BOARD CHARACTERISTICS AND RESEARCH AND DEVELOPMENT OF LISTED MANUFACTURING FIRMS IN NIGERIA

Okere Wisdom[a] †
Offiaeli Amarachuwku Grace[b]
Ilo Stephanie[c]

[a,b,c]*Department of Accounting, Bells University of Technology, Ota Ogun State, Nigeria.*
† ✉ wisescar@yahoo.com *(Corresponding author)*

ABSTRACT

The study evaluated the impact of board characteristics on the research and development of quoted manufacturing firms in Nigeria. Its objective was to assess the association between board characteristics and R&D in quoted manufacturing firms in Nigeria. The scope of the study was from 2011 to 2020, secondary data was adopted in this study, which was extracted from the corporate reports of the listed food-manufacturing firms in Nigeria. The study made use of a sample size of 10 manufacturing firms. The agency theory was adopted in the work. A panel ordinary least square regression was used to test for the relationship and impact of the variable and the results. The findings of the study show a positive correlation between board characteristics and R&D in listed food manufacturing firms in Nigeria. This study recommends that the manufacturing firms should not overlook the effect research and development have on the value creation of the firms as over time this would promote business sustainability.

Contribution/Originality: This study contributes to the literature by investigating the impact of board characteristics on the research and development of quoted manufacturing firms in Nigeria

1. INTRODUCTION

The notion of R&D concerning board characteristics is not a new concept in the Nigerian economy. This is because innovation is greatly influenced by the intensity of R&D in organisations. An economy that does not undertake a sufficient amount of R&D would suffer from a lack of innovation (Gompers, Ishii, & Metrick, 2003). Additionally, this would result in a high degree of inefficiency and duplication in the companies' procedures and operations (Gosen, 2020). This demonstrates the fundamental issue confronting Nigeria's industrial sector (especially in the food industry). The manufacturing sector is a prime example of this, with unskilled workers involved in the production process, outdated recruitment criteria, and even a lack of automation in the factories of major manufacturing firms in the country, all of which can result in gross inefficiency, waste, substandard products, and even workplace hazards (Palaniappan, 2017).

According to Xie and O'Neill (2013), innovation is seen as a long-term goal that is achieved primarily via the results of R&D; a board is responsible for an entity's strategic and long-term business achievements. According to

research conducted by Ashwin, Krishnan, and George (2016), a big board would foster financial flexibility for R&D investment (Ashwin et al., 2016). Numerous works of literature exist that seek to understand the relationship between corporate governance and R&D intensity (Chou & Johennesse, 2021; Gosen, 2020; Milkovich, Gerhar, & Hannon, 2019; Waris, Irfan, Shahid, Khan, & Kamran, 2019), but this research seeks to solve the empirical problem through several different approaches, including making board characteristics a key variable, thereby filling a methodology gap, and also by conducting the study using the most recent data.

2. LITERATURE REVIEW

2.1. Conceptual Review

2.1.1 Boards of Directors

With reference to Hermalin and Weisbach (2013), boards are an essential variable that helps big entity's in curbing agency issues. Whatever its charms or shortcomings, boards of directors are an integral element of the market solution to contracting issues. In line with Alves (2019), a director's capability to manage an entity's stated performance is strained by the capability of its internal controls, especially those of boards. Hermalin and Weisbach (2013) argue that boards do not exist only to fulfil legal requirements, since if that were the case, their composition would also be legally mandated, but in reality, boards have a variety of compositions.

2.1.2. Board Characteristics

The board of directors can be characterized using the following elements:

Board Size: There has been debate about whether a large or small board is preferable from many perspectives (Hermalin & Weisbach, 2013). While some have advocated for smaller boards to improve business success (e.g., Wang (2012)), others have argued for bigger boards to maximize corporate performance (Adam & Mehran, 2018).

Board Meetings: Conger (2015) identified board meetings as a key resource for increasing the efficacy of the board. Vafeas (2017) most likely considered the strength of board actions to be a major value-relevant board characteristic. The regularity with which board members meet to address various concerns made against the business has a significant impact on the board's performance (Carcello, 2020).

Director Ownership: Berle and Means (1932) established a link between ownership and company performance, proposing that public companies separate ownership from control. Vafeas (2017) argued in favour of this perspective, saying that separation of ownership enhances professionalism via managerial competence and firm-specific expertise. However, agency theory demonstrates that separating ownership and control creates a conflict of interests (Carcello, 2020), which results in manager expropriation (Carcello, 2020).

2.1.3. Research and Development

According to Barker and Mueller (2015), R&D investment is a strong proxy for innovation, and businesses spend a fair amount of resources on R&D in the long term to create value as well as improve performance. However, R&D expenditures are more complicated and have a higher chance of failure.

To remain competitive in an ever-changing market, businesses are increasingly seeking methods to improve their performance via R&D expenditures (Barker & Mueller, 2015). This has compelled some businesses to take significant efforts toward using both internal and external sources of information.

2.2. Theoretical Review

2.2.1. The Stakeholders Theory

According to Mason (2017), the stakeholder theory of a company has posed a challenge to the conventional economic underpinning premise that a firm's primary objective should be profit maximization. Edward Freeman proposed it in 1984. The fundamental tenet of this idea is that organizations are responsible for acting in the best interests of all stakeholder groups (Mason, 2017). In other words, this view emphasizes the organization's social function and explains why organizations have a moral need to behave ethically. According to Van Puyvelde (2015), a stakeholder is "any individual or group that can claim an organization's attention, resources, or output, or who may be impacted by the organization." On the other hand, stakeholders are described as "any identified group or person who may influence or is impacted by an organization's accomplishment of its goals" (Mason, 2017). Other scholars have lately endorsed the idea, including (Ashwin et al., 2016), as well as Han, Bose, Hu, Qi, and Tian (2015). The idea is relevant to the present research because businesses' actions influence the whole environment in which they operate, which includes both the internal and external environments that comprise the stakeholders.

2.2.2. The Stewardship Theory

Donaldson and Davis developed the stewardship hypothesis in 1997. It is based on the belief that board members are seen as leaders; they are expected to exercise a high degree of responsibility, function as caretakers, and also serve as role models for the executive team (Hernandez, 2017). Their actions have a significant effect on a corporation's future.

From a leadership viewpoint, "stewardship was traditionally used to safeguard a kingdom when people in authority were abroad or, more often, to rule on behalf of an underage monarch" (Hernandez, 2017). According to several academics, agency theory is not the sole viable theory for evaluating a firm's ownership as well as control distinction (Hernandez, 2017). Stewardship theory has also been proposed as a possible explanation for the division of ownership and management between shareholders and managers (Fama & Jensen, 1983). Lin (2015), in a similar

spirit, recognized that not all managers are self-centred, as agency theory asserts, but rather see themselves as stewards of the company they serve (Lin, 2015).

2.2.3. Agency Theory

In 1973, Stephen Ross and Barry Mitnick proposed the agency hypothesis. With reference to Jensen and Meckling (1976), the separation of ownership and management in the majority of big businesses enables administrators to avoid bearing the financial costs of their actions. Separation of ownership and control of a business seems to be a precipitating element for the agency issue. In situations when controlling shareholders exist and secondary markets are less liquid, Vishny (2016) recommends using internal management control measures to safeguard minority owners. In this case, the board of directors is a viable alternative. According to La Porta, Lopez-de-Silanes, Shleifer, and Vishny (2017) investor protection are critical since dominant shareholders often expropriate minority stockholders and debtors.

2.3. Empirical Review

Chou and Johennesse (2021) examined the effect of board characteristics and ownership structures on strategic R&D investment choices. The empirical findings indicate that there are negative and statistically significant connections between CEO Duality, Board size (in large firms), Executive and Manager, Board of Directors and Top Block holders, ownership arrangements, and company R&D intensity.

Gosen (2020) presented fresh evidence that a positive connection exists between a firm's degree of R&D intensity and its anomalous stock return, based on more recent data. Additionally, businesses with a high degree of R&D intensity are more robust during periods of economic hardship.

Milkovich et al. (2019) investigated the impact of research and development on executive pay in big companies. Organizations with a high R&D intensity tended to have a higher base pay, a larger bonus pay, and greater relative eligibility for long-term incentive payments.

Muhammad, Muahmmad, Sadiq, Amanullah, and Muhammad (2019) investigated the connection between board qualities, ownership structure, development potential, and corporate risk-taking behaviour in Pakistan's publicly traded companies. Overall, the findings indicate that company size, board diligence, family ownership, ownership concentration, the presence of an independent director on the board of directors, and the overall number of independent directors on the board are all related to less risk-taking.

Rahman and Razali (2019) investigated whether adhering to the suggested board features of size, independence, and compensation had any impact on the performance of GLCs. The findings indicate that the Green Book is an excellent instrument for increasing the efficacy of the board's monitoring role. GLC's success is unaffected by compliance with board features such as size, independence, and compensation.

Chouaibi, Boujelbene, and Affes (2019) investigated the board of directors' characteristics and their participation in innovation activities from a cognitive viewpoint. The empirical evidence indicates that a large board of directors has a detrimental effect on the growth of innovative companies.

AlHares, Ntim, Hares, and Abed (2018) investigated the effect of board structure on risk-taking in OECD nations as assessed by research and development (R&D) intensity. The findings indicate that board meeting frequency and board size are both substantially and adversely associated with risk-taking as assessed by R&D intensity.

Watkins-Fassler and Rodríguez-Ariza (2019) examined the impact of Chief Executive Officers (CEOs) and board of directors' characteristics on international entrepreneurship. The results of a binary profit model indicate that family participation decreases the likelihood of pursuing overseas activities.

Yehong and Yucheng (2018) investigated the link between research and development and production. According to studies, businesses with technology leaders have a substantially higher R&D intensity, while companies with management executives have a lower R&D intensity.

3. METHODOLOGY

The study examined the effect of board characteristics on the research and development intensity of the listed food manufacturing firms in Nigeria. The Study adopted the agency theory and made use of an Ex- facto approach. Both descriptive and inferential statistics were carried out on the extracted data. The result gotten from the analysis served as the basis of the conclusion of the study. Secondary data was used in the study and was sourced from the annual reports of the selected firms for a period of 10 years $(2011 - 2020)$.

3.1. Model Specifications

To examine the effects of board features on the R&D strength of manufacturing companies in Nigeria, the study adapted the works of Di Vito and Laurin (2010), which initially used:

$$RDI = \beta_0 + \beta_1 BS + \beta_2 BI + \beta_3 DUAL + \beta_4 INDEP + \beta_5 FS + \beta_6 LEV + \mu \text{ where:}$$

RDI = research and development intensity.
BS = Board size.
DUAL = CEO duality.
INDEP = Board independence.
FS = Firm size.
LEV = leverage.

For the purpose of this study, the model would be adjusted to:

$RDI_{it} = \beta_0 + \beta_1 BS_{it} + \beta_2 LEV_{it} + \beta_3 INDEP_{it} + \beta_4 FS_{it} + \mu$

Where:
RDI = research and development.
BS = Board size.
INDEP = Board independence.
FS = firm size.
LEV = Leverage.
i = cross-section.
t = time.

3.2. Measurement of Variable

Table 1 presents the sets in computing the variables, these formulas are gotten from the works of (Sonnenfeld, 2020), and they include:

Table 1. Measurement of variables.

S/N	Indicator/unit of Measurement	Symbol	Explanation of Variable
1	Board Size (Independent variable)	BS	The total value is extracted from the governance report of the firm. (Sonnenfeld, 2020)
2	Leverage (Independent variable)	LEV	Total equity/total debt (Sonnenfeld, 2020)
3	Independence (Independent variable)	INDEP	Total board size / non-executive members
4	Research and development expenses (Dependent variable)	RDE	Value extractable from the notes to the account. (Sonnenfeld, 2020)
5	Firm size (Control variable)	FZ	The natural log total asset would be used

Table 2. Descriptive statistics.

TESTS	RDE	FZ	LEV	INDEP	BS
Mean	1.524	14.319	1.048	0.624	12.280
Median	0.068	14.288	0.999	0.636	12.500
Maximum	17.833	19.779	1.836	0.900	20.000
Minimum	0.001	7.982	0.759	0.100	6.000
Std. Dev.	3.210	3.906	0.230	0.145	2.745
Skewness	3.138	-0.083	2.159	-0.710	0.167
Kurtosis	14.573	1.419	7.198	3.985	2.971
Jarque-Bera	722.110	10.533	151.115	12.456	0.470
Probability	0.000	0.005	0.000	0.002	0.791
Sum	152.395	1431.875	104.771	62.345	1228.000
Sum Sq. Dev.	1020.333	1510.562	5.227	2.090	746.160
Observations	100	100	100	100	100

Table 2 shows the descriptive statistics of the research variables which include the mean, median, maximum and minimum values. As well as normality tests captured by the Jacque-bera.

4. ANALYSIS OF DATA AND INTERPRETATION OF RESULT

4.1. Descriptive Statistics.

The mean value of RDE is 1.5, for FZ it is 14.3, for LEV it is 1.0, for INDEP it is 0.6, and for BS it is 12.28. The median denotes the distribution's minimal value. This variable indicates the zone in which the entire distribution is cantered. The max variable indicates the distribution's maximum values. It emphasizes the distribution's maximum value. The skewness of the FZ and INDEP values shows that they are negatively skewed, while the RDE, LEV, and BS values are favourably skewed. This indicates that the FZ and INDEP values are below the average in the firm's distribution, while the RDE, LEV, and BS values are above the average. The kurtosis is positive, indicating that the distribution fits well. The Jarque-Bera test is used to determine the distribution's normality.

Table 3 shows the correlation analysis of the variables to see the relationship that exists between them as well as to check for multicollinearity.

4.2. Correlation Matrix

It demonstrates the strength of the link between the variables. According to Wisdom, Lawrence, Akindele, and Muideen (2018). multicollinearity exists when the correlation coefficient between the regressors is more than 0.8. As a consequence, Table 3 shows that there is no evidence of a strong connection.

Table 3. Correlation matrix.

	RDE	FZ	LEV	INDEP	BS
RDE	1	0.72	0.62	0.02	-0.21
FZ	0.72	1	0.24	-0.019	-0.17
LEV	0.62	0.24	1	0.14	-0.33
INDEP	0.02	-0.01	0.14	1	-0.39
BS	-0.21	-0.17	-0.33	-0.39	1

4.3. Hausman Tests

Table 4 presents the Hausman test. These tests were carried out for the various models to find which effect best fits the model; the decision rule states if the prob value is above 5% reject the null hypothesis hence, a random effect should be adopted if lower than 5% a fixed effect should be used.

Table 4. Hausman test.

Correlated Random Effects - Hausman Test			
Equation: Untitled			
Test cross-section random effects			
Test Summary	**Chi-Sq. Statistic**	**Chi-Sq. d.f.**	**Prob.**
Cross-section random	3.925177	3	0.2697

In line with the established decision rule, the panel regression model would be run using a random effect, due to the Prob value > 5%.

Table 5. Panel regression.

Dependent Variable: RDI				
Method: Panel Least Squares				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
BS	0.024902	0.009401	2.648957	0.0096
INDEP	0.102891	0.163318	0.630006	0.0304
FZ	0.406800	0.104861	3.879433	0.0002
LEV	0.400649	0.516027	0.776410	0.0396
C	3.324213	1.158922	2.868365	0.0052
Root MSE	0.389097	R-squared		0.696477
Mean dependent var	20.01309	Adjusted R-squared		0.655944
S.D. dependent var	16.42149	S.E. of regression		0.419575
Akaike info criterion	0.222555	Sum squared resid		15.13968
Schwarz criterion	0.587278	Log-likelihood		2.872272
Hannan-Quinn criter.	0.370165	F-statistic		18.75050
Durbin-Watson stat	1.543896	Prob(F-statistic)		0.000000

4.4. Panel Regressions

Table 5 shows the regression table containing the results. BZ and FZ are statistically significant since they have P-values less than 5% and T-statistics greater than 2. According to the panel OLS, LEV has a negative correlation with RDI, but FZ, INDEP, and BS have a positive correlation with RDE, this was similar to the findings of Gosen (2020). R squared has a coefficient of determination of 79 per cent, with an adjusted R-square of 75 per cent. This indicates that 75% of the variation in the dependent variable (RDE) is due to variation in the independent variables (BS, FZ, INDEP, LEV). The F-statistic is 18.75050, which indicates that the variables are well fitted at a probability of 0.000000. Durbin-Watson's statistic value of 1.54 indicates that there is no evidence of autocorrelation.

5. CONCLUSION AND RECOMMENDATION

The study concludes that there is a positive significant relationship between board characteristics mechanisms and research and development of the listed food-manufacturing firms in Nigeria, this conclusion is in line with Rahman and Razali (2019); Milkovich et al. (2019) and Gosen (2020). This study recommends that the manufacturing firms should not overlook the effect research and development have on the value creation of the firms. The firm should incorporate the need for value creation and innovation when appointing members of their board and structuring other corporate governance mechanisms, this would give the members a clear direction when considering the importance of research and development. The study also recommends that the firms should take create policies and research centres that are properly funded to ensure continuous growth in the possibilities archivable through R&D.

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