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Research Article

Impact of Environmental, Social, and Governance Activities on Financial Performance of Nigeria Listed Pharmaceutical Firms: Moderating Role of Technological Innovation

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Abstract: Examining the moderating function of technological innovation, this research attempts to evaluate the impact of environmental, social, and governance (ESG) activities on the financial performance of listed pharmaceutical companies in Nigeria. The research is based on the firms' financial statements, sustainability reports, and annual reports from 2009 to 2024 using panel regression and descriptive statistics. Research and development (R&D) investment was used to gauge technical innovation, content analysis was used to assess ESG practices, and return on equity (ROE) served as a stand-in for financial performance. According to the data, ESG activities have a considerable and favorable impact on ROE, and the combination of ESG activities and R&D investment significantly improves financial performance. Leverage, however, has a negative impact on ROE, although firm age and size have little effect. These findings suggest that pharmaceutical firms can enhance their financial performance and sustain long-term competitive advantage by integrating consistent ESG practices with strategic investments in research and development, while maintaining prudent debt management to mitigate financial risk.

Keywords: *Environmental, Social and Governance (ESG), Financial Performance, Technological Innovation*

1. Introduction

Because it demonstrates how well businesses employ resources to turn a profit, financial performance is crucial. This is especially true for pharmaceutical companies that must contend with high operating expenses, fierce competition, and stringent regulations. As investors, regulators, and the public increasingly assess Environmental, Social, and Governance (ESG) policies, businesses are now expected to go beyond profit. ESG can improve financial outcomes by fostering trust, drawing in investors, and lowering risk, according to data from Fu and Li (2023) and Ogboi et al. (2024). However, there are still conflicting findings in developing nations where ESG adoption is still developing.

Studies like Kong et al. (2023) and Ugbam and Okoro (2017) highlight the pharmaceutical industry's contribution to both economic expansion and public health. Though its significance in Nigeria is still understudied, technological innovation can further boost ESG advantages through waste reduction, improved medicine safety, and improved communication.

Nigeria's pharmaceutical sector is essential to both public health and economic stability, but it must maintain profitability while satisfying growing ESG standards (Wikipedia contributors, 2025). The industry operates in the face of social injustice, environmental difficulties, and economic unpredictability (Nwankwo & Mba, 2020). ESG integration is crucial for resilience and competitiveness, according to academics (Oluwagbemiga et al., 2023; Akinlo, 2022), yet technology adoption is still inconsistent (Adejoro, 2025). These limitations are demonstrated by delays in projects such as Emzor's Active Pharmaceutical Ingredient facility (BusinessDay, 2025; Adejoro, 2025). Nigerian studies frequently rely on outdated data and leave out technological moderation, whereas international studies use technology in ESG research. This study uses data from 2009 to 2024 to fill that gap.

By elucidating how ESG practices impact financial performance and long-term sustainability in Nigeria's pharmaceutical industry, the study will assist pharmaceutical stakeholders in making well-informed decisions. In order to accomplish this goal, particular research goals were established;

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i. To investigate the relationship between ESG activities 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.

2. Literature review

The ideas of financial performance and ESG are reviewed in this section, together with pertinent theoretical stances and an assessment of earlier research on the important factors.

2.1 Financial Performance

By demonstrating how effectively organizational resources are used to accomplish desired goals, financial performance represents management's accountability to shareholders. It is evaluated using several financial indicators and is typically defined as the degree to which a company achieves its financial goals (Agu & Amedu, 2018). Financial performance, according to Fu and Li (2023), measures a company's capacity to produce profits, control expenses, and make efficient use of resources in order to maximize shareholder value. It shows the results of strategic choices, operational effectiveness, and resource allocation, making it a crucial measure of organizational performance.

Return on Equity (ROE) is used as the main indicator of financial performance in this study. ROE, which is computed by dividing net income by shareholders' equity, assesses how well a business uses shareholders' money to produce profit (Kong et al., 2023). Because ROE directly represents the returns on investors' capital, it is particularly pertinent for evaluating value creation and shareholder wealth in pharmaceutical companies, in contrast to ROA, which concentrates on asset use.

2.2 Environmental, Social and Governance

By influencing choices about social impact, environmental responsibility, and governance quality, Environmental, Social, and Governance (ESG) reflects a company's dedication to long-term stakeholder sustainability and social well-being (Zhao et al., 2018). ESG techniques entail incorporating governance, social, and environmental factors into business operations and strategy planning (Ademi & Klungseth, 2022). Environmental aspects are concerned with how a business impacts the environment, including problems like pollution, resource depletion, and climate change (Zhao et al., 2018). Sustainable supply chains and lower greenhouse gas emissions are examples of eco-friendly activities that help lower risks while generating new opportunities (Velte, 2017).Through initiatives like encouraging inclusion, defending labor rights, and assisting with community development, social practices place an emphasis on relationships with workers, clients, and communities (Zhao et al., 2018). According to Zhao et al. (2018), governance include leadership structures, ethical behavior, transparency, and procedures like audit systems and board composition that promote long-term sustainability and improve accountability.

2.3 Technological Innovation

Technological innovation is receiving more attention as a major force behind societal advancement, sustainability, and economic success. It helps businesses to increase efficiency, stay competitive, and generate new business prospects (Mgbada et al., 2024). Additionally, it is a comprehensive notion that encompasses concepts, systems, procedures, tools, goods, and services that are introduced or enhanced within a company to improve profitability, efficiency, and convenience of transactions (Akinyele et al., 2019). In general, technological innovation is the creation and use of new or enhanced products, services, or technologies that boost productivity, efficiency, and competitiveness in commercial operations.

2.4 Empirical Review on Related Studies on ESG and Financial Performance

Agu and Amedu (2018) used an ordinary least squares regression model to investigate the impact of sustainability reporting on the profitability of Nigerian pharmaceutical businesses listed between 2012 and 2017. According to their findings, environmental and social disclosures had a positive but negligible impact on return on assets (ROA), but economic disclosures had a negative and negligible impact. Furthermore, it was discovered that environmental disclosures had a negative impact on return on equity (ROE), while social and economic disclosures had a favorable but negligible impact on both ROE and net profit margin. Israel and Patrick (2020) investigated how advanced technology affected company performance and its link with labor expenses using data from 13 Nigerian industrial firms between 2010 and 2018. Israel and Patrick (2020) used regression analysis to investigate the relationship between technology and business performance using data from 13 Nigerian industrial firms between 2010 and 2018. The study's findings demonstrated that while an excessive reliance on labor resources had a detrimental impact on company performance, technological innovation had a positive effect, underscoring the need of technological integration for better operational outcomes. However, technology was not included in Agu and Amedu's (2018) analysis. From 2011 to 2020, Agarwal et al. (2023) examined the connection between ESG and financial success in Indian pharmaceutical companies using The dependent variable is represented by the MTB ratio. ESG activities have a poor and

significant relationship with financial performance, according to the study, which used the panel data approach. However, ESG significantly improved financial performance when competition was added as a moderator, indicating that competitive market pressures can increase the financial benefits of ESG adoption. They deviated from Agu and Amedu (2018), however, by showing that this link became noticeably positive when competition was added as a moderating element, suggesting that external pressures can unlock the potential benefits of ESG.

Igbinovia and Agbadua (2023) used regression analysis, correlation, and descriptive statistics to examine the impact of ESG reporting on value-based performance across Nigerian listed manufacturing companies between 2017 and 2021. The findings showed that ESG reporting did not significantly affect firm value on its own. However, ESG reporting significantly improved value-based performance when firm advantage—defined as profitability less capital cost—was taken into account. This suggests that ESG disclosures only raise a company's valuation when they increase profitability, either by improving public opinion or reducing financing costs. Similar to Agarwal et al. (2023), their findings imply that particular internal or contextual firm conditions affect ESG efficacy.

Fu and Li (2023) used regression analysis to examine the impact of ESG on financial performance in Chinese A-share listed companies between 2015 and 2021, taking into account digital transformation as a moderating factor. The control variables included firm size, debt level, operating leverage, firm age, cash holding level, equity restriction ratio, executive compensation, and regional development level. The findings demonstrated that ESG had a statistically significant and favorable impact on financial performance, which was reinforced by digital transformation but gradually diminished. ESG also has a good and substantial effect on polluting industries and private sector businesses, especially those in the eastern region. In contrast to the minimal standalone ESG benefits noted in the Nigerian context by Agu and Amedu (2018) and Igbinovia and Agbadua (2023), this is consistent with Israel and Patrick's (2020) prior emphasis on technical advancement. Kong et al. (2023) investigated how, in emerging and least developed countries, technological innovation modifies the link between firm value and ESG performance. By using PMG and GMM estimators on secondary data from 78 pharmaceutical companies (2009–2022), the study discovered that environmental and social aspects of performance had a positive impact on firm value, but governance performance had no appreciable effect. Additionally, the positive correlation between firm value and ESG performance was found to be strengthened by technological innovation, underscoring the importance of this relationship in fostering efficiency and sustainable business practices. This study is in line with Fu and Li's (2023) since they both supported the positive role of ESG.

Hazbi and Mounir (2023) used PLS-SEM to investigate how technological innovation mediates the relationship between environmental performance and ESG practices in Morocco's publicly traded companies. The results demonstrated that ESG practices stimulate technical innovation, which improves environmental performance through waste management, energy efficiency, and the creation of environmentally friendly products. Their results highlight the mediating function of innovation, which is in line with the findings of Fu and Li (2023) and Kong et al. (2023) that technology improves ESG efficacy. Using economic value added (EVA) and market value added (MVA) as proxies, Umanah and Akpan (2024) evaluated the impact of ESG disclosures on shareholders' wealth in Nigerian industrial goods firms from 2013 to 2022. The results showed that governance disclosures had a positive and significant impact on 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, which is consistent with the findings of Agu and Amedu (2018) cross-country findings where environmental and social aspects were most influential. Ogboi et al. (2024) investigated the effect of ESG reporting on the financial performance of Nigerian deposit money banks between 2013 and 2022. They used the Hausman specification test to determine whether to employ a fixed-effects or random-effects model in their regression research. Their results showed that ESG disclosure greatly enhanced financial success. However, social costs had a positive but insignificant impact on financial performance, while board diversity had a negative and significant impact. Ubandawaki (2024) investigated the connection between ESG reporting and company performance in Nigerian listed manufacturing firms using data from annual sustainability reports. The study demonstrated that governance transparency has a favorable impact on market performance (Tobin's Q), return on assets (ROA), and return on equity (ROE) using a Pooled-Corrected Standard Error (PCSE) and Generalized Least Squares (GLS) regression analysis. However, Tobin's Q was negatively impacted by social and environmental disclosures, but operational and financial performance were not greatly impacted. The analysis confirms the findings of Agu and Amedu (2018) and Umanah and Akpan (2024), closing the loop by highlighting the relative dominance of governance and the restricted impact of social and environmental factors on company performance in the Nigerian context.

2.5 Research Gaps

While numerous international studies have examined the connection between ESG practices and financial success (Agarwal et al., 2023; Fu & Li, 2023), different contexts have given different focus to the impact of technological innovation. While Hazbi and Mounir (2023) demonstrated its mediation influence on the link between ESG and environmental performance in Moroccan listed firms, Kong et al. (2023) highlighted its moderating effect on ESG performance and company value in central and southern Africa. However, because Nigerian studies like Agu and Amedu (2018), Igbinovia and Agbadua (2023), Ogboi et al. (2024), and Ubandawaki (2024) have not included technological innovation as a moderating component, there is a significant conceptual and empirical gap.Furthermore, while the majority of Nigerian research uses older datasets from 2012 to 2020 (Agu & Amedu, 2018; Igbinovia & Agbadua, 2023; Umanah & Akpan, 2024; Ogboi et al., 2024; Ubandawaki, 2024), recent international studies (Fu & Li, 2023; Kong et al., 2023) use datasets that capture current ESG and innovation trends. As a result, current changes in ESG standards, legislative modifications, and industry-specific developments—particularly in Nigeria's pharmaceutical sector, which has come under closer scrutiny since the pandemic—are not taken into consideration in these research. By assessing the effect of ESG practices on financial performance and looking at technological innovation as a moderating factor in Nigerian pharmaceutical companies listed between 2009 and 2024, the current study aims to close these disparities.

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. Because it emphasizes the importance of incorporating governance, social, and environmental (ESG) elements into corporate operations, this theory is especially pertinent to the current study (Eriksson & Asgodom, 2019). Businesses should enhance their reputation and incorporate ESG factors into their operations to lower risks and attract socially concerned investors. Technology innovation affects resource consumption efficiency, transparency, and stakeholder involvement (Zhou et al., 2022). It enhances stakeholder relations and financial success by encouraging moral behavior and responsible governance (Huang, 2022). In the end, this integration makes businesses more marketable, compliant with the law, and in line with ESG principles.

2.6.2 Legitimacy Theory

According to legitimacy theory, businesses try to maintain a good reputation by making sure their behavior complies with social norms and expectations (Osei et al., 2019). It highlights the need for corporate behavior to align with prevailing societal standards, prioritizing the interests of society as a whole over internal goals (Erdogan-Bilyay, 2022). Technological innovation helps companies meet sustainability requirements and establish credibility and public confidence by improving ESG performance (Zhou, Liu, & Luo, 2022). By improving cost effectiveness, operational effectiveness, and long-term financial sustainability, technology strengthens the relationship between ESG performance and overall company outcomes. In an increasingly dynamic corporate world, firms can increase value generation and legitimacy by incorporating technological innovation into ESG initiatives. This study is supported by both Stakeholder Theory and Legitimacy Theory, which emphasize that aligning corporate actions with stakeholder expectations and societal demands—through ESG and technical innovation promotes legitimacy, stakeholder trust, and improved financial performance.

3. Methodology

3.1 Research Design

Using secondary data from 2009 to 2024, the study used an ex post facto research design to assess the evolution of ESG practices and regulatory changes in Nigeria's pharmaceutical sector. 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 strategy was employed due to the minimal number of listed companies. Financial statements, sustainability reports, and annual reports covering the study period were the sources of the data. A content analysis approach was used to measure ESG activities as the independent variable; complete disclosure received two points, partial disclosure one point, and no disclosure zero points. The dependent variable, return on equity (ROE), was employed as a stand-in for financial performance, and the moderating variable, firms' expenditure in R&D, was utilized to gauge technical progress. To reduce the bias caused by omitted factors, control variables included leverage, firm age, and firm size. EViews 10 and STATA 14.2 were used for panel regression analysis, and diagnostic tests were used to guarantee the accuracy and consistency of the findings.

3.2 Measurement of Variables

The study used a content analysis checklist based on the UN Sustainable Development Goals (SDGs) and Global Reporting Initiative (GRI) standards to evaluate ESG elements such environmental activities (EA), social activities (SA), and governance activities (GA). Every disclosure item received a score of 0 for non-disclosure, 1 for partial disclosure, and 2 for complete disclosure. Eight variables were used to evaluate governance, while seven indicators were used to examine the environmental and social elements. Table 1 presents an overview of the ESG measuring checklist and other study factors.

Table 1: ESG performance index checklist

Variables	Measurements	Sources
Dependent Variables		
Return on assets (ROE)	Net Income/ Shareholders' Equity	Agu and Amedu, (2018) and Kong et al., (2023)
Independent Variable (The Coding Element)		
Environmental Activities (EA)	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 Activities (SA)	SA1. Rates of employee retention and turnover, SA2. Social investments and community involvement, SA3. Charitable endeavors and contributions, SA4. Labor standards and procedures in the supply chain SA5. Records pertaining to health and safety SA6. Diversity and inclusion of employees (gender, age, ethnicity, etc.), SA7. Programs for training and development	Global Reporting Initiative (2012), Zheng et al. (2023) and Kong et al. (2023)
Governance Activities (GA)	GA1. Board makeup (diversity, independence, and experience), GA2. Pay and compensation ratios for executives, GA3. Engagement and rights of shareholders, GA4. Strategies for risk management and mitigation, GA5. Policies for corporate conduct and ethics GA6. Financial reporting transparency, GA7. Practices and procedures to combat corruption, GA8. Record of regulatory compliance.	Global Reporting Initiative (2012), Zheng et al. (2023) and Kong et al. (2023)
Moderating Variable		
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)
Control Variables		
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:

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

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

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

3.3 Model Specification

By using multiple regression analysis to create two models for evaluating the connection between ESG activities and financial performance, the study expands and improves the current model created by Kong et al. (2023), as shown in Equations (4) and (5).

$$FVit = \beta 0 + \beta 1EPit + \beta 2SPit + \beta 3GPit + \beta 4ROCEit + \beta 5LEVit + \beta 6AGEit + \beta 7OCit + \varepsilon it \quad (4)$$

$$ROEit = \beta 0 + \beta 1EAit + \beta 2SAit + \beta 3GAit + \beta 4\text{LEV}it + \beta 5AGEit + \beta 6FSIit + \varepsilon it \quad (5)$$

In a similar vein, the second model looks at how technology innovation effects or improves the relationship between ESG activities and financial performance.

$$ROEit = \beta 0 + \beta 1\ (EAit \times \text{R\&D}it) + \beta 2\ (SAit \times \text{R\&D}it) + \beta 3\ (GAit \times \text{R\&D}it) + \beta 4\text{LEV}it + \beta 5AGEit + \beta 6FSIit + \varepsilon it \quad (6)$$

The dependent variable in the model is financial performance (FP), with ε denoting the error term and β_0 the constant term. The subscripts i and t stand for the several firms and the examined time periods, respectively. Leverage (LV), firm age (AGE), and firm size (FSI) are included as control factors to account for firm-specific impacts, while environmental activities (EA), social activities (SA), and governance activities (GA) are the independent variables. The coefficients β_1 to $\beta\Psi$ measure the impact of the independent and control variables on financial performance.

4. Data Analysis and Presentation

4.1 Descriptive Test

Table 2

stats	roe	ea	sa	ga	ea*rd	sa*rd	ga*rd	lev	age	fsi
mean	9.537045	.2091430	.2914245	.1005714	.5320952	.1308571	.0882860	.5858187	39.57144	10.30873
sd	6.857132	.01474918	.0126672	.0825184	.2337763	.1363333	.1165156	.2254729	9.382735	.6208581
max	31	.25	.33	.49	.98	.62	.58	.95	55	11.71
min	.15	.19	.28	.01	.05	.01	.01	.13	19	9.03

Descriptive data show that return on equity (ROE) has an average of 9.53% and a standard deviation of 6.85, with a range of 0.15 to 31. This suggests high volatility but modest profitability, which is most likely due to differences in ESG integration. Environmental activities (EA) demonstrate relatively consistent engagement in areas including emissions, trash, and energy usage, with an average of 21% and minimal fluctuation (SD = 0.015). This may be due to industry practices or legislation. Social activities (SA) consistently prioritize employee welfare, community development, and health and safety, with an average of 29% (SD = 0.013). The average percentage of governance activities (GA) is 10%, but there is significant variation (SD = 0.083) and a broad range (1%–49%), indicating that some firms place a far higher emphasis on governance than others due to differences in board structures, transparency policies, and management systems.

4.2 Correlation Matrix

Table 3

	roe	ea	sa	ga	eard	sard	gard	lev	age	fsi
roe	1.0000									
ea	0.3360	1.0000								
sa	0.2563	0.8353	1.0000							
ga	0.0537	0.3338	0.1124	1.0000						
ea*rd	0.0141	-0.3157	-0.2186	0.0376	1.0000					
sa*rd	0.2039	0.5570	0.4765	-0.0096	-0.4462	1.0000				
ga*rd	0.3231	0.5402	0.5587	-0.0316	0.2343	-0.1495	1.0000			
lev	-0.2232	-0.0017	0.0072	-0.0374	-0.6067	0.2484	-0.1848	1.0000		
age	0.0117	-0.1326	-0.0765	-0.3211	-0.1012	-0.2684	0.3308	0.4089	1.0000	
fsi	-0.1534	-0.0026	-0.1012	-0.0627	-0.0640	-0.3546	0.0967	0.1226	0.1937	1.0000

Table 3 shows the correlation analysis results for each research variable. There are no multicollinearity issues because the correlation coefficients are less than the 0.8 or 0.9 threshold suggested by Judge, Griffiths, Hill, Luthepohl, and Lee (1985). Significantly, there is a positive correlation between ESG activities and financial performance as the dependent variable ROE shows a significant positive correlation with the independent variables Environmental ($\beta = 0.3360$, $p < 0.01$), Social ($\beta = 0.2563$, $p < 0.01$), and Governance ($\beta = 0.0537$, $p < 0.01$).

4.3 Multicollinearity Test

Table 4

Variable	VIF	1/VIF
ep	7.53	0.130208
gp*rd	7.57	0.133155
sp*rd	6.44	0.152905
ep*rd	4.36	0.228975
sp	4.35	0.231284
gp	4.20	0.239497
lev	3.39	0.286707
age	2.35	0.433381
fsi	2.22	0.466165
Mean VIF	4.72	

It is clear from the information in the preceding table that there is no multicollinearity issue with the explanatory variables. This is supported by the finding of Hair et al. (2006), which claims that multicollinearity is absent when the variables have tolerance levels over 0.10 and VIFs below 10. The VIF values in this case are all less than 10, ranging from 2.15 to 7.68. The results indicate that none of the independent or control variables in the study exhibit collinearity, as supported by a mean VIF score of 4.72.

4.4 Heteroskedasticity Test

Table 5: Breusch-Pagan / Cook-Weisbergtest for Heteroskedasticity

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

Source: The results generated from STATA 13 Software

A chi-square value of 0.21 and a probability of 0.6431 were obtained from the Breusch-Pagan/Cook-Weisberg test for heteroskedasticity. The null hypothesis of homoskedasticity is accepted since the p-value is greater than the conventional significance levels (0.01, 0.05, and 0.10), suggesting that heteroskedasticity is absent and the

regression error terms preserve constant variance. As a result, the model satisfies the requirement of equal variance with statistical reliability, strengthening the validity of the regression results.

4.5 Regression Analysis

Table 6: Results of Multiple Regression Analysis

Dependent Variables	ROE	
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
EA	38.6231	0.035
SA	74.1752	0.034
GA	24.29787	0.023
EA*R&D	15.38042	0.004
SA*R&D	41.67504	0.003
GA*R&D	59.6758	0.001
LEV	-17.49747	0.000
AGE	0.0290793	0.758
FSI	0.7946039	0.557
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_0: ESG activities negatively influences financial performance.

From the regression findings shown in Table 5, the influence of EA, SA and GA on financial performance showed a coefficient of 38.6231, 74.1752 and 24.29787 and P-value of 0.035, 0.034, and 0.023 respectively (<0.05), indicating that ESG show positive significant effect on ROA which led to rejection of the null hypothesis.

Hypothesis two

H_0: Technological innovation negatively influences the impact of ESG activities on financial performance.

The results in Table 4 also show coefficients of 15.38042, 41.67504, and 59.6758, with corresponding p-values of 0.003, 0.001, and 0.000 for the interactions of EA, SA, and GA with R&D, respectively. This indicates that the interaction between ESG components and R&D has a positive and statistically significant effect on ROE ($p < 0.05$), leading to the rejection of the null hypothesis.

4.6. Discussion of findings

Table 5 shows that environmental activities (EA) significantly and favorably affect return on assets (ROE) with a p-value of 0.035. ROE is increased by 38.6231 for every unit rise in EA, which stands for waste management, pollution control, and regulatory compliance. This implies that eco-friendly practices enhance financial performance, supporting Fu and Li (2023) and Kong et al. (2023), in opposition to Agarwal et al. (2023) and Igbinovia and Agbadua (2023). With a p-value of 0.034, social activities (SA) also have a positive impact on ROE; a one-unit rise in SA increases ROE by 74.1752, highlighting the clear and immediate financial advantages of social initiatives. In contrast to Igbinovia and Agbadua (2023) and Ubandawaki (2024), this is consistent with Agu and Amedu (2018) and Kong et al. (2023). Similar to Ubandawaki (2024) and Ogboi et al. (2024), but in contrast to Agarwal et al. (2023) and Kong et al. (2023), governance activities (GA) significantly increase ROE (p-value = 0.023), with a one-unit increment increasing ROE by 24.29787.

Kong et al. (2023) claim that interaction effects demonstrate that R&D expenditure boosts the positive impact of ESG activities on ROE, emphasizing the need for technical innovation in ESG projects. According to Fu

and Li (2023), leverage has a negative effect on ROE among control variables (p-value = 0.000), with a 1% increase reducing ROE by 17.50. Firm size and age have a favorable but statistically insignificant impact on ROE, according to Igbinovia and Agbadua (2023). Overall, the results show how crucial ESG adoption and technological innovation are to raising Nigerian pharmaceutical companies' financial success.

5. Concluding Remarks

5.1 Conclusion

This study looked at the effects of environmental, social, and governance (EA, SA, and GA) initiatives on the financial performance, measured by ROE, of pharmaceutical businesses listed in Nigeria. It also looked at the moderating role of investment in R&D. According to the study's findings, listed pharmaceutical companies in Nigeria have far better financial performance (ROE) when they engage in environmental, social, and governance (ESG) activities. Additionally, investing in research and development (R&D) highlights the moderating influence that ESG activities have in enhancing business performance. Leverage, on the other hand, has a negative impact on ROE, suggesting that high debt lowers profitability, whereas firm size and age have no bearing. Overall, the Nigerian pharmaceutical business benefits from long-term growth and financial sustainability when robust ESG initiatives are combined with successful R&D tactics.

5.2 Recommendations

The study recommends that pharmaceutical companies strengthen environmental activities 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 in order to achieve sustainable growth, increased profitability, and greater competitiveness in the Nigerian pharmaceutical industry. Additionally, they should use technology for effective ESG monitoring, work with government and research institutions for support and capacity building, maintain prudent debt management to reduce financial risks, and increase investment in research and development to promote innovation and magnify the positive effects of ESG activities on financial performance.

Future research should look into how R&D affects the relationship between ESG activities and financial performance in the agribusiness and agricultural industries.

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