclosures on shareholders' wealth in Nigerian industrial goods firms from 2013 to 2022, utilising economic value added (EVA) and market value added (MVA) as proxies. Using the OLS regression method with the aid of E-Views software, the results demonstrated that governance disclosure positively and significantly impacted EVA and MVA, while environmental and social disclosures had a positive but statistically insignificant effect. The study concluded that ESG disclosures had a limited impact on shareholders' wealth in Nigerian industrial goods firms. This finding both affirms Agu and Amedu (2018) results on the weak effect of environmental and social disclosures and contrasts with Kong et al. (2023) cross-country finding where environmental and social aspects were most influential.

The impact of ESG reporting on the financial performance of Nigerian deposit money banks between 2013 and 2022 was examined by Ogboi et al. (2024), deciding whether to use a fixed-effects or random-effects model in their regression study by applying the Hausman specification test. According to their findings,

financial performance was significantly improved by ESG disclosure. However, board diversity had a detrimental and large impact on financial performance, but social costs had a favorable but negligible effect. Using data from annual sustainability reports, Ubandawaki (2024) examined the relationship between ESG reporting and firm performance in the Nigerian listed manufacturing firms. The study utilised a Pooled-Corrected Standard Error (PCSE) and Generalised Least Squares (GLS) regression analysis and found that governance disclosure positively influenced market performance (Tobin's Q), return on assets (ROA), and return on equity (ROE). However, social and environmental disclosures negatively affected Tobin's Q and did not significantly impact operational and financial performance. The study echo those of Agu and Amedu (2018) and Umanah and Akpan (2024), completing the loop by reinforcing the limited role of environmental and social factors and the relative dominance of governance in influencing firm performance within the Nigerian context.

## 2.5 Research Gaps

Although various global studies have studied the relationship between ESG practices and financial success (Agarwal et al., 2023; Fu & Li, 2023), the effect of technology innovation has received diverse attention across contexts. Kong et al. (2023) emphasized its moderating effect on ESG performance and company value in central and southern Africa, while Hazbi and Mounir (2023) revealed its mediation influence on the relationship between ESG and environmental performance in Moroccan listed enterprises. However, there is a substantial conceptual and empirical gap because Nigerian studies, such as Agu and Amedu (2018), Igbinoia and Agbadua (2023), Ogboi et al. (2024), and Ubandawaki (2024), have not included technological innovation as a moderating component. Additionally, recent international studies (Fu & Li, 2023; Kong et al., 2023) utilize datasets extending to 2022 and 2023, capturing current ESG and innovation trends, whereas most Nigerian research relies on older datasets from 2012 to 2020 (Agu & Amedu, 2018; Igbinoia & Agbadua, 2023; Umanah & Akpan, 2024; Ogboi et al., 2024; Ubandawaki, 2024). Because of this,

these studies do not account for recent shifts in ESG standards, legislative changes, and industry-specific advancements, especially in Nigeria's pharmaceutical sector, which has come under increased scrutiny since the pandemic. In response, the present study intends to fill these gaps by measuring the impact of ESG practices on financial performance while examining technological innovation as a moderating factor in Nigerian pharmaceutical enterprises listed between 2009 and 2024.

## 2.6 Theoretical Framework

### 2.6.1 Stakeholder Theory

According to the stakeholder hypothesis, a company's capacity to take into consideration parties' interests other than its shareholders decide how successful it will be. This theory is particularly relevant to the current study since it highlights the significance of integrating governance, social, and environmental (ESG) factors into business processes (Eriksson & Asgodom, 2019). In order to reduce risks and draw in socially conscious investors, businesses should improve their reputation and integrate ESG considerations into their operations. Stakeholder involvement, transparency, and resource consumption efficiency are all impacted by technology innovation (Zhou et al., 2022). By promoting moral behavior and responsible governance, it improves stakeholder relations and financial success (Huang, 2022). Ultimately, this integration helps organizations become more competitive in the market, align with ESG principles, and comply with the law.

### 2.6.2 Legitimacy Theory

Legitimacy theory states that firms attempt to preserve a positive reputation by ensuring their actions adhere to society norms and expectations (Osei et al., 2019). It emphasizes that corporate behaviour must accord with prevalent societal ideals, giving priority to society's broader interests above internal objectives (Erdogan-Bilyay, 2022). By enhancing ESG performance, technological innovation helps businesses satisfy sustainability criteria and build public trust and credibility (Zhou, Liu, & Luo, 2022). Technology enhances the connection between ESG performance and overall business outcomes by increasing cost effectiveness, operational

effectiveness, and long-term financial sustainability. Integrating technology innovation into ESG activities allows organizations to boost value generation and legitimacy in an increasingly dynamic business environment. Stakeholder Theory and Legitimacy Theory jointly underpin this study, highlighting that aligning company actions with stakeholder expectations and societal demands—through ESG and technical innovation—promotes legitimacy, stakeholder trust, and enhanced financial performance.

### III. Methodology

#### 3.1 Research Design

The paper utilized an ex-post facto research design, utilizing secondary data from 2009 to 2024 to assess the progress of ESG practices and regulatory reforms in Nigeria’s pharmaceutical business. Mecure Industries Plc, Fidson Healthcare Plc, GlaxoSmithKline Consumer Nigeria Plc, May & Baker Nigeria Plc, Morison Industries Plc, Neimeth International Pharmaceuticals Plc, and Pharma-Deko Plc were the seven pharmaceutical companies listed on the Nigerian Exchange as of December 31, 2024. A census sampling method was used due to the small number of listed businesses. Financial statements, sustainability reports, and annual

reports from 2009 to 2024 were among the data sources. ESG practices was proxy as the independent variable. Content analysis awarded two points for complete disclosure, one point for partial disclosure, and zero points for non-disclosure. Return on assets (ROA) served as a proxy for financial performance, the dependent variable. Investment in research and development (R&D) made by businesses served as a proxy for technological innovation, the moderating variable. Control variables were leverage, firm age, and firm size used to reduce omitted variable bias. EViews 10 and STATA 14.2 were used for panel regression analysis, and diagnostic tests were used to guarantee the validity and dependability of the findings.

#### 3.2 Measurement of Variables

The study measured ESG dimensions such as environmental practices (EP), social practices (SP), and governance practices (GP) using a content analysis checklist aligned with the UN SDGs and GRI, assigning 2 points for full disclosure, 1 point for partial disclosure, and 0 for non-disclosure, with seven items each for environmental and social performance and eight for governance performance. A summary of the ESG measuring checklist and other variables were shown in Table 1.

**Table 1: ESG performance index checklist**

Variables	Measurements	Sources
<b>Dependent Variables</b>		
Return on assets (ROA)	Net Income/ Total Assets	Agu and Amedu, (2018) and Kong et al., (2023)
<b>Independent Variable (The Coding Element)</b>		

Environmental Practices (EP)	EA1. Carbon emissions (amount, intensity, and reduction goals), EA2. Pollution prevention strategies, EA3. Usage of renewable energy EA4. Conservation efforts to conserve biodiversity, EA5. Efficiency and energy usage, EA6. Water conservation and consumption, EA7. Waste management (reduction efforts, recycling rates)	Global Reporting Initiative (2012), Bednárová, Klimko and Rievajová (2019) and Kong et al. (2023)
Social Practices (SP)	SP1. Rates of employee retention and turnover, SP2. Social investments and community involvement, SP3. Charitable endeavors and contributions, SP4. Labor standards and procedures in the supply chain SP5. Records pertaining to health and safety SP6. Diversity and inclusion of employees (gender, age, ethnicity, etc.), SP7. Programs for training and development	Global Reporting Initiative (2012), Zheng et al. (2023) and Kong et al. (2023)
Governance Practices (GP)	GP1. Board makeup (diversity, independence, and experience), GP2. Pay and compensation ratios for executives, GP3. Engagement and rights of shareholders, GP4. Strategies for risk management and mitigation, GP5. Policies for corporate conduct and ethics GP6. Financial reporting transparency, GP7. Practices and procedures to combat corruption, GP8. Record of regulatory compliance.	Global Reporting Initiative (2012), Zheng et al. (2023) and Kong et al. (2023)
<b>Moderating Variable</b>		
Investment in R & D	Percentage of the amount of money invested in research and development in technological innovation or amount used to acquire technology	Kong et al. (2023) and Hazbi and Mounir (2023)
<b>Control Variables</b>		
Leverage	Total debt/Total equity	Kong et al. (2023) and Fu and Li (2023)
Firm age	Current year minus founding year	Kong et al. (2023) and Fu and Li (2023)
Firm size	total assets	Agu and Amedu, (2018) and Fu and Li (2023)

Kong et al. (2023), Farisyi et al., (2022) and Calabrese et al., (2020)



The following formula is used to independently calculate the ESG performance index:

$$EP = \frac{\text{Number of environmental items reported in the annual report}}{\text{The total number of environmental items on the disclosure check list}} \quad (1)$$

$$SP = \frac{\text{Number of social items disclosed in the annual report}}{\text{The total number of social items on the disclosure check list}} \quad (2)$$

$$GP = \frac{\text{Number of governance items reported in the annual report}}{\text{The total number of governance items on the disclosure check list}} \quad (3)$$

### 3.3 Model Specification

The study built upon and improved an existing model offered by Kong et al. (2023) given in

Equations (4) and (5) by using multiple regression to develop two study models for examining the relationship between ESG practices and financial performance.

$$FV_{it} = \beta_0 + \beta_1 EP_{it} + \beta_2 SP_{it} + \beta_3 GP_{it} + \beta_4 ROCE_{it} + \beta_5 LEV_{it} + \beta_6 AGE_{it} + \beta_7 OC_{it} + \epsilon_{it} \quad (4)$$

$$FP_{it} = \beta_0 + \beta_1 EP_{it} + \beta_2 SP_{it} + \beta_3 GP_{it} + \beta_4 LEV_{it} + \beta_5 AGE_{it} + \beta_6 FSI_{it} + \epsilon_{it} \quad (5)$$

Similarly, the subsequent model explores the moderating role of technological innovation on the relationship between ESG activities and

financial performance, providing insights into how innovation strengthens or alters this association.

$$ROA_{it} = \beta_0 + \beta_1(EP_{it} \times R\&D_{it}) + \beta_2(SP_{it} \times R\&D_{it}) + \beta_3(GP_{it} \times R\&D_{it}) + \beta_4 LEV_{it} + \beta_5 AGE_{it} + \beta_6 FSI_{it} + \epsilon_{it} \quad (6)$$

In the model, financial performance (FP) is the dependent variable,  $\beta_0$  is the constant term,  $\epsilon$  represents the error term,  $i$  stands for the firms, and  $t$  represents the time periods. The coefficients  $\beta_1$  to  $\beta_6$  capture the effect of the independent and control variables. Specifically,

the independent variables include environmental practices (EP), social practices (SP), and governance practices (GP), while leverage (LV), firm age (AGE), and firm size (FSI) serve as control variables.

VI. Data Analysis and Presentation

4.1 DESCRIPTIVE TEST

Table 2

stats	roa	ea	sa	ga	ea*rd	sa*rd	ga*rd	lev	age	fsi
mean	9.547048	.2091429	.2914286	.1005714	.5320952	.1308571	.0882857	.5858095	39.57143	10.30914
sd	6.877042	.0147488	.0126665	.0825184	.2337763	.1363333	.1165156	.2254729	9.382735	.6208851
max	31	.25	.32	.49	.98	.62	.58	.95	55	11.71
min	.15	.19	.27	.01	.05	.01	.01	.13	19	9.03

According to descriptive data, return on assets (ROA) ranges from 0.15 to 31, with an average of 9.55% and a standard deviation of 6.88. This indicates moderate profitability but high fluctuation, which is probably caused by variations in ESG integration. Environmental activities (EA) average 21% with minimal variability (SD = 0.015), showing very consistent engagement in areas such as emissions, waste, and energy use, possibly driven by industry norms or legislation. Social

activities (SA) average 29% (SD = 0.013), showing a consistent emphasis on health and safety, community development, and employee welfare. Governance activities (GA) average 10%, but with considerable variability (SD = 0.083) and a wide range (1%–49%), demonstrating that some organizations value governance considerably more than others, driven by variances in board structures, transparency policies, and management systems.

4.2 CORRELATION MATRIX

Table 3

	roa	ep	s	gp	eprd	sprd	gprd	lev	age	fsi
roa	1.0000									
ep	0.3270	1.0000								
sp	0.2673	0.8353	1.0000							
gp	0.0546	0.3338	0.1124	1.0000						
ep*rd	0.0131	-0.3157	-0.2186	0.0376	1.0000					
sp*rd	0.2019	0.5570	0.4765	-0.0096	-0.4462	1.0000				
gp*rd	0.3632	0.5402	0.5587	-0.0316	0.2343	-0.1495	1.0000			
lev	-0.2242	-0.0017	0.0072	-0.0374	-0.6067	0.2484	-0.1848	1.0000		
age	0.0119	-0.1326	-0.0765	-0.3211	-0.1012	-0.2684	0.3308	0.4089	1.0000	
fsi	-0.1546	-0.0026	-0.1012	-0.0627	-0.0640	-0.3546	0.0967	0.1226	0.1937	1.0000

The correlation analysis results for each study variable are displayed in Table 3. The correlation coefficients fall below the 0.8 or 0.9 level indicated by Judge, Griffiths, Hill, Luthepohl, and Lee (1985), showing no multicollinearity concerns. Importantly, the dependent variable

ROA demonstrates a significant positive correlation with the independent variables; Environmental ( $\beta = 0.3270$ ,  $p < 0.01$ ), Social ( $\beta = 0.2673$ ,  $p < 0.01$ ), and Governance ( $\beta = 0.0546$ ,  $p < 0.01$ ), highlighting a positive link between ESG practices and financial performance.

### 4.3 MULTICOLLINEARITY TEST

**Table 4**

Variable	VIF	1/VIF
ep	7.68	0.130208
gp*rd	7.51	0.133155
sp*rd	6.54	0.152905
ep*rd	4.37	0.228975
sp	4.32	0.231284
gp	4.18	0.239497
lev	3.49	0.286707
age	2.31	0.433381
fsi	2.15	0.466165
Mean VIF	4.72	

According to the data provided in the above table, it can be inferred that the explanatory variables do not have a multicollinearity problem. The conclusion of Hair et al. (2006), which states that multicollinearity is absent when the variables have VIFs below 10 and tolerance

levels over 0.10, provides proof for this. In this situation, the values of VIF range from 2.15 to 7.68, which are all below 10. A mean VIF score of 4.72 supports the findings show that none of the independent or control variables display collinearity within the research.

### 4.4 Heteroscedasticity Test

**Table 5: Breusch-Pagan / Cook-Weisberg test for Heteroscedasticity**

Test	Chi-square	Prob>chi2
Breusch-Pagan / Cook-Weisberg	0.21	0.6431

**Source:** The results generated from STATA 13 Software

The Breusch-Pagan/Cook-Weisberg test for heteroskedasticity produced a chi-square value of 0.21 with a probability of 0.6431. Given that the p-value exceeds the standard significance levels (0.01, 0.05, and 0.10), the null hypothesis of homoskedasticity is accepted, indicating that

the regression error terms maintain constant variance and heteroskedasticity is not present. Therefore, the model is statistically reliable in terms of meeting the assumption of equal variance, which strengthens the validity of the regression estimates.

## 4.5 Regression Analysis

**Table 6: RESULTS OF MULTIPLE REGRESSION ANALYSIS**

Dependent Variables	ROA	
No. of observation	105	
F- statistics	5.39	
Prob >F	0.0000	
R-square	0.3379	
Adj R-square	0.2751	
Independent Variables	Coefficient	Significant
EP	38.6431	0.043
SP	74.1982	0.033
GP	24.29978	0.021
EP*R&D	15.38042	0.003
SP*R&D	41.67504	0.002
GP*R&D	59.8675	0.000
LEV	-17.49774	0.000
AGE	0.0290379	0.755
FSI	0.7946903	0.559
CONSTANT	107.5256	0.002

**Source:** Results obtained from STATA version 13 analysis

**Note:** Significance level 5%

### Test of hypotheses

The regression outcomes in Table 4 are applied to examine the following hypotheses:

#### Hypothesis one

**H<sub>0</sub>:** ESG practices negatively influences financial performance.

From the regression findings shown in Table 5, the influence of EP, SP and GP on financial performance showed a coefficient of 38.6431, 74.1982 and 24.29978 and P-value of 0.043, 0.033, and 0.021 respectively (<0.05), indicating that ESG show positive significant effect on

ROA which led to rejection of the null hypothesis.

#### Hypothesis two

**H<sub>0</sub>:** Technological innovation negatively influences the impact of ESG practices on financial performance.

The results in Table 4 also show coefficients of 15.38042, 41.67504, and 59.8675, with corresponding p-values of 0.003, 0.002, and 0.000 for the interactions of EP, SP, and GP with R&D, respectively. This indicates that the interaction between ESG components and R&D

has a positive and statistically significant effect on ROA ( $p < 0.05$ ), leading to the rejection of the null hypothesis.

#### 4.6. Discussion of findings

With a p-value of 0.043, Table 5 demonstrates that environmental practices (EP) have a positive and significant impact on return on assets (ROA). A one-unit increase in EP, representing regulatory compliance, pollution control, and waste management, boosts ROA by 38.6431. In contrast to Agarwal et al. (2023) and Igbinovia and Agbadua (2023), this suggests that eco-friendly methods improve financial performance, supporting Fu and Li (2023) and Kong et al. (2023). Social practices (SP) also positively affect ROA, with a p-value of 0.033; a one-unit increase in SP raises ROA by 74.1982, emphasizing the immediate, evident financial benefits of social endeavors. This corresponds with Agu and Amedu (2018) and Kong et al. (2023), but differs with Igbinovia and Agbadua (2023) and Ubandawaki (2024). Governance practices (GP) significantly enhance ROA (p-value = 0.021), with a one-unit increment enhancing ROA by 24.29978, comparable with Ubandawaki (2024) and Ogboi et al. (2024), but opposing Agarwal et al. (2023) and Kong et al. (2023).

According to Kong et al. (2023), interaction effects show that R&D investment increases the beneficial effect of ESG practices on ROA, highlighting the necessity of technical innovation in ESG initiatives. Leverage has a negative impact on ROA among control variables (p-value = 0.000), with a 1% increase decreasing ROA by 17.50, in line with Fu and Li (2023). According to Igbinovia and Agbadua (2023), firm age and size have positive but statistically insignificant influence on ROA. Overall, the findings highlight how important technology innovation and ESG adoption are to improving the financial performance of Nigerian pharmaceutical companies.

## V. CONCLUDING REMARKS

### 5.1 Conclusion

This study examined the moderating function of investment in research and development (R&D) as well as the effects of environmental, social,

and governance (EP, SP, and GP) practices on the financial performance, as assessed by ROA, of pharmaceutical companies that are listed in Nigeria. The study concludes that environmental, social, and governance (ESG) practices significantly enhance the financial performance (ROA) of listed pharmaceutical firms in Nigeria. Moreover, investment in research and development (R&D) strengthens the positive effect of ESG practices, emphasizing its moderating role in improving firm performance. However, leverage negatively affects ROA, indicating that high debt reduces profitability, while firm size and age show insignificant influence. Overall, integrating strong ESG practices with effective R&D strategies promotes financial sustainability and long-term growth within the Nigerian pharmaceutical industry.

### 5.2 Recommendations

In order to achieve sustainable growth, increased profitability, and greater competitiveness in the Nigerian pharmaceutical industry, the study advises pharmaceutical companies to strengthen environmental practices through waste management and pollution control, enhance social responsibility through community health and employee welfare initiatives, and uphold good governance through transparency and ethical leadership. They should also increase investment in research and development to foster innovation and amplify the positive effects of ESG practices on financial performance, maintain prudent debt management to lower financial risks, use technology for efficient ESG monitoring, and work with government and research institutions for support and capacity building.

Future research should look into how R&D affects the relationship between ESG practices and financial performance in the agribusiness and agricultural industries, as well as in significantly polluting industries like mining industry.

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