THE IMPACT OF FIRM'S INNOVATIVENESS ON SUSTAINABILITY REPORTING OF LISTED NON-FINANCIAL COMPANIES IN NIGERIA

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Abstract

As sustainability reporting pushes organizations to balance environmental and social responsibilities with profitability, many firms face substantial challenges in integrating these elements into their reporting practices. A key factor in addressing these challenges is firm innovativeness, which enables companies to adapt more seamlessly to corporate reporting systems that prioritize environmental, social, and economic accountability. Therefore, this study investigates the impact of a firm's innovativeness on sustainable reporting of non-financial listed companies in Nigeria. Using an ex-post facto research design, the study covers a period of 12 years from 2011 to 2022. The study examines key variables of firm complexity, technological infrastructure, research and development, managerial efficiency, and firm size. Findings indicate that firm complexity, research and development, and managerial efficiency positively impact sustainability reporting in Nigeria. On the other hand, technological infrastructure and firm size show no significant effect. The study concludes that firm complexity, research and development (R&D), and managerial efficiency are significant factors that influence sustainability reporting among non-financial companies in Nigeria. This study recommended among others that since R&D significantly influences sustainability reporting, management of non-financial companies in Nigeria should prioritize and increase investments in R&D activities.

Keywords: Firm Innovativeness, Sustainability Reporting, Non-Financial Companies

Jel Classification Codes: O32, Q56, M14, G30

1. Introduction

As globalization intensifies and the urgency of addressing climate change escalates, companies worldwide are increasingly scrutinized for their environmental, social, and governance (ESG) practices. This scrutiny is particularly pronounced in non-financial sectors, where expectations for transparency and accountability in sustainability reporting have surged. For instance, the European Union has mandated extensive sustainability disclosures for large companies, reflecting a shift towards greater corporate responsibility (European Commission, 2021). Similarly, in the United States, regulatory bodies like the

Securities and Exchange Commission (SEC) emphasize the importance of ESG reporting, prompting firms to adopt innovative practices to meet stakeholder expectations (SEC, 2022).

In Nigeria, the role of sustainability reporting is even more critical, given the country's reliance on oil and gas, which faces scrutiny over environmental degradation and social responsibility. The World Bank (2023) highlights Nigeria's environmental vulnerabilities, necessitating a comprehensive approach to sustainability that includes innovative practices at the firm level. Despite the growing importance of sustainability reporting, challenges persist. Evidence shows that many Nigerian companies struggle to adopt innovative practices that enhance their sustainability disclosures. A survey by the Nigerian Economic Summit Group (2022) found that only 30% of listed non-financial firms provided comprehensive sustainability reports, indicating a substantial transparency gap. This lack of engagement undermines corporate accountability and limits investors' decision-making regarding firms' social and environmental impacts (Okafor, 2022).

To contextualize this issue, it is crucial to consider the role of managerial dynamics in shaping firm behaviour towards sustainability. Managerial dynamics including leadership styles, decision-making processes, and organizational culture significantly influence a firm's capacity for innovation and commitment to sustainability (Aguinis & Glavas, 2019). In Nigeria, where traditional management practices often prevail, there is a need to explore how innovative managerial approaches can enhance sustainability reporting among listed non-financial companies. This aligns with the Nigerian Corporate Governance Code, which encourages firms to adopt sustainability-promoting practices (Financial Reporting Council of Nigeria, 2018).

Against this background, this study broadly aims to evaluate the impact of firm innovativeness and managerial dynamics on sustainability reporting among listed non-financial companies in Nigeria. The specific objectives are to: examine the influence of firm complexity on sustainability reporting; assess the role of technological infrastructure in shaping sustainability reporting; evaluate the impact of research and development on sustainability reporting and examine the influence of managerial efficiency on sustainability reporting among non-financial companies in Nigeria.

This study focuses on listed non-financial companies in Nigeria from 2011 to 2022. Understanding the interplay between firm innovativeness and managerial dynamics is essential for improving sustainability reporting practices in Nigeria and fostering a culture of innovation that aligns with global best practices.

Research Hypotheses

The research hypotheses are stated as follows;

$\boldsymbol{H_{01}}$**:** The Firm's complexity does not significantly influence the sustainability reporting among listed non-financial companies in Nigeria.

$\boldsymbol{H_{02}}$**:** Technological infrastructures do not significantly influence the sustainability reporting among listed non-financial companies in Nigeria.

H_{03}: Research and development do not significantly influence sustainability reporting among non-financial companies in Nigeria.

H_{04}: Managerial efficiency does not significantly influence sustainability reporting among non-financial companies in Nigeria.

2.0 Literature Review

This literature review explores the current landscape of sustainability reporting, particularly among Nigerian non-financial companies.

2.1 Conceptual Review

2.1.1 Firm Innovativeness

Firm innovativeness is defined as an organization's ability to engage in unique activities such as the introduction of new products or services, new procedures, or inventive techniques. As a result, these businesses frequently reintroduce business processes and engage in unique activities that result in the development of new goods, processes, and services (Rajapathirana & Hui, 2018). Innovativeness is thought to be the catalyst that propels organizations to competitive domination, and the firm's ability to innovate allows it to constantly remodel and adapt in a changing commercial environment (Zehir & Balak, 2018). Furthermore, it has been frequently demonstrated that firm innovativeness is a crucial enabler that propels organizations toward improved performance (Mohamad et al., 2020).

Firms' complexity: The subject of organizational complexity has received a lot of attention in academic studies (Markarian & Parbonetti, 2007). However, organizations in a postindustrial society have been described as having increasing complexity, with internal complexity defined as the complexity associated with rapid technological change and external complexity defined as the complexity associated with sophisticated customers and a changing external environment (Loughran & McDonald, 2020).

***Technological infrastructure*:** Technological infrastructure comprises the essential components that enable the operation and management of enterprise IT services and environments. It includes hardware, software, networks, and facilities that organizations use to develop, test, deliver, manage, and support IT services (Isdianto, 2014). Effective IT infrastructure supports technological advancements within a company, largely due to its flexibility, which is crucial for organizational risk management. Strategic IT infrastructure planning that is aligned with organizational goals is essential to maximize performance and leverage IT effectively (Havidz & Mahaputra, 2020).

***Research and development*:** Research and development involves activities that companies pursue to innovate, introduce new products and services, and enhance existing offerings, positioning themselves to address evolving market needs and maintain a competitive edge (Richey & Klein, 2014). Aghion and Howitt (1996) observed that research intensity often correlates positively with growth rates, even when long-term growth is driven primarily by secondary innovations arising from the development process. Aghion (2004) further refines Schumpeterian models by differentiating between research and development, suggesting that while basic competition might reduce

incentives for innovation, a dedicated focus on R&D can counterbalance this effect and spur growth. This attention to R&D significantly strengthens a firm's innovative capacity by fostering the generation and application of new ideas and technologies, which is essential for enhancing competitiveness and sustaining growth (Jung & Kwak, 2018).

***Managerial efficiency*:** Managerial efficiency is a tool to help a manager maximize his effectiveness and productivity ratio of output to the input of interest. Equally, managerial efficiency is the proportion of total organization resources that contribute to productivity during the manufacturing process (Cho & Lee, 2019). The higher this proportion, the more efficient the manager. The more resources are wasted or used during the production process, the more efficient the manager. It is possible for managers to be efficient but not effective and vice versa (Berrett & Sudweeks, 2023).

2.1.2 Sustainable Reporting

Sustainability reporting broadly encompasses a company's disclosure of environmental, social, and governance (ESG) goals, alongside financial elements, and communicates progress toward these objectives (Baumüller & Sopp, 2021). Amid growing calls for transparency, companies face pressure to disclose their ESG impacts, driven by stakeholder demands for accountability on health, environmental, and social issues (Tsalis et al., 2020; Christensen et al., 2021). Corporate Sustainability Reporting thus serves as a framework for tracking ESG progress and supporting sustainable development, aiding companies in goal-setting and transitioning toward a resource-efficient and inclusive economy (Christensen et al., 2021).

2.1.3 Non-financial firms in Nigeria

Non-financial firms refer to companies whose primary business operations do not involve financial services or banking activities, focusing instead on sectors such as manufacturing, telecommunications, energy, and consumer goods. In Nigeria, the non-financial sector plays a pivotal role in economic development, contributing significantly to employment and GDP growth (Akinyemi & Adediran, 2022). To achieve effective management and growth, these firms often focus on technological infrastructure, managerial efficiency, and research and development (R&D). This approach enables them to enhance productivity and comply with evolving regulations (Adeola & Egbetokun, 2019). The push for sustainability reporting has also gained traction, as non-financial firms aim to showcase their environmental, social, and governance (ESG) initiatives to stakeholders (Nwaiwu & Oluka, 2023).

2.1.4 Control Variable

Firm Size: Firm size refers to the size or magnitude of a corporate organization, which is often defined by parameters such as staff count, annual revenue, market capitalization, or total assets. It is a fundamental feature used to categorize and analyze businesses within an industry or economic setting (Bartiketal., 2020; Yadav et al., 2021). Firm size can range from small and micro-sized firms (SMEs) with a few employees and modest sales to huge multinational organizations with thousands of employees and a considerable worldwide market presence (Guldmann & Huulgaard, 2020).

2.2 Theoretical Underpinning

The Resource-Based Theory (RBT) was propounded by Birger Wernerfelt in 1984. It emphasizes leveraging a firm's unique resources and capabilities for competitive advantage. Resource-Based Theory (RBT) view is a managerial framework that helps identify the strategic resources that a company can use to gain a long-term competitive advantage. It is widely acknowledged that Barney's 1991 article "Firm Resources and Sustained Competitive Advantage" played a key role in the development of the resource-based perspective (Conner & Prahalad, 1996; Acedo et al., 2006). In this study, Resource-Based Theory was relevant as it emphasizes the critical role of internal resources and capabilities in shaping a firm's competitive advantage (Utami & Alamanos, 2022).

2.3 Empirical Review

The study reviewed some empirical studies as follows:
Tijjani and Yahaya (2023) conducted a bibliometric analysis on corporate ownership demographics and sustainability reporting quality in Nigeria using an ex post facto design and regression analysis. The study, carried out between 2019 and 2022 revealed that institutional ownership positively and significantly affects sustainability reporting quality, while managerial ownership has a negative and significant effect.

Mustapha et al. (2023) examined risk management practices and organizational performance, focusing on the mediating role of business model innovation. The study carried out in 2022, used quantitative research methods and analyzed data using partial least square structural equation modelling (PLS-SEM). The findings revealed that risk management practices had a direct and significant effect on financial performance, while also linking risk management to non-financial performance. Additionally, business model innovation was found to have a negative relationship with non-financial performance.

Lee and Roh (2023) studied digitalization capability and sustainable performance in emerging markets, focusing on the mediating roles of inbound/outbound open innovation and coopetition strategy. The study, conducted in 2022, used a survey research design and examined variables such as outbound open innovation, inbound open innovation, coopetition strategy, and sustainable performance. The findings revealed that a firm’s digitalization capability positively impacts outbound/inbound open innovation, coopetition strategy, and sustainable performance.

Ezejiofor and Emeneka (2022) investigated the impact of leverage on social sustainability reporting in listed oil and gas firms in Nigeria. The study carried out between 2020 and 2021, adopted an ex-post facto research design and content analysis method. Data were analyzed using descriptive and inferential statistics, including Pearson Correlation, Panel Least Squares (PLS) regression analysis, and the Hausman test. The findings revealed that leverage had a significant effect on social sustainability reporting in Nigeria.

Abdulrasheed (2022) examined firms’ innovativeness, managerial dynamics, and sustainability reporting among listed manufacturing companies in Nigeria. The study, conducted between 2020 and 2021, used an ex-post facto and survey research design. Data were analyzed using Generalized Least Squares and Panel Corrected Standard Error

Estimation. The findings concluded that research and development, along with managerial efficiency, influence economic, environmental, and social disclosure in listed manufacturing companies in Nigeria.

Akhalumeh and Ohiokha (2022) examined the relationship between firm growth and corporate attributes. The study, conducted between 2020 and 2021, used the ordinary least squares (OLS) method for data analysis. The variables studied included firm age, firm size, innovativeness, management efficiency, capital intensity, profitability, institutional ownership, and international affiliation. The findings revealed a positive and significant causal relationship between firm innovativeness, management efficiency, and firm growth, along with similar positive effects of firm size, institutional ownership, and international affiliation on firm growth.

Exploring a pathway to sustainable performance in manufacturing firms, Sarfraz et al. (2022) evaluated the interplay between innovation capabilities, green process, product innovations, and digital leadership. The study, conducted in 2021, used innovation capabilities, green process innovation, and sustainable performance as variables. Adopting a survey research design, the study employed Chi-square, time logarithmical, and Cox & Snell R^2 approaches. The results identified a significant correlation between innovation capabilities, green process innovation, and sustainable performance.

Salamzadeh et al. (2022) studied sustainability-oriented innovation foresight in international new technology-based firms (NTBFs). The study, carried out in 2021, used variables such as international NTBFs, technology, internationalization, scenario planning, foresight, and sustainability-oriented innovation, and employed a regression analytical approach. The research presented a strategy in the form of a scenario and identified the effective driving forces while examining states of certainty.

Eucharia et al. (2021) examined the influence of technological skills on employee performance in manufacturing firms in South-East Nigeria. The study carried out between 2019 and 2020, used a survey research design and analyzed data with descriptive and inferential statistics, including an ordered logistic regression approach. ICT, employees, manufacturing firms, and job performance were the key variables. The findings indicated a statistically significant relationship between ICT skills and employee job performance.

Oluwatoyin et al. (2021) emphasized the relationship between managerial dynamics, firm innovation, and sustainable reporting of non-financial companies in Nigeria. The study carried out between 2018 and 2020, explored how managerial decisions and innovation influence sustainability reporting practices. The findings indicated that managerial dynamics significantly impact firm innovation, which, in turn, enhances the quality of sustainability reporting among Nigerian non-financial companies.

Bello et al. (2021) examined the impact of board dynamics on environmental, social, and governance (ESG) practices among Nigerian-listed non-financial firms. The study employed an ex-post facto research design and used the Generalized Least Squares (GLS) estimation technique to analyze data collected from 2017 to 2020. The findings revealed that independent directors' industry knowledge had an insignificant positive effect on

ESG practices. However, board financial expertise and board size were found to have a significant positive impact on the adoption and implementation of ESG practices.

Aifuwa (2020) conducted a conceptual review on sustainability reporting and firm performance in developing countries, utilizing a systematic content analysis approach. The review carried out in 2020 revealed inconclusive evidence regarding the impact of sustainability reporting on firm performance; however, many studies indicated a positive relationship. Additionally, it noted that financial performance measures often included profitability metrics (Return on Asset (ROA) and Return on Equity(ROE)) and market-based measures (Earnings Per Share (EPS) and Dividends Per Share (DPS)), while highlighting that the level of sustainability disclosure in developing countries remains low compared to developed nations.

Nwankwo (2019) explored technological innovations as a means to achieve sustainable economic growth in Nigeria, utilizing variables such as economic growth, manufacturing, and infrastructure. The study carried out from 2015 to 2018 emphasized the importance of collaboration between industries and academic institutions to enhance sustainable methods and maximize production output. The findings underscore the need for ongoing partnerships to drive innovation and economic progress.

Anazonwu et al. (2018) studied corporate board diversity and sustainability reporting among selected listed manufacturing firms in Nigeria using a panel research design. Fixed effects panel regression analysis measured sustainability reporting through an Economic, Social, and Governance (ESG) index. The study conducted from 2015 to 2017 revealed no significant influence of board member nationality, but a significant impact from the proportion of women directors, non-executive directors, and multiple directorships.

Atanda et al. (2013) evaluated the causality between employees' economic rewards and sustainable performance in Nigerian quoted manufacturing firms. Using variables like economic rewards, EVA, and sustainable performance, the study applied multiple statistical methods, including OLS and co-integration tests. The study, conducted between 2010 and 2012, explored panel data to analyze the relationship. Findings showed that both variables are strong predictors of each other, with employees' economic reward being a better predictor of sustainable performance.

3.0 Methodology

The ex-post facto research design was used in this study. Data was collected from seven non-financial companies listed on the Nigeria Stock Exchange as of December 31, 2022. The unit of analysis in this study is a quoted manufacturing company on the Nigerian Stock Exchange as of December 31, 2022. The sample size was calculated using the formula by Krejcie and Morgan (1970) and was proportionally allocated across each sector. The total population of 76 firms resulted in a calculated sample size of 49 firms, ensuring a balanced and proportional representation across all sectors in the study. Table 1 shows the breakdown of the sample size allocation.

Table 1 Sample Size and Sampling Technique

S/N	Sector	Population	Sample Size Calculation	Sample Size
1	Healthcare	9	9/75*49	6
2	Natural Resources	4	4/75*49	3
3	Construction/Real Estate	9	9/75*49	6
4	Conglomerates	7	7/75*49	4
5	Oil and Gas	13	13/75*49	8
6	Consumer Goods	21	21/75*49	14
7	Industrial Goods	13	13/75*49	8
	Total	**76**	**49**	**49**

Source: Researchers' Computation (2024)

3.1 Model Specification

The model developed by Oluwatoyin et al., (2021) was adapted and modified to align with this study's objectives. The dependent variable, the Sustainability Reporting Index (SRI), is influenced by independent variables such as firms' innovativeness measured by complexity, technological infrastructure, research and development, and managerial dynamics represented by managerial efficiency while the Firm size was introduced as a control variable. The modified model is thus, formulated as follows:

$$\boldsymbol{SRI_{it} = \beta_0 + \beta_1 FC_{it} + \beta_2 TI_{it} + \beta_3 R\&D_{it} + \beta_4 ME_{it} + \beta_5 FS_{it} + \mu_{it}} \ldots\ldots\ldots\ldots\ldots\ldots \boldsymbol{(1)}$$

Where:

SRI_{it} = Sustainability Reporting Index (Economic, Social and Environmental Disclosure index for "i" firm and time "t")

FC_{it} = Firms Complexity "i" firm and time "t"

TI_{it} = Technological Infrastructures "i" firm and time "t"

$R\&D_{it}$ = R&D Research and Development "i" firm and time "t"

ME_{it} = managerial efficiency "i" firm and time "t"

FS_{it} = Firm Size "i" firm and time "t"

β_0 = Intercept

$\beta_1 - \beta_5$ = coefficient of slop or regression coefficient

μ_{it} = error term

***a priori* Expectations:**

The coefficients of the independent variables in the model are expected to positively influence the Sustainability Reporting Index (SRI), as outlined below.

3.2 Measurement of Variables

Variables	Construct	Measurement	Source	A-priori Expectation
Sustainability Reporting Index	SRI	GRI Index (G4) = Total Score disclosure Total GRI score index	Aifuwa (2020); Abdulrasheeed (2022); Mishra *et al*. (2021) ; Mishra *et al*. (2021); Aifuwa (2020);	+
Firms' Complexity	FC	Number of business units/segments in a company	Subramanian and Ramanathan (2012); Gunasekaran *et al*. (2015)	±
Technological Infrastructures	TI	Is the Dummy variable 1 if firms introduce new assets to improve innovation? Zero (0) otherwise	Castro *et al*. (2013); Benzidia *et al*. (2021)	+
Research and Development	R&D	R&D = (ECA 04/d2)*100 logarithm of % of total annual sales spent on research and development	Choi (2020)	±
Managerial Efficiency	ME	Output (Revenue) Input (Cost of sale + operating expenses + PPE (introduce)	Fizel and D'Itri (1997); Cho and Lee (2019)	±
Firms Size	FS	Natural logarithm of total company's asset	Shalit and Sankar (1977); Kumar (1999)	+

Source: Researchs' Compilation, 2024

3.3 Model Estimation Techniques

The research utilized Panel Corrected Standard Errors (PCSE) to address heteroscedasticity, serial correlation, and cross-sectional dependence, which are typical issues in panel datasets with firms of diverse characteristics (Beck & Katz, 1995; Reed & Ye, 2011). This method enhances the reliability of estimates by adjusting for limitations in traditional panel estimators such as fixed effects, random effects and pool OLS, thereby strengthening the robustness and validity of the findings (Hoechle, 2007; Torres-Reyna, 2007).

4.0 Data Presentation, Analysis and Discussion of Findings

Table 2 presents the descriptive outcome of the financial disclosure and firm innovativeness indicators across non-financial companies.

Table 2: ***Summary Analysis of the Variables Included in the Model***

Variables	Obs.	Mean	Std. Dev.	Minimum	Maximum
SRI	634	1.550	0.582	0	2.8
FC	634	2.516	0.670	1	4
TI	634	0.761	0.448	0	2
R&D	634	0.546	0.498	0	1
ME	634	1.188	1.081	0.02	12.76
FS	634	10.172	1.020	0.94	12.96

Source: Authors' Computation, 2024

From the Table, the sustainability reporting index has an average of 1.550 with a standard deviation of 0.582, indicating consistency across firms. Indicators of firm innovativeness show that firm complexity averages 2.516 (SD 0.670), indicating minimal variability, with values ranging from 1 to 4. Technological infrastructure has an average of 0.761 (SD 0.448) and is relatively consistent, with a range from 0 to 2. Research and development also demonstrate close alignment, averaging 0.546 (SD 0.498), within a range of 0 to 1. Managerial dynamics reveal broader variance in managerial efficiency, which averages 1.188 (SD 1.081), ranging from 0.02 to 12.76, indicating significant differences across firms. Finally, firm size shows uniformity with an average of 10.172 (SD 1.020), indicating minimal variation in this measure across companies.

4.1 Preliminary Estimation Techniques

Tables 3, 4 and 5 show the preliminary estimation techniques such as the Multicollinearity Test, unit root test and correlation matrix with correlation coefficients, and their respective p-values which were utilized in scrutinizing the distribution of individual variables.

Table 3: ***Pairwise Correlation Matrix***

Variables	SRI	FC	TI	R&D	ME	FS
SRI	1					
FC	-0.164	1				
	(0.000)					
TI	-0.019	-0.114	1			
	(0.618)	(0.003)				
R&D	0.202	0.092	0.041	1		
	(0.000)	(0.019)	(0.307)			
ME	0.101	0.103	0.028	0.083	1	
	(0.011)	(0.009)	(0.478)	(0.037)		
FS	0.165	-0.035	0.198	-0.301	0.0239	1
	(0.000)	(0.373)	(0.000)	(0.000)	(0.548)	

Source: Authors' Computation, 2024

Table 3 presents correlation coefficients showing the bivariate relationships between variables, highlighting no multicollinearity concerns as none exceed the 0.70 threshold (Kennedy, 2008). The sustainability reporting index shows positive, significant correlations with research and development (0.202), managerial efficiency (0.101), and firm size (0.165), all at $p < 0.001$, except managerial efficiency at $p = 0.001$ while a negative significant relationship is found with firm complexity (-0.164, $p < 0.001$). Firm complexity correlates positively with research and development (0.092) and managerial efficiency (0.103), and negatively with technological infrastructure (-0.114), with all correlations significant at $p < 0.05$, but is not significantly related to firm size. Technological infrastructure is positively correlated with firm size (0.198, $p < 0.001$) but has no significant correlations with research and development or managerial efficiency. Research and development correlates positively with managerial efficiency (0.083, $p = 0.037$) and negatively with firm size (-0.301, $p < 0.001$). Lastly, managerial efficiency shows a positive but non-significant correlation with firm size (0.0239, $p = 0.548$).

Table 4: ***Multicollinearity Test (VIF and Tolerance)***

Variables	VIF	Tolerance
Firms' Complexity (FC)	1.03	0.967
Technological Infrastructure (TI)	1.07	0.936
Research and Development (R&D)	1.13	0.884
Managerial Efficiency (ME)	1.02	0.981
Firm Size (FS)	1.16	0.863
Average VIF	1.08	

Source: Authors' Computation, 2024

The multicollinearity test for the independent variables (predictors) as presented in Table 4 indicated that all the predictors had VIF less than 5. The highest was 1.16, which is the firm size. Meanwhile, the tolerance in all the predictors was observed to be greater than 0.1. This therefore indicated that there was no threat of multicollinearity.

Table 5: ***Fisher-type Unit Root Test***

Variables	P	Z	L*	Pm	Order of Integration
SRI	269.5095	-9.5165	-15.1073	12.2507	I(0)
FC	22.8154	-2.2244	-2.4435	-5.3703	I(1)
TI	269.5380	-8.6949	-13.6061	12.2527	I(0)
R&D	93.4047	-6.9142	-8.6068	-0.3282	I(1)
ME	390.5296	-10.4970	-14.3467	20.8950	I(0)
FS	336.2351	-7.4434	-9.7971	17.0168	I(0)

Source: Authors' Computation, 2024

Table 5 reveals that all study variables are stationary, either at level (I(0)) or at the first difference (I(1)), as shown by the Fisher-type unit root test results. This mix of I(0) and I(1) stationarity meets the conditions for dynamic panel data analysis, as none of the variables are I(2). Specifically, variables such as SRI, FC, TI, ME, and FS are stationary at level, indicating they do not contain unit roots while R&D is stationary at the first difference, necessitating differencing to achieve stationarity.

4.2 The Effect of Firm Innovativeness, Managerial Dynamics on Sustainability Reporting Index (SRI)

Table 6 presents the estimated equations for sustainability reporting. To tackle the identified issues of autocorrelation and heteroskedasticity in the initial model presented in Appendix 1, a re-estimation was carried out to derive more reliable coefficient estimates. Panel-Corrected Standard Errors (PCSE), noted for their robustness, were applied during this re-estimation. The re-evaluation concentrated on a fixed effects model, as indicated by the results of both the F-test for homogeneity and the Hausman test, which confirmed

that the fixed effects specification was the most appropriate. The results of the revised fixed effects model, featuring robust standard error estimates, are presented in Table 6.

Table 6: ***Estimates of the Models on the Effect of Firm innovativeness, Managerial Dynamics on Sustainability reporting index (SRI) with Robust Standard Error***

Variable	Coefficient	t	p-value
FC	0.053	2.3	0.019
TI	-0.005	-0.41	0.681
R&D	0.028	2.3	0.017
ME	0.026	2.45	0.009
FS	0.002	0.35	0.725
Constant	1.376	11.49	0.000
R-squared	0.170		
Wald Chi-Squared	30.05		0.000

Source, Authors' Computation, 2024

Analysis from Table 6 further revealed that firms' complexity, research and development, and managerial efficiency have statistically significant positive impacts on sustainability reporting, with coefficients of 0.053, 0.028, and 0.026, respectively, suggesting that an increase in these factors leads to improved sustainability reporting. However, technological infrastructure (-0.005, p-value = 0.681) and firm size (0.002, p-value = 0.725) were found to have no statistically significant effect. Thus, these findings indicate that firms with higher complexity, robust research and development efforts, and efficient management tend to achieve better sustainability reporting outcomes in Nigeria's non-financial sector.

The Diagnostic tests, including R-squared and Wald Chi-squared statistics, confirmed model validity, with an R-squared of 0.170, meaning that 17% of the variation in the sustainability reporting index is explained by factors such as firms' complexity, technological infrastructure, research and development, managerial efficiency, and firm size. This might be due to the complex and multidimensional nature of sustainability reporting, which may depend on external factors such as regulatory frameworks, industry norms, or stakeholder pressures, not captured in the model. Additionally, measurement limitations or variability in data across firms could contribute to the poor fit. Further research incorporating additional variables or interaction effects may improve explanatory power. The Wald Chi-squared value of 30.05 (p-value = 0.000) signifies that the model is a good fit.

5. Discussion of Findings

The study finds a positive relationship between firms' complexity and sustainability reporting, evidenced by a p-value below the significance threshold. This suggests that as firms become more complex, they are more likely to adopt comprehensive sustainability reporting practices to manage a diverse range of stakeholders, regulatory environments, and societal expectations (Hazarika & Zhang, 2019; Pechancova et al., 2019; Iqbal et al., 2020; Nwankwo, 2019; Khan et al., 2021). The increased complexity necessitates transparency and accountability, prompting organizations to enhance their sustainability reporting. Also, complex firms often have access to greater resources, such as dedicated

sustainability teams and advanced reporting technologies, which facilitate the production of high-quality reports. This aligns with Resource-Based Theory, as complex organizations leverage their resources such as specialized knowledge and skilled personnel to effectively manage sustainability initiatives, transforming them into strategic assets that enhance market reputation and long-term competitiveness.

The study identifies research and development (R&D) as a significant determinant of sustainability reporting among non-financial firms, supported by a p-value indicating strong statistical significance. Increased investment in R&D enables companies to innovate and align their practices with environmental, social, and governance (ESG) standards, leading to better identification and mitigation of potential risks, reduced environmental impact, and improved resource efficiency (Bello et al., 2021; Alraja et al., 2022; Ahmed et al., 2020; Tijjani & Yahaya, 2023; Lee & Roh, 2023; Pechancova et al., 2019). Firms that prioritize R&D are more likely to engage in comprehensive sustainability reporting, highlighting their eco-friendly products and sustainable practices. Additionally, R&D fosters a culture of continuous improvement and accountability, enabling companies to address global challenges like climate change. From a Resource-Based Theory perspective, non-financial companies can leverage their unique internal resources to enhance innovation.

The study demonstrates that managerial efficiency significantly affects sustainability reporting among non-financial firms in Nigeria, as indicated by robust statistical evidence. The findings suggest that increased managerial efficiency leads to enhanced sustainability reporting practices, as efficient managers prioritize transparency, accountability, and compliance with environmental, social, and governance (ESG) standards (Ganapathy et al., 2017; Oware & Mallikarjunappa, 2020; Kitenga, 2020; Hassan et al., 2018). They are better positioned to integrate sustainability into core operations and facilitate the adoption of best practices in reporting, such as accurate data collection and continuous monitoring of sustainability metrics. The resource-based theory corroborates this as managerial efficiency represents an intangible asset that enables firms to optimize processes and decision-making, thereby enhancing their capacity to produce high-quality sustainability reports.

6. Conclusion and Recommendations

The study found that firms' complexity positively and significantly influences sustainability reporting among listed non-financial companies in Nigeria, indicating that greater complexity enhances sustainable practices. Conversely, technological infrastructure did not show a statistically significant impact on sustainability reporting. Positive and significant effects were observed for research and development (R&D) and managerial efficiency, suggesting that improvements in these areas can enhance sustainability reporting. Based on the findings from this study, the following are recommended:

1. Given the positive impact of firms' complexity on sustainability reporting, the management of non-financial companies in Nigeria should enhance their internal structures and processes. This includes diversifying operations, expanding into new markets, and integrating advanced technologies. By leveraging their

complexity, firms can better track and report sustainability metrics, thereby enhancing transparency and building stakeholder trust.

2. Since R&D positively and significantly influences sustainability reporting, management of non-financial companies in Nigeria should prioritize and increase investments in R&D activities. Also, promoting innovation will lead to the development of technologies and processes that enhance sustainability practices, resulting in more efficient resource utilization and reduced environmental impact. Establishing dedicated teams to integrate R&D outcomes into sustainability strategies will further ensure effective communication in reports.
3. As managerial efficiency positively impacts sustainability reporting, management of non-financial companies in Nigeria should focus on improving managerial processes and decision-making frameworks. Investing in leadership training and promoting a culture of accountability among managers is crucial. Streamlining operations and enhancing internal communication can further support effective sustainability initiatives and reporting.

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Appendix 1

Estimates of the Models on the Effect of Firm Innovativeness, Managerial Dynamics on Sustainability Reporting Index (SRI)

Variables	Pooled OLS			Fixed Effects			Random Effects		
	Coeff	z stat	p-value	Coeff	z stat	p-value	Coeff	z stat	p-value
FC	0.043	2.04	0.046	0.053	1.99	0.047	0.043	2.04	0.046
TI	-0.005	-0.39	0.696	-0.004	-0.37	0.713	-0.005	-0.39	0.696
R&D	0.032	2.14	0.039	0.028	2.15	0.039	0.032	2.14	0.039
ME	0.026	3.24	0.000	0.026	3.16	0.000	0.026	3.24	0.000
FS	0.004	0.37	0.712	0.002	0.16	0.871	0.004	0.37	0.712
Constant	1.371	8.24	0.000	1.376	9.25	0.000	1.371	8.24	0.000
R-squared	0.113	-	-	0.149	-	-	0.113	-	-
Wald Chi-squared	15.48	-	0.000	22.03	-	0.000	15.48	-	0.000
Autocorrelation test				1.499	-	0.226			
Heteroskedasticity test				33.62	-	0.000			
Observations		634			634			634	

Source, Author's Computation (2024)

FC is Firms Complexity, TI is Technological Infrastructures, R&D is Research and Development, ME is Managerial Efficiency, and FS is Firm Size