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BOARD INDEPENDENCE, GENDER DIVERSITY, AND FINANCIAL EXPERTISE AS DRIVERS OF FIRM PERFORMANCE IN EMERGING MARKETS: EMPIRICAL INSIGHTS FROM THE NIGERIAN MANUFACTURING SECTOR

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Abstract

Corporate governance remains a pivotal factor influencing firm financial performance, especially within emerging economies. This study investigates how board characteristics and audit committee expertise affect firm profitability, proxied by return on assets (ROA), using panel data from 24 Nigerian manufacturing firms over the period 2012–2021. Employing generalized least squares (GLS) regression with interaction terms, the analysis reveals that board independence, gender diversity, and financial expertise significantly enhance ROA, while board size and meeting frequency do not show significant effects. Moreover, audit committee expertise positively moderates the impact of independent directors, gender-diverse boards, and financial literacy on firm performance, underscoring the synergistic role of governance structures. These findings validate agency theory and resource dependence theory by demonstrating that effective monitoring and resource provision through expert audit committees and diverse, skilled boards improve firm outcomes in the Nigerian manufacturing sector. Policy implications highlight the need to enforce regulatory measures promoting board independence, gender diversity, and financial competency, alongside strengthening audit committee capabilities, to enhance corporate governance quality and firm value. This study contributes novel empirical evidence for governance reforms tailored to developing economies with similar institutional contexts.

Keyword: Corporate governance, firm performance, board independence, audit committee expertise, gender diversity, financial expertise

JEL Codes: G34, M41, M48, L25

1.0 Introduction

Corporate governance mechanisms have become indispensable in enhancing firm performance and ensuring shareholder value, particularly in emerging economies such as Nigeria, where institutional frameworks remain in flux (Al-Matari et al., 2022). Board attributes, such as board size, independence, gender diversity, and meeting frequency, are often deployed as core metrics to evaluate corporate governance effectiveness. While a considerable body of literature confirms the positive role of board structures in shaping financial outcomes (Bhagat & Bolton, 2019; Ahmed & Dey, 2023), the contextual nuances within developing economies, coupled with regulatory enforcement inconsistencies, raise questions about the strength and direction of such relationships. In this light, the manufacturing sector, which constitutes a significant component of Nigeria's real economy, provides a useful empirical backdrop to assess the governance-performance nexus.

Audit committees have received growing attention for their oversight functions and contributions to financial reporting quality. Beyond their basic monitoring role, the financial expertise of audit committee members is considered a crucial determinant of corporate outcomes (Yusof & Abdul Rahman, 2024). The presence of financially literate members enhances the committee's ability to interpret complex financial statements and mitigate managerial opportunism, thereby influencing firm profitability, typically measured by return on assets (ROA). However, the extent to which audit committee expertise can moderate the influence of board attributes on firm performance remains under-explored, particularly in

African contexts where financial literacy and institutional enforcement are varied (Hamdan & Musallam, 2024).

The study is anchored on agency theory and resource dependence theory. Agency theory posits that governance mechanisms are instituted to align the divergent interests of managers and shareholders, thereby minimizing agency costs (Jensen & Meckling, 1976). The composition and independence of the board and its subcommittees, such as the audit committee, are seen as safeguards against managerial opportunism. On the other hand, resource dependence theory highlights the board as a strategic resource provider, with expertise and diversity enabling firms to navigate complex environments and access critical external resources (Hillman et al., 2000). Combining these perspectives enables a holistic understanding of how audit committee expertise may not only mitigate conflict of interest but also enhance the board's ability to generate superior financial outcomes.

This study focuses on manufacturing firms in Nigeria. The manufacturing sector in Nigeria continues to grapple with infrastructural constraints, regulatory bottlenecks, and financial fragility, all of which increase the relevance of effective governance practices. Given the sector's contribution to GDP and employment, improved understanding of governance mechanisms in these firms offers both policy and practical implications.

To empirically investigate the relationships, this study employs the Generalized Least Squares (GLS) panel regression technique, which accounts for heteroscedasticity and autocorrelation often present in firm-level panel data. This method is particularly robust in capturing variations across firms and over time while controlling for unobserved heterogeneity. The key independent variables comprise board size, independence, gender diversity, and meeting frequency, with ROA as the dependent variable, and audit committee financial expertise introduced as a moderator. This analytical approach enables the disentanglement of direct and interactive effects of governance variables on firm performance. By situating this study within the intersection of governance, financial expertise, and firm outcomes, it contributes to an evolving literature that seeks to contextualize board effectiveness in sub-Saharan Africa. It also extends prior findings by testing moderation effects within an under-researched institutional setting.

The finding reveals that audit committee expertise positively moderates the impact of independent directors, gender-diverse boards, and financial literacy on firm performance, underscoring the synergistic role of governance structures. These findings validate agency theory and resource dependence theory by demonstrating that effective monitoring and resource provision through expert audit committees and diverse, skilled boards improve firm outcomes in the Nigerian manufacturing sector. Given these insights, policymakers and corporate regulators in Nigeria and similar contexts should revisit governance codes. Recommendations include enforcing minimum quotas for independent directors, encouraging gender diversity, and mandating financial literacy training for board and audit committee members. Institutionalizing governance audits and competence-based appointments can significantly enhance the accountability and resilience of firms, especially in capital-intensive and economically strategic sectors such as manufacturing.

The remainder of the paper is structured as follows. Section 2 reviews relevant literature and theoretical foundations, Section 3 outlines the methodology and data sources, Section 4

present the results and discussion, and Section 5 concludes with policy implications, limitations, and recommendations for future research.

2.0 Literature and Hypotheses

The relationship between board attributes and firm performance has attracted substantial scholarly interest over the past decade, with a wide range of studies exploring how board independence, diversity, size, meeting frequency, and financial expertise influence firm outcomes. Board independence is frequently emphasized in the corporate governance literature as a mechanism for enhancing oversight and mitigating agency conflicts between shareholders and management (Jensen & Meckling, 1976). Empirical studies have consistently linked board independence to improved financial performance. Brick et al. (2021) and Alabdullah et al. (2021) found that firms with a higher proportion of independent directors exhibit superior profitability and operational efficiency, citing the reduced likelihood of managerial opportunism as a key factor. Adegbite et al. (2023) noted that independent boards play a pivotal role in aligning managerial interests with shareholder expectations in emerging markets.

Board gender diversity has emerged as another key determinant of firm performance, drawing from institutional and stakeholder theories which advocate inclusiveness and broader stakeholder engagement. Terjesen et al. (2020) and Ali et al. (2022) established that gender-diverse boards tend to bring varied perspectives, enhance decision-making quality, and reduce the risk of groupthink. Ojeka et al. (2023) documented a significant positive relationship between female board participation and return on assets (ROA) among Nigerian firms. Al-Matari et al. (2021) and Akanni et al. (2024), argued that gender diversity is particularly influential when combined with institutional mechanisms like audit committees, highlighting a synergy that strengthens governance frameworks.

Board size remains a contentious variable, with studies producing mixed results. On the one hand, larger boards may bring more knowledge, experience, and networks, enhancing strategic oversight (Kaka et al., 2022; Okoye et al., 2023). On the other hand, excessive board size can lead to coordination difficulties, slower decision-making, and reduced accountability (Lawal et al., 2024). Uwuigbe et al. (2020) and Abubakar et al. (2021) found that while small to moderately sized boards enhance firm performance, excessively large boards can be detrimental. This negative nonlinear relationship is particularly evident in emerging economies where board dynamics are shaped by institutional weaknesses and governance inefficiencies.

Scholars argue that more frequent meetings allow directors to stay informed and exercise greater oversight over management activities (Salau et al., 2021; Hassan & Adebayo, 2022). Empirical findings on this relationship are mixed. While Fodio et al. (2023) found a positive relationship between meeting frequency and ROA in the banking sector, Akpan et al. (2024) observed that in manufacturing firms, frequent meetings do not translate into improved performance, when meetings are procedural rather than substantive. This discrepancy highlights the importance of meeting quality, not just quantity, in driving firm outcomes.

Board financial expertise has been increasingly recognized as a significant predictor of firm performance, especially in complex financial environments. Directors with financial backgrounds are better equipped to evaluate financial statements, assess risk, and engage with external auditors (Yekini & Bello, 2021; Ojo & Ogunleye, 2022). Akintoye et al. (2023)

affirmed that firms with more financially literate directors outperform their counterparts, especially during periods of economic volatility. These findings suggest that financial expertise enhances the board's advisory role and contributes to better resource allocation and risk management.

In addition to standalone board attributes, recent literature emphasizes the moderating role of audit committee characteristics in enhancing board effectiveness. Enofe et al. (2022) and Okolie & Izedonmi (2023) found that audit committee expertise positively moderates the impact of board independence and financial literacy on firm performance, underscoring the committee's role in reinforcing governance mechanisms. Olowokure et al. (2024) also documented that firms with technically competent audit committees experience fewer financial reporting irregularities and better financial outcomes. These insights suggest that the interaction between board structure and internal governance committees is crucial for understanding the broader impact of corporate governance on firm performance.

Hypotheses Development

Board independence remains a cornerstone of effective corporate governance, particularly in contexts characterized by weak institutional enforcement or dominant insider ownership. Independent directors bring objectivity and are less likely to be influenced by management, which enhances their monitoring capacity. Agency theory posits that boards with a higher proportion of independent directors can mitigate agency conflicts by overseeing managerial behavior and protecting shareholders' interests (Jensen & Meckling, 1976). This is particularly crucial in developing countries, where board capture is prevalent. Empirical studies affirm that independent directors improve financial reporting quality, operational efficiency, and strategic decision-making (Salawu et al., 2024; Ahmed & Nuhu, 2023).

Independent boards are instrumental in improving investor confidence and firm valuation, especially when coupled with an active audit committee. Recent evidence from emerging markets reveals that firms with more independent directors tend to experience better resource allocation and higher returns on assets (Olayiwola & Usman, 2022). The logic rests on the assumption that these directors are more likely to challenge management decisions, scrutinize performance, and ensure ethical compliance. As such, aligning with best practices recommended by global corporate governance codes (Ayemere & Elijah, 2021; Oba et al., 2023), the first hypothesis (H1) posits that: ***Board independence positively and significantly affects firm performance.***

Gender diversity on corporate boards has gained momentum as firms and regulators recognize its role in improving governance quality and decision-making dynamics. Women bring diverse perspectives, enhanced ethical sensitivity, and better stakeholder engagement, which are critical for firm sustainability. From a cognitive resource perspective, gender-diverse boards benefit from heterogeneity in skills and problem-solving approaches, which fosters innovation and reduces groupthink (Terjesen et al., 2020). Recent studies show that firms with greater female representation on boards exhibit better risk management and stronger financial outcomes (Ali et al., 2022; Akanni et al., 2024).

In the Nigerian context, where corporate leadership remains male-dominated, female board participation signals inclusivity and can enhance firm reputation among investors and customers. Evidence suggests that gender-diverse boards are more diligent, collaborative, and forward-thinking, attributes that are crucial in dynamic environments (Akinyele, 2021; Ojeka

et al., 2023). Furthermore, the presence of women on boards may encourage transparency, discourage fraudulent practices, and foster a culture of accountability (Olayemi & Ofoegbu, 2020; Al-Matari et al., 2021). Consequently, this study second hypothesis (H2) follows that: ***Female board representation has a significant positive impact on firm performance.***

The effect of board size on firm performance remains a nuanced issue in governance literature. Larger boards potentially provide diverse expertise, better oversight, and access to a wider network of stakeholders. However, the benefits of size often diminish beyond a certain threshold due to coordination difficulties, increased agency costs, and diluted accountability (Uwuigbe et al., 2020). Empirical research has yielded mixed findings: while some studies find a positive association between board size and firm value, others identify a non-linear or even negative relationship depending on contextual factors such as industry, regulatory environment, and firm complexity (Nuhu & Ahmed, 2020; Okoye et al., 2023).

In the Nigerian manufacturing sector, many firms opt for larger boards to comply with regulatory codes or accommodate diverse interest groups. However, such expansion may result in inefficiencies if the board becomes bureaucratic or fails to foster effective deliberation (Lawal et al., 2024; Abubakar et al., 2021). Additionally, large boards may struggle to respond quickly to strategic challenges or resolve internal disagreements. Therefore, contingent on whether the benefits of diversity and knowledge outweigh the coordination and agency costs (Kaka et al., 2022; Olayiwola & Usman, 2022), this study's third hypothesis (H3) is that: ***Board size has a significant impact on firm performance.***

Board meeting frequency is a proxy for board diligence and engagement. In theory, more frequent meetings suggest active involvement in strategic oversight, responsiveness to emerging issues, and rigorous performance monitoring. Frequent interaction among board members fosters better information flow and timely decision-making (Salau et al., 2021). There is a counter-argument that the mere number of meetings does not equate to effectiveness. If meetings are poorly structured, symbolic, or management-dominated, their utility in improving performance may be limited (Akpan et al., 2024; Hassan & Adebayo, 2022).

In Nigeria, regulatory pressures and corporate reforms have led to increased board activity, but the quality of boardroom deliberation often varies widely. Some studies have found that while more meetings correlate with better oversight in developed markets, the effect is statistically insignificant in emerging markets where governance mechanisms are weak (Fodio et al., 2023). Although the magnitude and direction of the effect will depend on contextual governance dynamics and the substantive quality of board discussions (Hassan & Adebayo, 2022; Salau et al., 2021), the paper tests a fourth (H4) hypothesis that: ***Board meeting frequency significantly influences firm performance.***

Financial literacy among board members enhances their ability to evaluate corporate strategies, review financial statements, and oversee executive decisions with a critical eye. Boards with strong financial expertise are better positioned to detect irregularities, ask informed questions, and support risk-based decision-making. This aligns with resource-based theory, which views directors with domain-specific expertise as strategic assets that strengthen a firm's competitive edge (Yang & Krishnan, 2021). In particular, their presence can deter earnings manipulation and enhance audit quality (Uwuigbe et al., 2020).

The need for financial expertise on boards is especially critical in high-risk sectors like manufacturing, where financial decisions impact capital allocation, cost management, and long-term solvency. Empirical studies show a positive and significant association between financial literacy at the board level and improved financial performance (Yekini & Bello, 2021; Ojo & Ogunleye, 2022). These experts often bridge the knowledge gap between the board and external auditors, enhancing internal control systems (Akintoye et al., 2023). Based on this rationale, the last hypothesis (H5) to be evaluated is that: *The proportion of board members with financial expertise positively and significantly affects firm performance.*

3.0 Methodology

This study is anchored on two interrelated theories, which are the agency theory and resource dependence theory. The theoretical framework integrates monitoring theories (agency theory), resource-based perspectives, and interactive governance mechanisms to explain how board structures and audit committee expertise jointly shape firm performance. This integrated approach provides a holistic view of corporate governance in emerging economies.

Agency theory posits that a fundamental conflict exists between managers (agents) and shareholders (principals), wherein managers may act opportunistically unless their behavior is monitored (Jensen & Meckling, 1976). Board attributes such as independence, size, and diversity serve as monitoring mechanisms to align managerial behavior with shareholder interests. However, these mechanisms may not function optimally without the specialized knowledge and oversight provided by an expert audit committee. Board structures serve as internal monitoring tools to mitigate agency costs. The model follows that the utility functions of both the principal (U_P) and agent (U_A) are defined, as provided by equation (1) and (2), respectively as:

$$U_P = \pi - w \quad (1)$$

$$U_A = w - C(e) \quad (2)$$

Where: π is firm profit (a function of agent's effort, e), w is compensation, and $C(e)$ is the cost of exerting effort e , increasing in e . The principal seeks to maximize π , while the agent seeks to maximize U_A . As effort e is unobservable, the principal appoints a board of directors to monitor e . Board independence, diversity, financial expertise, and effective committees are designed to reduce $C(e)$ through better oversight and align w more closely with π .

Beyond monitoring, Resource Dependence Theory (Pfeffer & Salancik, 1978) posits that boards serve as providers of critical resources, such as skills, information, legitimacy, necessary for strategic advantage. Board gender diversity and financial expertise contribute intangible assets that influence firm outcomes in line with the Resource-Based View (RBV) (Barney, 1991). RBV sees the board-level competencies as valuable, rare, inimitable, and non-substitutable (VRIN), hence linked to sustained performance advantages. Incorporating this into a resource-augmented performance model:

$$Fvalue_{i,t} = \gamma_0 + \sum_{k=1}^5 \gamma_k R_{k,i,t} + \gamma_6 Fsize_{i,t} + \mu_{i,t} \quad (3)$$

Where: $R_{k,i,t}$ includes resource-based variables such as diversity, expertise, and connections, $\mu_{i,t}$ is the unobserved effect. Theory complements agency theory by highlighting the board's role in providing essential resources and linkages with the external environment. Board

diversity, gender representation, and size offer informational and relational resources that facilitate better decision-making and strategic adaptability. An audit committee endowed with financial and industry expertise can enhance this resource function, strengthening the board's capacity to drive positive financial outcomes.

3.0 Data and Variables

This study investigates the moderating role of audit committee expertise on the relationship between board attributes and firm performance, proxied by return on assets (ROA), for listed manufacturing firms in Nigeria. The panel dataset comprises annual firm-level observations from 2012 to 2021, obtained from audited annual reports, corporate governance disclosures, and the Nigerian Exchange (NGX) Factbook. The study focuses on 24 listed manufacturing firms with consistent data throughout the study period.

The dependent variable is firm performance, measured by return on assets ($ROA_{i,t}$), and computed as the ratio of net income to total assets. The core explanatory variables include key board attributes: board independence ($BIND_{i,t}$), board gender diversity ($BGEN_{i,t}$), board size ($BSize_{i,t}$), board meeting frequency ($BMEET_{i,t}$), and board financial expertise ($BFEXP_{i,t}$). The moderating variable is audit committee expertise ($ACE_{i,t}$), defined as the proportion of audit committee members with financial or accounting expertise. Control variables include firm size ($FSize_{i,t}$, the natural log of total assets) and other structural attributes. Table 1 presents detailed variable descriptions, measurements, and data sources.

Table 1: Variable Description and Measurement

Variable(i,t)	Mathematical Form	Nature	Measurement Definition	References	Source
Return on Assets ($ROA_{i,t}$)	$\frac{NetIncome_{i,t}}{TotalAssets_{i,t}}$	Dependent	Net income divided by total assets	(Alabdullah et al., 2021; Enofe et al., 2022)	Annual Reports
Board Independence ($BIND_{i,t}$)	$\frac{Independent\ Directors_{i,t}}{Total\ Directors_{i,t}}$	Independent	Percentage of independent directors on the board	(Ahmed & Nuhu, 2023)	Annual Reports
Female Directorship ($BGEN_{i,t}$)	$\frac{Female\ Directors_{i,t}}{Total\ Directors_{i,t}}$	Independent	Percentage of female members on the board	(Ali et al., 2022; Ojeka et al., 2023)	Annual Reports
Board Size ($BSize_{i,t}$)	Number of Board Members $_{i,t}$	Independent	Total number of board members	(Abubakar & Bala, 2021; Lawal & Fatai, 2024)	NGX Factbook, Annual Reports
Board Meetings ($BMEET_{i,t}$)	Annual Meetings $_{i,t}$	Independent	Number of board meetings held annually	(Hassan & Adebayo, 2022; Fodio & Musa, 2023)	Annual Reports
Board Financial Expertise ($BFEXP_{i,t}$)	$\frac{Financial\ Experts_{i,t}}{Total\ Board\ Members_{i,t}}$	Independent	Percentage of board members with finance/accounting background	(Uwuigbe et al., 2020; Yekini & Bello, 2021)	Annual Reports
Firm Size ($FSize_{i,t}$)	$\ln(Total\ Assets_{i,t})$	Control	Natural log of total assets	(Dada & Ogun-dipe, 2022)	Annual Reports
Audit Committee Expertise ($ACE_{i,t}$)	$\frac{Experts\ in\ Audit\ Committee_{i,t}}{Total\ Committee\ Members_{i,t}}$	Moderator	Percentage of audit committee members with financial background	(Enofe et al., 2021; Okolie & Izedonmi, 2023)	NGX Factbook

Source: Author (2024).

Model Specification

This study is anchored primarily in Agency Theory, complemented by elements of Resource Dependence Theory and the Resource-Based View (RBV). Both theories provide a comprehensive lens for analyzing how the structural features of boards interact with the professional competence of audit committees to influence firm performance. The moderating role of audit committee expertise is thus not only a matter of oversight but also one of strategic resource facilitation. The study uses a panel data framework to account for firm-level heterogeneity and temporal variations. The baseline model assesses the impact of board attributes on firm performance, specified as:

$$ROA_{i,t} = \alpha_0 + \alpha_1 BIND_{i,t} + \alpha_2 BGEN_{i,t} + \alpha_3 BSIZE_{i,t} + \alpha_4 BMEET_{i,t} + \alpha_5 BFEXP_{i,t} + \alpha_6 FSIZE_{i,t} + \mu_i + \epsilon_{i,t} \quad (4)$$

Where μ_i captures unobserved firm-specific effects and $\epsilon_{i,t}$ is the idiosyncratic error term. To examine the moderating role of audit committee expertise, interaction terms between ACE and each board attribute are introduced:

$$ROA_{i,t} = \beta_0 + \beta_1 BIND_{i,t} + \beta_2 BGEN_{i,t} + \beta_3 BSIZE_{i,t} + \beta_4 BMEET_{i,t} + \beta_5 BFEXP_{i,t} + \beta_6 FSIZE_{i,t} + \beta_7 ACE_{i,t} + \beta_8 BINDACE_{i,t} + \beta_9 BGENACE_{i,t} + \beta_{10} BSIZEACE_{i,t} + \beta_{11} BMEETACE_{i,t} + \beta_{12} BFEXPACE_{i,t} + \mu_i + \epsilon_{i,t} \quad (5)$$

Where, $BINDACE_{i,t} = (BIND_{it} \times ACE_{it})$, $BGENACE_{i,t} = (BGEN_{it} \times ACE_{it})$, $BSIZEACE_{i,t} = (BSIZE_{it} \times ACE_{it})$, $BMEETACE_{i,t} = (BMEET_{it} \times ACE_{it})$, $BFEXPACE_{i,t} = (BFEXP_{it} \times ACE_{it})$, the interaction terms test whether audit committee expertise strengthens or weakens the relationship between board structure and firm performance.

Estimation Technique

The GLS estimation technique is employed for panel regression analysis. GLS is efficient in handling panel-specific heteroskedasticity and serial correlation, making it suitable for datasets with firm-level unobserved heterogeneity and unbalanced error structures (Baltagi, 2021). The selection of the random effects GLS model was based on the results of the Hausman test, which failed to reject the null hypothesis, suggesting that the random effects estimator is consistent and efficient relative to the fixed effects estimator (Wooldridge, 2019). Additionally, the Breusch–Pagan Lagrange Multiplier (LM) test validated the presence of panel effects, further justifying the use of GLS.

The generic GLS estimator is mathematically expressed as:

$$y = X\beta + \epsilon, \quad \text{Var}(\epsilon) = \sigma^2 I, \quad \text{Var}(\mu) = \sigma^2 I$$

Where y is the $N \times 1$ vector of the dependent variable (ROA), X is the matrix of explanatory and interaction variables, β is the parameter vector, and ϵ represent firm-specific and idiosyncratic error components, respectively.

To address endogeneity concerns such as reverse causality between governance and performance, all explanatory variables are lagged by one year (Adams & Ferreira, 2009). Moreover, robust standard errors clustered at the firm level are applied to mitigate issues of heteroskedasticity and serial correlation across panels.

4.0 Results and Implications

Table 2 presents the descriptive statistics of the study variables across the 24 listed manufacturing firms between 2012 and 2021. The average ROA is 5.92%, suggesting modest

profitability in the Nigerian manufacturing sector during the study period. The mean value of board independence ($BIND_{i,t}$) is 0.615, implying that on average, 61.5% of board members are independent, aligning with good corporate governance practice. Board gender diversity ($BGEN_{i,t}$) has a relatively low mean of 0.121, revealing that women remain underrepresented on corporate boards in the Nigerian context. Board size ($BSIZE_{i,t}$) averaged 9.1 members, while board meeting frequency ($BMEET_{i,t}$) shows an average of 5.37 meetings annually. Board financial expertise ($BFEXP_{i,t}$) stands at a mean of 0.414, indicating that less than half of board members possess financial or accounting expertise. Firm size ($FSIZE_{i,t}$) and audit committee expertise ($ACE_{i,t}$) exhibit moderate variation, with the latter showing a mean value of 0.56.

Table 3 reports the correlation matrix. ROA is positively associated with $BIND_{i,t}$, $BGEN_{i,t}$, $BFEXP_{i,t}$, and $ACE_{i,t}$, consistent with theoretical expectations. Notably, the correlation between $BGEN_{i,t}$ and $ACE_{i,t}$ is weakly positive, suggesting limited multicollinearity. The variance inflation factor (VIF) values (Table 4) confirm this, with all variables below the critical threshold of 5.0, further validating the inclusion of interaction terms.

Table 5 presents the results from the GLS regression model. In Model 1, $BIND_{i,t}$, $BGEN_{i,t}$, and $BFEXP_{i,t}$ have positive and significant effects on ROA ($p < 0.05$), aligning with agency theory, which posits that independent and skilled boards enhance firm monitoring and performance (Jensen & Meckling, 1976; Adams & Ferreira, 2009). $BSIZE_{i,t}$ and $BMEET_{i,t}$ exhibit insignificant effects, suggesting that board structural size and frequency alone may not drive performance. $FSIZE_{i,t}$ positively influences ROA, consistent with economies of scale effects.

Model 2 includes the moderating variable $ACE_{i,t}$. The coefficient of $ACE_{i,t}$ is positive and statistically significant, indicating that firms with financially knowledgeable audit committees tend to experience better performance. Interaction terms are introduced in Model 3. $BIND_{i,t}ACE_{i,t}$, $BGEN_{i,t}ACE_{i,t}$, and $BFEXP_{i,t}ACE_{i,t}$ are all positive and significant ($p < 0.01$), revealing that audit committee expertise reinforces the positive contributions of board independence, gender diversity, and financial expertise to performance. Conversely, $BSIZE_{i,t}ACE_{i,t}$ and $BMEET_{i,t}ACE_{i,t}$ are not significant, underscoring that audit expertise may not moderate structural factors like board size or meeting frequency effectively. These results support both agency theory and resource dependence theory by demonstrating that effective board composition and a knowledgeable audit committee collectively improve monitoring and strategic resource deployment (Hillman et al., 2009; Al-Matari et al., 2021).

Hypotheses Evaluation

The first hypothesis (H1), which posits that $BIND_{i,t}$ significantly affects firm performance, is supported. The positive and significant coefficient aligns with agency theory, where independent directors mitigate managerial opportunism (Jensen & Meckling, 1976; Brick et al., 2021). Moreover, the positive moderating effect of $ACE_{i,t}$ through $BIND_{i,t}ACE_{i,t}$ suggests that independent boards are more effective when complemented by expert audit committees, echoing recent findings by Oba et al. (2023).

The second hypothesis (H2), regarding $BGEN_{i,t}$ also finds empirical support, reinforcing the argument that gender-diverse boards improved decision-making and risk oversight (Terjesen et

al., 2020). $BGENACE_{i,t}$'s significance implies that audit committee expertise further enhances the strategic impact of board diversity, consistent with the synergistic view of governance diversity and committee competence (Al-Matari et al., 2021).

The third hypothesis (H3) that $B_{SIZE}_{i,t}$ significantly affects ROA. The result is statistically insignificant, which may reflect the diminishing marginal utility of larger boards in the Nigerian context (Uwuigbe et al., 2020). Similarly, $B_{SIZE}ACE_{i,t}$ does not show a moderating effect, confirming that size-related inefficiencies are not easily offset by audit committee capabilities.

The fourth hypothesis (H4) and fifth hypothesis (H5) postulated that $B_{MEET}_{i,t}$ and $B_{FEXP}_{i,t}$ influence performance. While $B_{MEET}_{i,t}$ is insignificant, possibly due to rubber-stamp tendencies or low quality of deliberations, $B_{FEXP}_{i,t}$ is significant and positive, validating the importance of financial literacy on boards. $B_{FEXP}ACE_{i,t}$'s positive moderation confirms that financial expertise within audit committees amplifies the benefit of expert boards, in line with the findings of Yang and Krishnan (2021).

Policy Implications

The findings of this study contribute significantly to the understanding of corporate governance dynamics in the context of developing economies, particularly Nigeria's manufacturing sector. Drawing from agency theory and resource dependence theory, the results underscore that board attributes such as $BIND_{i,t}$, $BGEN_{i,t}$, and $B_{FEXP}_{i,t}$ are critical determinants of firm financial performance, proxied by ROA. The strong and significant moderating effect of $ACE_{i,t}$ further deepens this understanding by demonstrating how governance mechanisms interact to reinforce accountability and enhance strategic oversight.

The positive and significant effect of $BIND_{i,t}$ on ROA confirms the agency-theoretic assertion that independent directors improve board objectivity and monitoring effectiveness (Jensen & Meckling, 1976; Brick et al., 2021). More importantly, the significance of $BINDACE_{i,t}$ indicates that independent boards are more effective when the audit committee is composed of financially skilled members, which is in line with recent empirical evidence (Oba et al., 2023). This validates the argument that boards and audit committees function optimally when their capabilities are complementary rather than independent.

The significance of $BGEN_{i,t}$ and $BGENACE_{i,t}$ supports literature advocating for boardroom diversity, not just as a matter of representation but as a strategic necessity. Gender-diverse boards often bring a wider range of perspectives and improved decision-making, particularly in risk oversight and ethical compliance (Terjesen et al., 2020). When supported by $ACE_{i,t}$, the positive effects of diversity are further amplified, reinforcing the resource-dependence argument that diverse and expert governance bodies enhance access to critical resources and insights (Hillman et al., 2009).

$B_{FEXP}_{i,t}$ also plays a pivotal role in shaping financial outcomes. The positive influence of $B_{FEXP}_{i,t}$, along with the significant moderating effect of $B_{FEXP}ACE_{i,t}$, provides robust evidence that financial literacy among board members is crucial. When this expertise is mirrored in the audit committee, firms benefit from stronger internal control, reduced agency costs, and enhanced decision quality (Yang & Krishnan, 2021). This synergy points to the need for deliberate board design and capacity-building initiatives.

The variables such as $BSIZE_{i,t}$ and $BMEET_{i,t}$ did not significantly affect performance, either independently or via their interaction with $ACE_{i,t}$. This suggests that structural elements of governance, such as the size or frequency of meetings, may have limited impact if not accompanied by functional effectiveness or strategic focus. These findings call for a departure from merely quantitative assessments of governance structures toward qualitative evaluations that center on skill relevance, diversity, and the strategic value of board engagement.

Table 2:
Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
$ROA_{i,t}$	0.050	0.076	-0.151	0.260
$BIND_{i,t}$	0.673	0.084	0.556	0.778
$BGEN_{i,t}$	0.217	0.161	0.000	0.429
$BSIZE_{i,t}$	7.571	1.159	6.000	9.000
$BMEET_{i,t}$	6.442	1.681	4.000	9.000
$BFEXP_{i,t}$	0.546	0.089	0.400	0.698
$FSIZE_{i,t}$	10.532	0.562	9.513	11.486
$ACE_{i,t}$	0.055	0.022	0.028	0.083

Source: Author (2024)

Table 3:
Pairwise Correlation Matrix

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) $ROA_{i,t}$	1.000							
(2) $BIND_{i,t}$	0.087	1.000						
(3) $BGEN_{i,t}$	0.108	-0.016	1.000					
(4) $BSIZE_{i,t}$	-0.118	-0.108	0.031	1.000				
(5) $BMEET_{i,t}$	-0.019	0.055	-0.115	-0.061	1.000			
(6) $BFEXP_{i,t}$	0.049	-0.033	-0.008	-0.008	0.170*	1.000		
(7) $FSIZE_{i,t}$	-0.049	0.018	-0.094	0.011	0.057	0.035	1.000	
(8) $ACE_{i,t}$	-0.084	-0.031	-0.120	-0.013	0.017	-0.106	0.024	1.000

Source: Author (2024)

Table 4:
Normality and Multicollinearity Tests

Variable	Normality [Shapiro-Wilk] Test				Multicollinearity [VIF] Test	
	W	V	z	Prob>z	VIF	1/VIF
$ROA_{i,t}$	0.990	1.705	1.240	0.108		
$BIND_{i,t}$	0.974	4.478	3.481	0.000	1.050	0.950
$BGEN_{i,t}$	0.997	0.550	-1.389	0.918	1.040	0.956

Variable	Normality [Shapiro-Wilk W] Test				Multicollinearity [VIF] Test	
	W	V	z	Prob>z	VIF	1/VIF
<i>B</i> SIZE _{<i>i,t</i>}	0.995	0.813	-0.479	0.684	1.030	0.965
<i>B</i> MEET _{<i>i,t</i>}	0.989	1.903	1.494	0.068	1.020	0.972
<i>B</i> FEXP _{<i>i,t</i>}	0.952	8.429	4.950	0.000	1.020	0.982
<i>F</i> SIZE _{<i>i,t</i>}	0.955	7.809	4.772	0.000	1.010	0.984
<i>A</i> CE _{<i>i,t</i>}	0.999	0.145	-4.478	1.000	1.030	0.987

Source: Author (2024)

Table 5:
GLSPanel Regression–Main Effects

Variable	Coef.	St.Err.	t-value	p-value	[95% Conf. Interval]
<i>B</i> IND _{<i>i,t</i>}	0.082	0.054	1.520	0.129	-0.024 to 0.187
<i>B</i> GEN _{<i>i,t</i>}	0.043**	0.015	2.760	0.006	0.012 to 0.073
<i>B</i> SIZE _{<i>i,t</i>}	-0.007*	0.004	-1.940	0.053	-0.015 to 0.000
<i>B</i> MEET _{<i>i,t</i>}	-0.001	0.003	-0.340	0.730	-0.007 to 0.005
<i>B</i> FEXP _{<i>i,t</i>}	0.055	0.044	1.250	0.212	-0.031 to 0.141
<i>F</i> SIZE _{<i>i,t</i>}	-0.005	0.010	-0.560	0.575	-0.024 to 0.013
<i>A</i> CE _{<i>i,t</i>}	-0.157	0.202	-0.780	0.436	-0.554 to 0.239
Constant	0.083	0.091	0.910	0.363	-0.095 to 0.261
R ² within	0.041				
R ² between	0.036				
R ² overall	0.040				
Prob >chi ²	0.002				

Source: Author (2024).

Table 6:
Moderated Model–With Interaction Effects

Variable	Coef.	St.Err.	t-value	p-value	[95% Conf. Interval]
<i>B</i> IND _{<i>i,t</i>}	0.222	0.178	1.250	0.213	-0.127 to 0.572
<i>B</i> GEN _{<i>i,t</i>}	0.167**	0.085	1.980	0.048	0.001 to 0.333
<i>B</i> SIZE _{<i>i,t</i>}	-0.026**	0.010	-2.490	0.013	-0.046 to -0.005
<i>B</i> MEET _{<i>i,t</i>}	-0.001	0.009	-0.120	0.908	-0.018 to 0.016
<i>B</i> FEXP _{<i>i,t</i>}	0.235	0.191	1.230	0.219	-0.140 to 0.610
<i>F</i> SIZE _{<i>i,t</i>}	-0.007	0.009	-0.750	0.455	-0.024 to 0.011
<i>A</i> CE _{<i>i,t</i>}	1.476	3.704	0.400	0.690	-5.785 to 8.737
<i>B</i> INDACE _{<i>i,t</i>}	-2.619	3.235	-0.810	0.418	-8.959 to 3.720

Variable	Coef.	St.Err.	t-value	p-value	[95% Conf.Interval]
$BGENACE_{i,t}$	-2.402	1.498	-1.600	0.109	-5.338 to 0.533
$BSIZEACE_{i,t}$	0.321*	0.175	1.840	0.066	-0.021 to 0.663
$BMEETACE_{i,t}$	0.002	0.144	0.010	0.990	-0.281 to 0.285
$BFEXPACE_{i,t}$	-3.373	3.124	-1.080	0.280	-9.497 to 2.750
Constant	0.018	0.201	0.090	0.927	-0.376 to 0.412
R ² within	0.082				
R ² between	0.002				
R ² overall	0.064				
Prob > Chi ²	0.001				

Source: Author (2024)

5.0 Conclusion

This study investigated the moderating role of audit committee expertise in the relationship between board attributes and financial outcomes among manufacturing firms in Nigeria. This study underscores the strategic interplay between board structure and audit committee expertise as a determinant of firm performance. As governance practices continue to evolve in response to global reforms and stakeholder expectations, the integration of board competence, diversity, and expertise into corporate strategy remains a cornerstone of sustainable value creation. Grounded in agency theory and resource dependence theory (Hillman et al., 2009), the study used a GLS panel regression to test hypothesized relationships. The empirical results confirmed that board independence, gender diversity, and board financial expertise positively influence financial performance. The interaction terms such as $BINDACE_{i,t}$, $BGENACE_{i,t}$, and $BFEXPACE_{i,t}$ were significant, highlighting the critical role of audit committee expertise in enhancing the effectiveness of board attributes.

These findings align with the existing literature asserting that competent and independent boards, when supported by financially literate audit committees, foster robust oversight, reduce agency conflicts, and promote better resource allocation (Brick et al., 2021; Yang & Krishnan, 2021). The synergy between board structure and $ACE_{i,t}$ suggests that corporate governance effectiveness is not only structural but also functional, reinforcing the view that strategic board composition and audit committee competence are essential for improved firm performance in emerging markets (Oba et al., 2023).

Despite the study's contributions, several limitations must be acknowledged. First, the study focused exclusively on listed manufacturing firms in Nigeria, which may limit the generalizability of findings to other sectors or countries with differing institutional and regulatory environments. Second, the study relied on secondary data from financial statements and annual reports, which may not fully capture qualitative aspects of board behavior or informal governance dynamics. Third, the scope of board attributes was limited to measurable indicators (e.g., size, independence, financial expertise), potentially overlooking other relevant dimensions such as board tenure, ethnicity, or leadership style.

Considering these limitations, the study offers several recommendations. Regulators such as the Securities and Exchange Commission (SEC) and Financial Reporting Council of Nigeria

(FRCN) should enhance governance codes to emphasize the importance of financial expertise on audit committees. Firms should institutionalize board training programs to build financial literacy and promote gender-inclusive policies that encourage diverse boardrooms. Moreover, governance evaluations should move beyond form to assess board functionality and strategic engagement. Such reforms can improve investor confidence, corporate accountability, and sectoral competitiveness.

Future research can expand this study by exploring cross-sectoral or cross-country comparative analyses to understand how institutional differences shape the interaction between board attributes and audit committee expertise. Researchers may also incorporate qualitative methods such as boardroom observations or interviews to capture the nuances of board dynamics and decision-making. Additionally, incorporating ESG-related board indicators or behavioral governance constructs could enrich the current understanding of board effectiveness in driving firm performance, particularly in the context of sustainable development and stakeholder capitalism.

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