Global Scientific and Academic Research Journal of Economics, Business and Management
ISSN: 2583-5645 (Online)
Frequency: Monthly
Published By GSAR Publishers
Journal Homepage Link- https://gsarpublishers.com/journals-gsarjebm-home/

Debt Heterogeneity, R&D Investment and the Performance of Listed Manufacturing Goods Firms in Nigeria

BY

Uzochukwu Akwarandu

Department of Banking and Finance, Faculty of Social and Management Sciences, University of Africa Toru-Orua, Bayelsa State

Article History

Received: 01/05/2025
Accepted: 12/05/2025
Published: 15/05/2025

Vol –4 Issue – 5

PP: -14-20

Abstract

This paper examines the level at which debt heterogeneity impact performance of the industrial firms listed on the floor of the Nigerian Exchange Group Plc as at December 31st, 2023. Window of observation was from 2014-2023. The scope captures seventeen companies in the production of industrial goods listed firms. To examine the impact of debt heterogeneity, Panel regression analysis utilized to ascertain the degree of relationships that subsist between variables. The findings reveal that the relational debt ratio significantly negatively affects the return on assets, research and development investment disclosure shows an insignificant negative, although there exist a significant moderate relationship between relational debt and return on assets. The study therefore concludes that an increase in relational debt such as bank loans have a significant decreasing impact on the performance of listed industrial goods firms in Nigeria, as greater disclosure of research and development investment has an insignificant impact on firms performance. Additionally, high investment in research and development further exacerbates the negative effect of relational debt on firm performance. The study recommends that firms consider debt heterogeneity, as it significantly impacts research and development investment returns and underscores the importance of selecting the right type of debt.

Keywords: *Debt Heterogeneity, Firm Performance, R&D Expenditure Disclosure, Relational Debt, Return on Assets*

Introduction

Background of the Study

Research and development (R&D) has long been linked to corporate performance, as highlighted by Schumpeter's innovation theory. Numerous studies reveal a strong positive correlation between R&D investment and improved corporate outcomes. (Chen & Hu, 2020) emphasize R&D's role in enhancing product technology, quality, and meeting consumer demand, which strengthens competitive advantage and boosts productivity. Additionally, introducing new products or processes can differentiate companies, expand market share, and increase profits. (Lieberman & Montgomery, 2010) note that R&D can lead to temporary monopoly profits through novel offerings. While profits from existing products may be fleeting, consistent R&D investment can sustain profitability by fostering innovations Benlu et al, (2020). According to Song et al, (2005), internal R&D investment enhances companies' ability to leverage external technical knowledge, positively impacting innovation, especially after technology mergers and acquisitions.

Research by Artz et al, (2010), involving 272 enterprises across 35 industries, indicates that consistently introducing new products can significantly enhance long-term corporate performance. Innovation, particularly through technological research and development (R&D), is a vital factor in distinguishing a business. (Zheng & Kun, 2021) note that R&D investments enable companies to improve production technology, create product differentiation, and expand market presence, which in turn bolsters overall performance and profitability. This creates a virtuous cycle where increased profitability allows for further R&D investment, driving sustainable growth.

The role of R&D investment in improving productivity is emphasized by endogenous growth theory, which posits that real technological progress is linked to total factor productivity. Ren et al, (2022) suggest that higher R&D

*Corresponding Author: **Uzochukwu Akwarandu.**

spending facilitates the adoption of advanced equipment and enhances resource management, ultimately boosting productivity and corporate performance. Studies, such as that by (Qiu & Wei, 2016), confirm the positive relationship between high R&D investment and improved productivity.

Despite its benefits, R&D often generates intangible assets that are unsuitable as debt collateral, making lenders hesitant to fund these initiatives (Long & Malitz, 2015). (O'Brien, 2023) highlights how rigid debt contracts can restrict a firm's ability to engage in long-term R&D strategies. Empirical evidence shows a negative correlation between debt levels and R&D intensity (Long & Malitz, 1985). Most firms rely on debt for funding, representing over 90% of fresh external financing (Corbett & Jenkinson, 2017), thus, making the implications for R&D governance more critical. Some argue that not all debt is equal; distinguishing between "relational debt" (private loans) and "transactional debt" (public securities) is essential. Relational lenders are more likely to support ongoing R&D investments by providing guidance and assistance rather than pushing for immediate bankruptcy in tough times. This private nature of relational debt helps protect proprietary knowledge from competitors, thereby facilitating a healthier environment for R&D activities.

Statement of the Problem

The enhancement of business performance is a key focus of academic research, emphasizing factors such as industry context and organizational operations. In Nigeria, the importance of innovation and research and development (R&D) is vital for maintaining a competitive edge, yet many firms have not recognized its value, resulting in low investment levels. Although research on R&D's impact on corporate performance is mixed, substantial investment is linked to improved productivity and technological advancements. However, the financial risks of R&D have been largely overlooked, especially regarding debt heterogeneity.

The influence of research and development (R&D) on corporate performance is still debated. Mansfield (1980) noted that substantial basic research investment boosts productivity, while Rahman and Howlader (2022) stressed R&D's role in technology and product development. Companies employ various innovation strategies to stay competitive (Ehie & Olibe, 2010). However, R&D investments carry risks, uncertainties, and high costs (Song, 2022). This study investigates how debt heterogeneity and R&D investments affect the performance of listed industrial goods firms in Nigeria, particularly in less financially constrained environments.

Literature Review

Debt Heterogeneity

Debt Heterogeneity refers to the variations in the types and characteristics of debt instruments that firms utilize, which can significantly impact their performance, governance, and financial flexibility. This concept recognizes that not all debt is created equal; differences can arise based on factors such as the relationship between the borrower and lender, the terms of the debt, and the role of collateral (Graham & Harvey, 2001). Debt heterogeneity influences how firms structure their financial obligations, negotiate with creditors, and respond to economic challenges, particularly in the context of relational versus transactional lending Chen et al., (2013).

Transaction cost economics, as highlighted by Williamson (1988), clarifies the relationship between strategy and capital structure. All debt contracts exhibit common features, including specified repayment terms, covenants, and bankruptcy risks. The financial intermediation literature, particularly Boot (2000), demonstrates the heterogeneity of debt, classifying it into two types: transactional debt and relational debt, based on contract theory (Macneil, 1974); (Rousseau, 1995).

Relational Debt Ratio

Relational lenders engage in private loan transactions characterized by long-term relationships, often rolling over loans while providing additional services such as brokerage and cash management. This results in a broader evaluation timeframe and the use of multiple performance criteria (Boot, 2000). Unlike transactional lenders, who focus solely on immediate returns and enforce strict contract terms, relational lenders are motivated to renegotiate upon client defaults due to their extensive ties with the borrower and their business ecosystem, which would also be adversely affected by liquidation (Davis & Mizruchi, 1999; Aoki & Patrick, 1994; Chemmanur & Fulghieri, 1994; Detragiache, 1994). Their long-term relationships allow them to gather valuable firm-specific information essential for renegotiation, giving relational lenders advantages over transactional lenders in governance, particularly for R&D-intensive firms (Cremer, 1995); David et al., (2008).

R&D Investment Disclosure

Accurate identification of research and development (R&D) activities is crucial for properly accounting for R&D costs, as inconsistent classification can hinder the comparative analysis of financial statements Cazavan-Jeny et al., (2011). While the overall nature of R&D is generally understood, distinguishing between development and production activities can be challenging. R&D costs can be recognized as immediate expenses in the profit and loss account or deferred and amortized over future periods to align costs with related benefits. Physical capital, which encompasses an organization's relationships with customers, is comparable to other capital forms like human and structural capital. Physical capital, such as brand reputation, can be assessed by evaluating the premiums customers are willing to pay for specific brands, factoring in the cost of capital and remuneration levels. Strong relationships enhance purchasing likelihood, and better relationship quality increases opportunities for learning from both customers and suppliers.

Empirical Review

Chen et al, (2019) examined the impact of R&D investment behaviour on corporate performance in the Taiwanese semiconductor industry from 2005 to 2016, focusing on the aftermath of the 2008 financial crisis. Utilizing a dynamic

*Corresponding Author: **Uzochukwu Akwarandu.**

panel data model and a GMM estimator to address endogeneity, the study explored the lag effect of R&D investments. They observed that significant investment in R&D in certain period of time can negatively impact business performance in that same period and can stretched into subsequent periods.

Nekhili et al, (2012) investigate whether voluntary R&D disclosure has significant effect on the overall market performance and market value of firms and its relationship with ownership structure, using data from 84 French-listed firms from 2000-2004. Their findings show that such disclosures enhance equity market value, indicating that the benefits outweigh the costs. They also find that firms that owned by families usually tend towards retention of more R&D information. Furthermore, higher R&D investment correlates with increased R&D-related disclosures, and R&D capitalization encourages firms to disseminate more reliable information about their R&D activities.

(Merkley, 2010) examined link subsist between R&D-related disclosure and the performance of the firm with a sample of 20, 990 firms. Contrary to previous findings, qualitative disclosure on R&D was adjudged to have a adverse relationship with the current firms' performance, most especially for firms that place high value on R&D. to this end, Merkley concludes by saying that disclosures influence performance in many different ways.

Hayati et al, (2019) on the other examined the impact of debt financing on firm performance on 21 firms in manufacturing sector, that are also listed on the floor of Indonesia Stock Exchange from 2016 to 2020. The finding of the study reveals that short-term debt ratio (STDA) has no effect on (ROA), Return on Asset, while the debt ratio on long-term asset (LTDA) was observed to have a negative impacts return on asset (ROA). Sales Growth was revealed to have a positive significant effect on return on asset (ROA). Similarly, STDA does not influence Net Profit Margin (NPM), whereas LTDA negatively impacts NPM, and sales growth positively affects NPM.

Nwude et al, (2016) investigate the interactions between debt structure and performance of companies listed on the Nigerian Exchange Group, using a 12 year window of observation of annualized panel data from 2001-2012 of 43 firms from different sectors. Pooled Ordinary Least Square (OLS) was employed, Fixed Effects, and Random Effects regression estimations was generated due to unobserved heterogeneity. The findings reveal a significant but negative impact of debt structure on firm performance during the study period.

Agustia et al. (2020) use green product innovation (GPI) as an intervening variable to assess how research and development intensity (RNDI) affects firm performance (FP). Businesses that consistently innovate in response to market shifts will reap two rewards. Getting a competitive edge comes first. Second, achieving financial gains will improve business performance. 170 business observations from listed companies on the Indonesia Stock Exchange between 2013 and 2017 are used as a research sample in this study. The findings indicate that FP is impacted by RNDI, GPI is impacted by RNDI, and GPI is impacted by FP. They suggest that GPI may partially mitigate the impact of RNDI on FP.

(Li, 2020) examines the effects of external and internal debt financing on the performance of listed automobile companies from 2011 to 2019, using five performance metrics: return on equity (ROE), return on asset (ROA), Tobin's Q, return on capital employed (ROCE), and return on invested capital (ROIC). External debt is measured by short-term debt ratio, long-term debt ratio, and total debt ratio, while internal financing ratio serves as a fourth variable. The findings indicate that higher levels of external debt ratios negatively impact firm performance across all measured metrics, while internal financing positively correlates with performance in all sectors.

Methodology

The article was patterned to econometrically examine in retrospect using the ex post facto research design. As of December 2023, 17 listed industrial goods companies in the Nigerian Exchange Group make up the study's population. A sample of 11 businesses, or 65% of the population under study, was chosen using the purposive sampling technique. The yearly audited financial reports of the selected companies provided secondary data. The information gathered spans through the years, 2014–2023.

We define two econometric models based on previous empirical research and the theoretical literature. In order to determine the link between the dependent variables and the linear combinations of several determining variables included in the investigation, the model proposed by David et al. (2018) was modified for the study. Consequently, our model's econometric form can be written as follows:

$$RETA_{it} = \beta_0 + \beta_1 RELA_{it} + \beta_2 RDDS_{it} + \beta_3 MCAP_{it} + \mu_{it} \quad \ldots\ldots (1)$$

$$RETA_{it} = \beta_0 + \beta_1 RELA * RDDS_{it} + \beta_2 MCAP_{it} + \mu_{it} \quad \ldots\ldots\ldots\ldots (2)$$

Where:

RETA	=	Return on Asset
RELA	=	Relational Debt
RDDS	=	R&D Disclosure
MCAP	=	Market Capitalization
β_0	=	Constant
β_1- β_4	=	Beta
μ	=	Error Term
i	=	i^{th} firm
t	=	time period

Variables Operationalization

The table below shows how these variables are measured.

Table1: Measurement of Variables and Apriori Expectation

S/N	Variables	Symbolization and Source	Apriori Sign

*Corresponding Author: **Uzochukwu Akwarandu.**

Endogenous Variable			
1.	Return on Asset (ROA)	This measures the ratio of profit after taxes to total assets	
Exogenous Variables			
2	Relational Debt	This measures the ratio of borrowing to total assets	+
3	R&D Disclosure	R&D Disclosure is computed as "1" for Companies that disclose R&D Expenditure in their annual report and "0" for otherwise	+
4	Market Capitalization	This measures the log of the product of the share price and the number of outstanding shares	+

Source: Author's Computation, 2025

Data Analysis Technique

Descriptive statistics, correlation analyses, and residual normality tests were among the pre-regression analyses carried out in the study. Data features like the mean, maximum, minimum, standard deviation, and sum of observations were evaluated using descriptive statistics. To assess the relationships between the variables and look for collinearity, correlation analysis was employed. Panel fixed and random effect regression approaches were used to test the model's interactions.

The time and cross-sectional characteristics of the data support this decision; panel data regression provides superior outcomes by employing greater observations and lowering the degrees of freedom (Muhammad, 2012). It captures firm-specific effects associated with the dependent variable and helps reduce multicollinearity. The panel data estimation approach is further supported by (Hausman & Taylor, 1981), which emphasizes its ability to do cross-sectional time series analysis while accounting for endogeneity and heterogeneity.

Results and Discussion

Descriptive Statistics Analysis

The descriptive statistics examines the mean, standard deviation, maximum and minimum values of both the dependent, independent, and control variables of the study.

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
RETA	110	5.357	25.014	-179.92	108.9
RELA	110	40.557	36.6	.45	222.97
RDDS	110	.209	.409	0	1
MCAP	110	6.735	1.25	4.98	9.64

Source: Author's computation, 2025

The result from the descriptive statistics shows that the rate of return on the average on assets (RETA) for the firms under consideration stood at 5.357, with a standard deviation of 25.014, this indicates that each unit of asset has the capacity to generate about N5.36K on the average. The mean of relational asset (RELA) stood at40.557 and the standard deviation at 36.6, while, R&D expenditure disclosure had an average of 0.21 (21%) and a standard deviation of 0.409. Market capitalization (MCAP) as a control variable has an average of 6.735, while the standard deviation stood at 1.25.

Data Normality

Since the observation is not within 2000 range which is the target of the Jaque & Berra Skewness and Kurtosis test, the study used the Shapiro Wilkson Test to test for residual normalcy.

Table 3: Shapiro-Wilk W Test for Normal Data

Variable	Obs	W	V	z	Prob>z
RETA	110	0.641	32.142	7.738	0.000
RELA	110	0.727	24.418	7.125	0.000
RDDS	110	0.952	4.330	3.268	0.001
MCAP	110	0.888	9.979	5.130	0.000

Source: Author's computation, 2025

The Shapiro-Wilk test indicates that the dependent variable, firm performance measured by return on assets (prob>z = 0.000), as well as the independent variables of relational debt (prob>z = 0.000), R&D expenditure disclosure (prob>z = 0.001), and the control variable of market capitalization (prob>z = 0.000), are not normally distributed at the 1% significance level. To this end, the study

*Corresponding Author: **Uzochukwu Akwarandu.**

proceeded with ordinary least squares regression, interpreting the probability statistics relative to the t-statistics. This approach was based on the recommendation of Gujarati's (2004)

Correlation Analysis

The Spearman Rank Correlation Coefficient (correlation matrix) was used in examining the association among the variables.

Table 4: Spearman's Rank Correlation Coefficients

Variables	(1)	(2)	(3)	(4)
RETA	1.000			
RELA	0.025	1.000		
RDDS	0.035	0.101	1.000	
MCAP	0.515	-0.203	0.009	1.000

Spearman rho = 0.009

The results indicate a positive but weak association between relational debt (0.025) and firm performance, measured by return on assets. Similarly, R&D expenditure disclosure shows a positive association (0.035) with firm performance. In contrast, market capitalization has a positive and moderate association (0.515) with firm performance in the same context.

Regression Analyses

The Ordinary Least Square and panel regression results are shown and discussed below. Panel regression analysis was used to investigate the cause-effect linkages between the dependent and independent variables.

Table 5: Regression Result

	Before Moderation				**After Moderation**			
	RETA Model (Pool OLS)	**RETA Model (Fixed Effect)**	**RETA Model (Random Effect)**	**RETA Model (LSDV Regression)**	**RETA Model (Pool OLS)**	**RETA Model (Fixed Effect)**	**RETA Model (Random Effect)**	**RETA Model (LSDV Regression)**
CONS.	-8.833 {0.484}	-9.248 {0.877}	2.371 {0.911}	17.275 {0.083}	-18.525 {0.097}	-32.964 {0.592}	-19.296 {0.286}	-32.964 {0.592}
RELA	-0.260 {0.000} ***	-0.519 {0.000} ***	-0.417 {0.000} ***	-0.519 {0.000} ***				
RDDS	-5.530 {0.304}	-4.480 {0.336}	-5.098 {0.280}	-4.480 {0.336}				
MCAP	3.843 {0.030} **	5.432 {0.540}	3.115 {0.302}	5.432 {0.540}	4.207 {0.010} **	6.362 {0.487}	4.328 {0.100}	6.362 {0.487}
RELARDDS					-0.389 {0.000} ***	-0.396 {0.000} ***	-0.393 {0.000} ***	-0.396 {0.000} ***
F-Stat/W-Stat	10.48 {0.0000}	17.62 (0.0000)	45.09 (0.0000)	7.63 (0.0000)	25.41 {0.0000}	21.65 (0.0000)	48.75 (0.0000)	7.24 (0.0000)
R-Squared	0.2287	0.3551	0.3539	0.5080	0.3220	0.3086	0.3083	0.4726
VIF Test	1.06				1.01			
Hettero. Test	167.18 {0.0000}				136.31 {0.0000}			
FE/RE		YES {5.45	YES {9.97			YES {2.77	YES {88.07	

*Corresponding Author: **Uzochukwu Akwarandu.**

	(0.0000)}	(0.0170)}	(0.0047)}	(0.0000)}
Hausman	10.20 {0.0170}		80.07 {0.0000}	

Note: (1) bracket {} are p-values; (2) **, ***, implies statistical significance at 5% and 1% levels respectively

From the regression results, the independent and control variables account for 23% and 32% of the variances in company performance (as determined by return on assets), respectively. The unmoderated model's R-squared value is 0.2287, while the moderated model's is 0.3220. The error term captures the unexplained variance. At the 1% level, the model's statistical significance is confirmed by the F-statistic for the sample of Nigerian industrial goods companies, which has a p-value of 0.0000. With a p-value of 0.0000 for the unmoderated model (5% significance) and 0.0047 for the moderated model (1% significance), the Hausman test assesses whether the random effects model is superior to the fixed effects model.

These results indicate that the fixed effects model should be adopted for analysis, as it is statistically more appealing.

The panel fixed effects results in Table 5 show F-statistics of 17.62 for the unmoderated model and 21.65 for the moderated model, with p-values of 0.0000, indicating a strong overall fit for statistical inference. The R-squared values are 0.3551 for the unmoderated and 0.3086 for the moderated model, suggesting that the independent and control variables explain 36% and 31% of the changes in firm performance, respectively.

The panel random effects show Wald statistics of 45.09 for the unmoderated model and 48.75 for the moderated model, with p-values of 0.0000. The R-squared values for the random effects are 0.3539 for the unmoderated and 0.3083 for the moderated model, indicating that the independent and control variables explain 35% and 31% of the changes in firm performance.

The results of the least-square dummy variable (LSDV) regression showed that the independent variables accounted for 51% and 47% of the systematic changes in firm performance (as determined by return on assets) over the study period. The unmoderated model's R-squared value was 0.5080, while the moderated model's was 0.4726. The remaining variation is captured by the error term. With a p-value of 0.0000, the F-statistics for both models demonstrate statistical fit at the 1% significance level for inference. The findings are therefore essential for testing the hypotheses: the moderated model is used to test hypothesis 3, while the unmoderated model is used to test hypotheses 1 and 2.

The Least Square Dummy Variable (LSDV) regression results in Table5 show that the relational debt ratio [coef. = -0.519 (0.000)] negatively affects the return on assets of listed industrial goods firms in Nigeria. This indicates that an increase in relational debt (bank loans) significantly lowers their performance.

The LSDV regression results in Table 5 indicate that R&D investment disclosure [coef. = -4.480 (0.336)] has an insignificant negative effect on the return on assets of listed industrial goods firms in Nigeria. This suggests that increased R&D disclosure will insignificantly decrease firm performance.

The LSDV regression results in Table5 indicate that R&D investment disclosure [coef. = -0.396 (0.000)] significantly and negatively moderates the relationship between relational debt ratio and return on assets for listed industrial goods firms in Nigeria. This suggests that higher relational debt combined with increased R&D investment significantly decreases firm performance.

Discussion of Findings

The results indicate that the relational debt ratio has a significant negative effect on the return on asset measure of firm performance for listed industrial goods firms in Nigeria. This implies that increased relational debt (bank loans) leads to decreased performance, contrasting with studies like (Abor, 2005) and (Robb & Robinson, 2009), which found positive relationships between relational debt and firm performance. Specifically, our findings contradict Robb and Robinson's assertion that leverage enhances performance by providing returns greater than interest expenses. While previous theories by (Modigliani & Miller, 1963) and (Jensen, 1986) support a positive link between leverage and profitability, our study aligns with Hall et al, (2000); (Amjed, 2007), who found no significant relationship between leverage and firm performance.

Secondly, the study found that R&D investment disclosure [coef. = -4.480 (0.336)] has an insignificant negative effect on the return on asset measure of firm performance among listed industrial goods firms in Nigeria. This suggests that increased R&D disclosure does not significantly enhance performance. While R&D expenditures can lead to higher market value (Chan et al., 1990; Chauvin and Hirschey, 1993), shareholders may struggle to evaluate this information due to uncertainty around R&D investments, preventing a clear translation into stock prices (Nagar et al., 2003). Consequently, no significant relationship is expected between R&D disclosure and market value. Jones (2007) notes that firms with lower book-to-market ratios tend to disclose more detailed R&D information, as basic financial statements are less informative. Lim et al. (2007) find that while the market-to-book ratio improves information disclosure, this effect is reduced for strategic information like R&D.

Finally, the study found that R&D investment disclosure [coef. = -0.396 (0.000)] significantly and negatively moderates the relationship between relational debt ratio and return on asset performance among listed industrial goods firms in Nigeria. This suggests that increased relational debt

*Corresponding Author: **Uzochukwu Akwarandu.**

(bank loans) and high R&D investment can decrease firm performance. Previous studies have treated debt as a homogeneous instrument, but our findings challenge this view, highlighting the heterogeneity of debt's effects on R&D. While some debts follow an arm's-length model (Williamson, 1988), others involve closer relationships. By integrating transaction cost economics, we conclude that relational debt offers the necessary governance for aligning interests in R&D investments, unlike transactional debt, which lacks sufficient safeguards for such investments.

Conclusion and Recommendation

Conclusions

The study uses a sample of 11 listed industrial goods companies in Nigeria between 2014 and 2023 to examine the impact of debt heterogeneity on company performance. To evaluate the relationship between variables while accounting for market capitalization, panel regression analysis was utilized and study concludes that during the period under consideration, listed industrial companies in Nigeria perform performed much worse when relational debt increases. Additionally, the study further concludes that more disclosure of R&D expenditure did not significantly improve the performance of Nigerian listed industrial products companies throughout the study period. Meaning that a rise in relational debt (bank loans) combined with a large investment in R&D will have a substantial negative impact on the performance of Nigerian listed industrial goods companies over time.

Recommendation

Based on the study's findings, the following suggestions are put forth:

1. C should companies should take debt heterogeneity into consideration because failing to do so will have a negative economic impact on the returns on R&D investments. This helps firms understand how important it is to choose the correct kind of debt.
2. While relational debt offers suitable governance for certain expenditures, such as research and development, it is not suitable for the governance of general investments. Transactional debt's strong incentives and strict budgetary restrictions are more suitable for this purpose. These businesses will therefore be unable to pay back when the economic bubble pops, leaving banks burdened with bad debt.

References

1. Artz, K., Norman, P. M., Hatfield, D. E., & Cardinal, L. B. (2010). A longitudinal study of the impact of R&D, patents, and product innovation on firm performance. *J. Prod. Innovation Manag.* 27 (5), 725–740. doi:10.1111/j.1540-5885.2010.00747.x
2. Benlu, H., Yin, X., & Jin, C. (2020). CEO Characteristics, R&D Investment and corporate performance. *Res. Sci. Sci.* (02), 276–287. doi:10.16192/j.cnki.1003-2053. 2020.02.010
3. Chen, I. J. (2001). Planning for ERP systems: analysis and future trend. *Business process management journal*.
4. Chen, M. C., Cheng, S. J. & Hwang, Y. (2005). An empirical investigation of the relationship between intellectual capital firms'market value and financial performance. *Journal of Intellectual Capital*,6(2),159–176.
5. Chen, Z., Cheung, Y. L., Stouraitis, A., & Wong, A. W. (2005). Ownership concentration, firm performance, and dividend policy in Hong Kong. *Pacific-Basin Finance Journal*, *13*(4), 431-449.
6. Graham, J. R., & Harvey, C. R. (2001).The theory and practice of corporate finance: Evidence from the field.*Journal of Financial Economics*, 60(2-3), 187-243.
7. Lieberman, M. B., & Montgomery, D. B. (2010). First-mover advantages. *Strateg. Manag. J.* 9 (S1), 41–58. doi:10.1002/smj.4250090706
8. Long, M., & Malitz, I., (1985). Investment patterns and financial leverage, in Benjamin Friedman, ed., National Bureau of Economic Research: Corporate Capital Structures in the United States, University of Chicago Press, Chicago, Illinois, 325-348.
9. Mansfield, E. (1980). Basic research and productivity increase in manufacturing. Philadelphia: American Economic Review, 863–873.
10. Qiu, Y., & Wei, W. (2016). The impact of R&D investment on corporate performance: A study based on propensity score matching. *Contemp. Finance Econ.* (3), 96–106. doi:10.13676/j.cnki.cn36-1030/f.2016.03.010
11. Ren, Y., Zhang, X., Wu, J., & He, Z. (2022). Government subsidies, R&D investment and Total factor Productivity: An empirical study of Chinese manufacturing enterprises. *Sci. Decis.* (07), 44–62.
12. Song, M., Bij, H. V. D., & Weggeman, M. (2005). Determinants of the level of knowledge application: A knowledge-based and information-processing perspective. *J. Prod. Innov. Manage.* 22 (5), 430–444. doi:10.1111/j.1540-5885. 2005.00139.x
13. Williams, A. M. (2004). Toward a political economy of tourism. *A companion to tourism*, 61-73.
14. Zheng, H., & Kun, L. (2021). Research and development investment, executive team heterogeneity and corporate performance. *Finance Account. Commun.* (08), 27–31. doi:10.16144/j.cnki.issn1002-8072.2021.08.003

*Corresponding Author: **Uzochukwu Akwarandu.**