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FINANCIAL FLEXIBILITY IN R&D INVESTMENT: A STUDY OF OPERATING CASH FLOW, EARNINGS BEFORE INTEREST AND TAX AND GEARING RATIO

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Abstract

This study investigated the role of financial flexibility on Research and Development investment, focusing on operating cash flow, earnings before interest and tax, dividend payout, and gearing ratio among non-financial firms. Using an ex-post facto research design and purposive sampling, fifty-five (55) listed non-financial firms were analysed over six years (2018–2023). Panel data estimation techniques were employed to examine the impact of these financial variables on Research and Development activities. The regression results reveal a significant negative relationship between gearing ratio and Research and Development investment, with a coefficient of -0.0246 (p = 0.002), indicating that higher gearing constrains innovation efforts. Conversely, earnings before interest and tax and operating cash flow show positive but statistically insignificant effects on Research and Development, with p-values exceeding the 5% significance level. The low R-squared value (0.0232) suggests that these variables explain a small portion of the variation in Research and Development, although the overall model is statistically significant (Wald chi2 = 14.99, p = 0.0047). The findings highlight the complex dynamic between financial performance and innovation investment, underscoring that financial flexibility alone does not ensure increased Research and Development expenditure. The study recommends firms adopt strategic financial management practices that safeguard Research and Development funding during growth phases, enhance financial flexibility through better cash flow and diversified funding, and calls for policy measures to support consistent innovation investment. Further research is encouraged to explore additional factors influencing R&D in varying economic contexts.

Keywords: Financial flexibility, gearing ratio, innovation investment, operating cash flow, research and development

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1.0 Introduction

In an increasingly competitive and innovation-driven global economy, Research and Development (R&D) investment has become a critical driver of sustainable growth and long-term firm performance. Despite its strategic significance, many firms, particularly in emerging economies, face constraints in allocating sufficient resources to R&D due to limited financial flexibility. Financial flexibility refers to a firm's ability to adapt its financial policies and manage resources effectively to take advantage of investment opportunities, especially under conditions of uncertainty or financial constraints (Lee and Lee, 2021; Liu, 2024). The extent to which firms are able to invest in R&D is, therefore, closely linked to their internal financial strength and financing strategies. This study titled "Financial Flexibility in R&D Investment: A Study of Operating Cash Flow, Earnings Before Interest and Taxand Gearing Ratio" seeks to examine the financial conditions that encourage Nigerian firms to invest in R&D. Specifically, it evaluates the effect of operating cash flow to asset ratio, earnings before interest and tax (EBIT), dividend payout, and gearing ratio on R&D investments, with return on assets (ROA) serving as a control variable.

Financial flexibility plays a critical role in supporting firms' investments in Research and Development (R&D), especially in uncertain and resource-constrained environments. Lee *et al*. (2021) emphasize the interdependence between financing, dividend, and investment decisions. Operating cash flow and profitability (e.g., EBIT) provide internal resources for R&D, reducing reliance on costly external capital (Chao *et al*. 2022; Naz *et al.*, 2024). Dividend payouts can hinder R&D investment if not balanced (Vengesai, 2023), while excessive leverage reduces a firm's ability to undertake innovative projects (Jeroh *et al.*, 2022; Seun *et al.*, 2024; Ukoha and Udeh, 2024). Sheng *et al.* (2024) highlight the nonlinear effects of financial flexibility on corporate sustainability, including innovation. In Nigeria, studies by Ayo-Lawal *et al.* (2025) and Aminu and Raifu (2019) confirm that low-geared, profitable firms are more committed to R&D. Jeroh and Ozegbe (2022), Liu (2024) and Sreenivasulu and Mamilla (2024) advocated for flexible financial policies to promote sustainable innovation strategies, especially in emerging economies.

Ibrahim *et al.* (2023) investigated the moderating effect of R&D expenditure on the relationship between dividend policy and firm performance in listed Nigerian consumer goods companies from 2018 to 2022. The study used panel data from nine firms selected through filtering sampling criteria. Dividend payout ratio (DPR), dividend yield (DY), and dividend coverage ratio (DCR) were used as proxies for dividend policy, while return on equity (ROE) represented firm performance. Seun *et al*. (2024) investigated the impact of external financing on the quality of technology investment in listed manufacturing firms in Nigeria. Findings showed that long-term debt had a positive significant effect on research and development but an insignificant negative effect on return on investment and operational efficiency. Liu (2024) examined the key factors influencing corporate finance and investment decisions across developed and emerging economies, aiming to provide insights for policymakers, business leaders, and investors. Using a mixed-methods approach, the study combined quantitative analysis, via summary statistics, correlation, and panel regression, with qualitative thematic analysis drawn from interviews with financial managers and policymakers.

Prior studies have emphasized that high operating cash flow and profitability enhance a firm's capacity to self-finance innovation (Chao and Huang, 2022; Naz *et al*., 2024), while high dividend payout or leverage may crowd out R&D spending (Ibrahim*et al.,* 2023; Sheng and An, 2024). Similarly, firms with better EBIT and lower debt levels are more likely to maintain stable R&D funding, even in periods of financial distress (Jeroh, 2012; Ilyas and

Abbas, 2025; Akbar and Setiana, 2024). In the Nigerian manufacturing sector, Aminu *et al*. (2019) showed that firms with higher OCF/Asset ratios were more capable of making consistent R&D investments due to reduced dependence on volatile external capital. Similarly, Sinebe (2022) and Ayo-Lawal *et al.* (2025) observed that firms with strong cash flow ratios maintained steady R&D and training expenditures, reinforcing the strategic role of internal liquidity in innovation-led growth.

Despite the growing body of literature exploring financial flexibility, investment decisions, and sustainable performance, notable gaps remain, particularly within the context of emerging economies such as Nigeria. Most existing studies have focused on developed economies, with limited empirical evidence on how financial flexibility interacts with firm-specific factors like R&D expenditure, dividend policies, or leverage in resource-constrained environments. Anchored in recent empirical literature across developed and emerging markets, this study offers critical insights into how financial flexibility influences R&D behaviour in the context of listed Nigerian firms. Basically, this study will examine the effect of operating cash flow to asset ratio on research and development (R&D) investment in listed firms, as well as assessing the influence of earnings before interest and tax (EBIT) on R&D investment.

2.1 Accounting for Financial Flexibility in R&D Investment

2.2 Operating Cash Flow to Asset Ratio and Financial Flexibility in R&D Investment

The Operating Cash Flow to Asset (OPCF) ratio is also vital measure of a firm's internal liquidity and operational efficiency. It reflects the ability to generate cash from core activities relative to asset base, which is crucial for funding long-term investments such as Research and Development (R&D) without relying heavily on external financing. According to Lee, et al. (2021), firms with higher OCF ratios exhibit greater financial flexibility, enabling them to undertake strategic R&D initiatives with minimal financing constraints. Naz, et al. (2024) found that in the Asian automobile sector, firms with strong operating cash flows relative to assets were better positioned to sustain innovation and performance during economic fluctuations. Liu (2024) supports this, noting that internal cash flow is a critical determinant of R&D intensity, particularly in emerging markets where financial markets may not fully support high-risk investment.

2.0 Methodology

The study made use of the *ex-post facto* design from secondary data and employed the purposive sampling technique to select fifty-five (55) non-financial firms for a period six (6) years, within the period of 2018-2023, while the panel data estimation technique was adopted for the data analysis.

These hypotheses were used for this study.

H_{01}: *Operating cash flow to asset ratio has no significant effect on R&D investment in listed firms.*

H_{02}: *Earnings before interest and tax (EBIT) do not significantly influence R&D investment in listed firms.*

H_{03}: *Gearing ratio does not significantly affect R&D investment in listed firms.*

Model Specifications

The model for this study is stated in Equations 1 and 2.

Model I: Financial Flexibility in R&D investment = *f*(Financial Health)

$FFIR\&D_{it} = f(EBIT + OPCF + GER + ROA)$ 1

$FFIR\&D_{it} = \alpha_0 + \beta_1 EBIT_{it} + \beta_2 OPCF_{it} + \beta_3 GER_{it} + \beta_4 ROA_{it} + \varepsilon_t$ 2

Where;

f = Stochastic error term capturing other unexplanatory variables

ί = firm identifier (55 firms)

t = time variable (6 Years)

ε_t = error term

αo= intercept of the regression.

$\beta_1 - \beta_4$= coefficients measuring the impact of each explanatory variable on R&D investment.

The Apriori expectation: β_1,- $\beta_4$is lesser or greater than 0.

Table 1 shows the measurement of variables used for this study in the order of dependent variable and independent variables.

Table 1: Variable Measurement

VARIABLE	ACRONYM	MEASUREMENT
Research and Development	**R&D**	Investment made into the financial levers that drive or hinder R&D efforts.
Operating Cash Flow to Asset Ratio	**OPCF**	Measured as net operating cash flow divided by total asset.
Earnings Before Interest and Tax	**EBIT**	Measured as earnings before interest and taxes divided by sales (%).
Gearing ratio	**GER**	Total debt divided by Total assets.
Return on Assets	**ROA**	Measured as profit after tax divided by total asset (%).

3.0 RESULTS AND DISCUSSION

3.1 Descriptive statistics

The descriptive statistics in Table 2 reveal key insights into the financial and investment behaviour of the sampled firms. Research and Development (R&D) has a mean of 0.3606, indicating that around 36% of firms engage in R&D, though the high standard deviation (0.4809) suggests notable variability. EBIT and ROA show low average values (5.33% and 3.24%, respectively), with large standard deviations, implying inconsistent profitability across firms. The extreme minimum and maximum EBIT (-4.20 to 6.19) and ROA (-2.36 to 6.17) values suggest high performance volatility and potential financial distress for some firms.Operating Cash Flow (OPCF) has a low mean (0.081), with some firms experiencing negative cash flows, indicating weak internal financing capacity. Gearing (GER) also shows high variation (mean = 0.8536; max = 19.56), reflecting diverse capital structures and reliance on debt.

Table 2: Summary of Descriptive for RD, EBIT OPCF GER and ROA

VARIABLES	OBS	MEAN	STD. DEV	MIN	MAX
RD	330	.36061	.48091	0	1
EBIT	330	.05331	.45934	-4.20033	6.19316
OPCF	330	.08095	.14838	-.76720	.88077
GER	330	.85359	1.9772	.02032	19.5571
ROA	330	.03238	.38839	-2.3599	6.17431

Source: Regression Output, 2025.

3.2 Normality Test

The results of the Shapiro-Wilk normality test are presented in Table 3. The Shapiro-Wilk normality test results in Table 3 indicate that most of the variables, EBIT, OPCF, GER, and ROA, deviate significantly from a normal distribution, as shown by their p-values of 0.00000, which are below the 5% significance level. This suggests strong evidence of non-normality in these variables. Only R&D (RD) has a p-value of 0.5997, indicating that it follows a normal distribution and does not violate normality assumptions.The non-normality of key financial variables could distort inferential statistics and regression estimates, leading to unreliable conclusions if not addressed.To correct for non-normality, non-parametric methods would be more appropriate as ensuring the assumptions of normality are met enhances the validity of statistical inferences and model robustness.

Table 3: Shapiro-Wilk W test for normal data for RD, EBIT OPCF GER and ROA

VARIABLES	OBS	W	V	Z	PROB>Z
RD	330	0.99613	0.898	-0.253	0.59969
EBIT	330	0.30651	160.796	11.979	0.00000
OPCF	330	0.90443	22.160	7.306	0.00000
GER	330	0.22174	180.452	12.251	0.00000
ROA	330	0.25808	172.026	12.138	0.00000

Source: Regression Output, 2025.

3.3 Correlation Analysis

Table 4 presents the results of the Spearman correlation matrix. The Spearman correlation matrix in Table 4 reveals several significant relationships among the variables. Research and Development (RD) positively correlates with EBIT (0.1563), Operating Cash Flow (OPCF) (0.1896), Gearing (GER) (0.1684), and Return on Assets (ROA) (0.1818), all significant at the 1% level. This suggests that firms engaging more in R&D tend to exhibit better profitability, cash flow, and leverage management.EBIT and ROA have a very strong positive correlation (0.9387), indicating that higher operating profits translate directly into better asset returns. OPCF correlates positively with EBIT (0.3876) and ROA (0.3689), reinforcing the link between cash flow and profitability. GER, however, has a significant negative correlation with EBIT (-0.2258) and ROA (-0.2397), implying that higher leverage may detract from profitability and asset returns.

Table 4: Summary of Spearman Correlation Matrix for RD, EBIT OPCF GER and ROA

	RD	EBIT	OPCF	GER	ROA
RD	1.0000				
EBIT	0.1563*	1.0000			
	0.0044				
OPCF	0.1896*	0.3876*	1.0000		
	0.0005	0.0000			
GER	0.1684*	-0.2258*	-0.0087	1.0000	
	0.0021	0.0000	0.8749		
ROA	0.1818*	0.9387*	0.3689*	-0.2397*	1.0000
	0.0009	0.0000	0.0000	0.0000	

Source: Regression Output, 2025.

3.4 Result of Multicollinearity Test

Table 5 presents the Results of the Multicollinearity Test Using Variance Inflation Factor (VIF). The Variance Inflation Factor (VIF) results indicate potential multicollinearity concerns, particularly between ROA and EBIT, with VIF values of 8.63 and 8.55,

respectively. These values approach the commonly accepted threshold of 10, suggesting that these variables are highly correlated which could distort regression estimates and reduce the reliability of coefficient interpretations. GER and OPCF show low VIF values (1.13 and 1.01), indicating minimal multicollinearity.

Table 5: VIF Test Result

VARIABLE	VIF	1/VIF
ROA	8.63	0.115888
EBIT	8.55	0.116991
GER	1.13	0.888691
OPCF	1.01	0.993437
Mean VIF	4.83	

Source: Regression Output, 2025.

3.5 Other Diagnostic Tests

Table 6 presents the results of the Breusch and Pagan Lagrangian Multiplier (LM) test for the R&D regression model. Likewise, Table 7 presents the diagnostic tests results for all the variables. The test result shows a chi-square statistic of 0.40 with a p-value of 0.5282. Since the p-value is greater than the conventional significance levels (e.g., 0.05), we fail to reject the null hypothesis. The Levin-Lin-Chu (LLC) unit root test results indicate that all variables (RD, EBIT, OPCF, GER, and ROA) are stationary at level (I(0)), as shown by significant adjusted t-statistics and p-values (RD's p-value of 1.0000 appears inconsistent; all others confirm stationarity with p = 0.0000). Stationarity means these variables have a constant mean and variance over time, which is crucial to avoid spurious regression results in panel data analysis.Since all variables are stationary at level, this supports the use of conventional panel data estimation techniques without differencing. It ensures valid and reliable inference in the model. The study can proceed confidently with regression analyses, minimizing concerns of unit root bias and improving robustness of empirical results.

Table 6: Breusch and Pagan Lagrangian Multiplier test

Breusch and Pagan Lagrangian Multiplier test for R&D	
Decision rule	If p-value is statistically significant, then reject Ho and accept HA
Result	chi2(1) = 0.40; Prob>chi2= 0.5282

Source: Regression Output, 2025

Table 7: Diagnostic Tests Results for all the variables

Variable	Statistics		P-value	Remarks	Implication
RD	Unadjusted t	-2.8284			stationary
	Adjusted t*	65.4082	1.0000	1(0)*	
EBIT	Unadjusted t	-55.0537			stationary
	Adjusted t*	-59.5792	0.0000	1(0)*	
OPCF	Unadjusted t	-34.7257			stationary
	Adjusted t*	-37.0730	0.0000	1(0)*	
GER	Unadjusted t	-22.1089			stationary
	Adjusted t*	-23.1177	0.0000	1(0)*	
ROA	Unadjusted t	-77.0449			stationary
	Adjusted t*	-83.6963	0.0000	1(0)*	

Source: Regression Output, 2025.

3.6 Hypotheses Testing

Table 8 presents the summary of a linear regression analysis examining the relationship between Research and Development (RD) investment and four financial variables: Earnings Before Interest and Tax (EBIT), Operating Cash Flow (OPCF), Growth in Economic Resources (GER), and Return on Assets (ROA). The regression uses a panel-corrected standard error approach with 330 observations. The R-squared value of 0.0232 indicates that the model explains only 2.3% of the variation in RD investment, suggesting limited explanatory power. However, the overall model is statistically significant, as shown by the Wald chi-square value of 14.99 and a p-value of 0.0047. Among the independent variables, only GER has a statistically significant effect on RD, with a coefficient of -0.0246 ($p = 0.002$), implying a negative relationship. EBIT, OPCF, and ROA all show positive but statistically insignificant effects on RD investment. The constant term (_CONS) is positive and highly significant, indicating a base level of RD investment regardless of the predictors.

Table 8: Summary linear regression analysis for RD, EBIT OPCF GER and ROA

Panel-Corrected				
RD	**COEF.**	**STD. ERR.**	**z**	**P>|z|**
EBIT	-.1439614	.1327282	-1.08	0.278
OPCF	.3887504	.2826979	1.88	0.169
GER	-.0246327	.0079073	-3.12	0.002
ROA	.2013788	.1691108	1.19	0.234
_CONS	.3513168	.0180903	19.42	0.000
N				330
R-squared				0.0232
Wald chi2(4)				14.99
Prob> chi2				0.0047

Source: Regression Output, 2025

3.7 Discussion of Findings

The regression analysis reveals that GER significantly and negatively impacts Research and Development (RD), suggesting that firms experiencing higher growth may allocate resources away from R&D, possibly prioritizing immediate operational needs over innovation (Akbar, et al. 2024; Aminu, et al. 2019). The insignificant effects of EBIT, OPCF, and ROA on RD align with prior studies indicating that while profitability and cash flow are important, they do not directly translate into R&D investment without strategic intent or financial flexibility

(Chao, et al. 2022; Liu, 2024). The low explanatory power of the model ($R^2 = 0.0232$) highlights the complexity of factors influencing R&D, consistent with Barney's (2000) resource-based view that firm-specific capabilities and external environment heavily shape innovation outcomes.Financial flexibility plays a crucial moderating role, as supported by Sheng, et al. (2024), who emphasized the nonlinear impact of financial flexibility on corporate sustainability. Firms may need to balance growth ambitions and R&D investment through strategic financial management, which can be influenced by macroeconomic policies and corporate governance (Liu, 2024; Ilyas *et al.,* 2025). Future research should incorporate broader firm attributes and governance variables to better explain the drivers of R&D in manufacturing and other sectors (Ndu *et al*., 2024; Seun *et al.,* 2024).

4.0 Conclusion and Recommendations

Conclusion

The study found that Gearing Ratio (GER) significantly negatively affects Research and Development (RD), indicating that firms with rapid growth might reduce R&D investments to focus on immediate operational needs. Earnings Before Interest and Taxes (EBIT), Operating Cash Flow (OPCF), and Return on Assets (ROA) showed no significant impact on RD, suggesting profitability and cash flow alone do not guarantee increased innovation spending. The model's low explanatory power reflects the complexity of factors driving R&D investment, consistent with resource-based theory. The findings align with existing literature highlighting the critical role of financial flexibility in balancing growth and innovation. Overall, firms must strategically manage financial resources to sustain R&D efforts, with future studies recommended to explore additional firm-specific and governance factors influencing innovation.

This study concludes that Gearing Ratio (GER) has a significant negative impact on Research and Development (RD) in manufacturing firms, suggesting that rapid growth may constrain innovation investments. Meanwhile, profitability (EBIT), operating cash flow (OPCF), and return on assets (ROA) do not significantly influence R&D activities. These results highlight the complex interplay between financial performance and innovation, emphasizing that financial flexibility alone does not guarantee enhanced R&D. Firms need to carefully balance resource allocation between growth and innovation to maintain long-term competitiveness.

Recommendations

1. Strategic Financial Management: Firms should adopt financial strategies that protect R&D budgets, even during periods of rapid growth, to foster sustained innovation.
2. Enhance Financial Flexibility: Firms are encouraged to improve financial flexibility by optimizing cash flow management and diversifying funding sources, facilitating continuous investment in R&D.
3. Policy Support: Regulators and policymakers should create incentives, such as grants or tax relief, to encourage firms to invest consistently in R&D despite growth pressures.
4. Further Research: Future studies should explore other factors like corporate governance and market dynamics influencing the innovation-growth relationship.

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