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The Board of Directors' Influence on the Intellectual Capital of Nigeria's listed firms

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Abstract
Companies have to do a lot of work right now to keep track of their intellectual capital. Intellectual capital is the most valuable thing a business can own. Because of this, it is very important to know how they treat the people who make this asset. From a business point of view, companies may not share this information to lower the costs of competition. But the Value-Added Intellectual Capital Score is what we use because it is based on research. We look at the intellectual capital of 112 listed Nigerian companies over a period of 10 years to figure out what role the board of directors' plays in making intellectual capital work. According to the Stakeholders' Theory, the way Nigerian companies talk about intellectual capital issues depends on the size of the board, the independence of directors, the gender of directors, and how much equity they own. The article helps improve intellectual capital. Since the study was done on listed companies in Nigeria, more research is needed to find out more about how the board of directors and intellectual capital are related. One of the problems with this research is that it does not take into account other things about boards, like their nationality, pay, etc. This study gives more proof of how board and IC work together in Nigeria. Size of the board, independence of the board, gender of directors, and the number of shares owned by directors all have an impact on a company's intellectual capital, we have found. Factors such as a firm's size, length of public trading, and debt load all have an impact on its intellectual capital. We think that shareholders and regulators should reduce the number of board members, non-executive directors, and directors who own stock in the companies. But we think that more women should be hired as directors.

Keywords
board characteristics, the board of directors, intellectual capital, listed firms, Nigeria

Introduction

It is true that Nigerian companies do not use their intellectual capital (IC) assets as well as they could. A recent study (Yahaya & Lamido, 2022) found that 44 of the 156 quoted companies on the Nigerian Exchange Group are suspended for a variety of reasons, such as failing to meet listing criteria or failing to file regulatory documents on time. These and other things are signs that IC assets are not being used well. Poor intellectual capital is also a clear reason why Nigeria does not have enough oil and gas resources, a problem that seems stubborn. Even though oil and gas companies that do exploration and development may not be the source of the problem in the industry right now, there is a clear problem with how petroleum resources are moved and sold.

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IC is the total value of a company's employees' knowledge, skills, training, and other abilities that give the company a competitive edge. It is the result of mental processes that create a set of intangible assets that can be used to make money and create wealth. These assets are a reflection of the skills of the employees. So, it is clear that an organization's intellectual capital is the total value of all its intangible assets. It includes the firm's employees, its buildings, and any other capital that the company has. It gives companies that have a lot of it an edge over those that do not. It is what made Microsoft Corp., Alphabet Inc. (Google), Toyota, Honda, General Motors, Ford Motors, Cola-Cola, Apple, The Amazon, Tesla, Volkswagen Motors, BMV Motors, Berkshire Hathaway Inc., Meta Platforms Inc., etc. so big and successful in the business world. It is the difference concerning economies that have grown and those that have not.

Given all of the benefits that come from making good use of intellectual capital assets, it is natural to wonder what companies in developing countries should do. Although there is a wide variety of strategies accessible to corporate executives, this paper will concentrate on the part played by the board of directors in assuring the most effective application of intellectual capital. How does the number of directors on a board affect the availability of ideas? How does the freedom of the board affect the allocation of scarce intellectual resources? What effect does the gender of people on a board have on intellectual capital? Lastly, what does it mean for intellectual capital when the board owns equity shares? In this research, these are the research questions that are being looked into.

Another well-established fact is that a company's board of directors (BOD) serves as its corporate governance (CG) structure, whose job it is to guide the company in the achievement of its objectives. As the highest level of decision-making in a corporation, it is appointed or elected by the shareholders. The board of directors, who are responsible for the day-to-day operations of the company, holds frequent meetings to examine management's performance. Accordingly, every publicly traded company must have a board of directors. In most cases, this group consists of shareholders' representatives. While there is no legal requirement for non-profits to have a board of directors, realistically speaking, it is impossible to conceive of a functioning organization without at least some kind of governing body.

The board of directors is accountable to its shareholders for safeguarding the business by setting policy, supervising management, and deciding critically important matters. The board's responsibilities may include, but are not limited to, formulating dividend policies, selecting and dismissing the company's top executives, determining executive compensation, backing the executives' teams, overseeing resource management, and establishing the company's overarching objectives. Although there are many factors to consider when evaluating a board of directors, this study focuses on board size (BSIZ), independence (BIND), gender (BGND), and ownership (BESO). Executive directors, independent directors, and the chief executive officer all make up the board's total membership. The ratio of independent board members to total board members is a measure of board independence. The gender makeup of a board indicates how many women are represented there. Finally, the number of equity shares held by board members is referred to as their "board shares ownership."

Various government agencies in Nigeria, including the Securities and Exchange Commission, the Financial Reporting Council of Nigeria, the Central Bank of Nigeria, and the Nigerian Deposit Insurance Corporation, will benefit from the study's findings. Shareholders, who are responsible for electing the board of directors, can also benefit from the research. Investors will have the option of increasing their current stake or selling out entirely. Different from other efforts and adding to the existing body of knowledge, the results of this study should be commended. The rest of this paper will discuss the background, hypotheses, methodology, results, discussion, and recommendations.

Literature Review and Hypotheses

Conceptual, empirical, and theoretical writings are done here. In this paper, we will go over the board of directors, intellectual capital, and control factors in detail. The term "board of directors" will be used throughout this article to refer to four distinct categories of board makeup: board size, independence, gender balance, and equity ownership. The term "board size" refers to the total number of board members, including the CEO, executive directors, and non-executive directors. The percentage of independent directors on a board is a proxy for the board's level of autonomy. To put it another way, the higher the positive number, the more effective the board. Women's representation on the board is evaluated relative to the total number of board members. Women are regarded as more disciplined and intellectually capital-friendly than men. Directors' ownership of ordinary shares, expressed as a percentage, is referred to as "board ownership."

In this research, we postulate that the board of directors helps to increase the company's intellectual capital. The paper makes this connection concerning the features of the board of directors and intellectual capital. In this context, "intellectual capital" refers to intangible assets that a company possesses and uses to generate profits. Expertise of personnel, processes, information and abilities, and experiences gathered over time are all examples of such assets. There are many who refer to it as "the magic wand" of the company. When a company pools its' employees' expertise and resources, the result might be substantial. It gives the company an advantage over rivals in the market.

Different sectors and companies have different average sizes for the control variables. The size of a company is typically quantified in terms of its assets, equity, or employee count in the business world. The company's size is a major consideration while designing a model. Everything about a company's finances, intellectual capital, business value, capital structure, etc. is dependent on the size of the company. The age of the company's listing on stock exchanges is also a significant factor in its level of intellectual capital. Companies that are publicly traded have a higher incentive to spend money on R&D and other sources of intellectual capital since they must grow their business to meet the demands of their shareholders. Finally, gearing or debt, which go by the name leverage or gearing, is a prominent driver of practically all dependent variables in empirical works. As such, it serves as a measure of the extent to which a company is owing to its various creditors. In general, a company's ability to invest in intellectual capital declines as its debt load rises.

Empirically, der Zahn and Mitchell (2004) tested the link concerning gender diversity and IC of 84 firms in South Africa. The findings indicated a positive link concerning the female directors and IC. Further, Cerbioni and Parbonetti (2007) scrutinized the relationship concerning corporate governance and IC among European biotechnology corporations. They concluded that independent directors are positively related to IC. The connection concerning corporate governance and IC of 100 UK firms was examined by Li et al. (2008). They reported substantial link concerning board independence and IC. Also, Safieddine et al. (2009) studied the relationship concerning IC and corporate governance at the American University of Beirut. The verdicts suggested that both are indeed linked and that faculty members viewed the board of directors as a major factor for IC attraction.

Using data from the Nairobi Stock Exchange for 26 companies in 2002 and 2003, Abeysekera (2010) investigated the effect of board size on IC. According to his account, there is a beneficial relationship concerning the two. Additionally, the impact of corporate governance on IC was empirically examined by Hidalgo et al. (2011). They discovered a correlation concerning a more robust board and higher levels of IC. The relationship concerning the boards of directors and IC at 147 banks in the Gulf Cooperation Countries concerning 2008 and 2010 was investigated by Al-Musalli and Ismail (2012). Board autonomy was found to be inversely related to IC. They discovered, however, that board size had no bearing on IC.

Haji and Ghazali (2013) surveyed the influence of corporate governance and its influence on IC in Malaysia in 2008 and 2010. They reported that board size and independent directors are significant in explaining IC. However, directors' equity ownership was found to be negatively related to IC. Also, Ibikunle and Damagum (2013) studied whether or not board characteristics have impacts on IC. The verdicts revealed that board independence and board gender diversity are non-significant in predicting IC. However, board size and firm size were found to be relevant contributors to the variation in IC. Ishak et al. (2013) tested the influence of the board on IC in 137 banks in Gulf Cooperation Countries. They reported an affirmative link concerning the board and IC.

Wang (2013) researched the importance of corporate governance and IC in the ICT sector in Taiwan. The findings demonstrated a connection concerning IC and board size and female directors. Furthermore, Mubaraq and Ahmed (2014) analyzed the impact of corporate governance on IC in the Nigerian banking sector over a four-year period (2006-2009). Board size and the presence of independent, non-executive directors are two key components of effective corporate governance. According to the findings, an independent board significantly increases the likelihood of IC. Verdicts showed that governance had a significant impact on at least one of the IC components. In addition, there is a significant positive correlation concerning IC and size, which can be used as a control variable. From 2004-2009, Rasmini et al. (2014) analyzed the correlation concerning board characteristics and IC at 33 financial services firms listed on the Indonesian Stock Exchange. The verdicts indicated that gender equality affects the value of companies' intellectual property. Equally as important, the findings demonstrated that the percentage of outside directors has no bearing on the company's IC. When controlling for other factors, firm size also has a positive effect on IC.

Appuhami and Bhuyan (2015) analyzed 300 firm-observations to learn how corporate governance affects IC at leading companies in Australia's service sector. They found a strong correlation concerning IC and the presence of independent, non-executive directors. No correlation concerning board size and performance was discovered. In their investigation of IC in Bangladesh, Muttakin et al. (2015) also explored the link concerning corporate governance and IC. Independent board members were found to have a positive effect on a company's IC, according to the study's authors. To further investigate the effect of board characteristics on IC, Piri and Nathegian (2015) analyzed 92 companies traded on the Tehran Stock Exchange concerning 2004 and 2012. No statistically significant relationship concerning board size and independence and IC was found. Mahmudi and Nurhayati (2015) tested 31 publicly traded banking companies (or 155 firm research observations) concerning 2008 and 2012 to draw conclusions about board composition and IC. The findings demonstrated a causal relationship concerning IC and board features like the proportion of independent board members.

When it comes to Thai non-financial companies listed on Thai stock exchanges in 2014, Attarit (2016) investigated the connections concerning IC and company performance. The verdicts of the study demonstrated a correlation concerning the size of the board of directors and the availability of IC. When it comes to publicly traded banks in Bangladesh, Bhattacharjee et al. (2017) investigated the relationship concerning IC and corporate governance. According to the findings of this research, board size is a significant contributor to the understanding of IC. The researchers also found no link concerning IC and independent directors. Kamardin et al. (2017) tested the correlation concerning corporate governance and IC at 55 publicly quoted Malaysian companies concerning 2006 and 2011. They came to the conclusion that independent directors are beneficial to the company's IC. What's more, they found that large, highly leveraged corporations are the ones with the most IC. Research conducted by Rodrigues et al. (2017) tested the relationship concerning the board of directors and IC at 15 publicly traded Portuguese companies operating concerning 2007 and 2011. Investment in IC was cited as a reason for the expansion of the board of directors and the company as a whole. A decrease in IC has been linked to an increase in the number of independent directors. Tejedo-Romero et al. conducted research to examine

the role of women on corporate boards and the impact they have on the company's IC (2017). In their study, they discovered a strong link concerning gender and IC.

Alfraih (2018) looked at companies listed on the Kuwait Stock Exchange to determine how corporate governance affected their levels of IC. The verdicts indicate that corporate governance has a major effect on IC. Al-Sartwi (2018) investigated the link concerning corporate governance and IC in a sample of 274 firms based in the Gulf Cooperation Council. Researchers discovered a negligible impact of corporate governance on innovation capital. Esmaeili et al. investigated the effect of board governance on the intangible assets of companies trading on the Tehran Stock Exchange concerning 2009 and 2011. (2018). A positive correlation concerning board governance and IC was discovered. IC is also significantly impacted by board independence and company size. Tulung et al. conducted research into how corporate governance affected the IC of sixty-two private banks in Indonesia (2018). An independent commissioner was found to have a significant and beneficial effect on the firm's IC.

For the period of 2002-2014, Buallay et al. (2019) collected 489 observations by studying the correlation concerning the degree of board independence and the level of IC at 171 Saudi Arabian publicly traded companies. Independent board members were found to have a beneficial effect on a company's IC. For the years 2013–2017, Dey and Faruq (2019) studied 30 companies in Bangladesh, referred to as DS30 companies, to learn more about IC and the factors that affect it. Having an impartial board of directors is found to have a significant positive effect on innovation performance in this paper. Conversely, there is a negative correlation concerning IC and gender diversity on boards. However, our analysis does not indicate that board size, leverage, or firm size significantly affect IC. In addition, Hatane et al. (2019) tested the effect of corporate governance on IC in Indonesia and Malaysia by focusing on the consumer goods sector from 2010 to 2015, with a total of 25 companies (150 firm-years) in Indonesia and 106 firms (636 firm-years) in Malaysia. The verdicts in Indonesia were positive, but the verdicts in Malaysia were negative. The size and independence of boards have little effect on IC in Indonesia, but they do in Malaysia.

Using data from the National Stock Exchange of India, Kamath (2019) analyzed the effect of corporate governance on the IC of 95 companies over the seven-year period 2010-2011 to 2016-2017. The verdicts of the study showed conclusively that CG do affect the IC of India's large-cap firms. More importantly, it seems that board size and director independence have the greatest effects. IC of large-cap companies is inversely related to the size of their boards. There is a significant inverted-U relationship concerning board size and the capital efficiency spent. The study by Rahman et al. (2019) tested the 2016-2017 trends and drivers of IC in Bangladesh's pharmaceutical and chemical industry. Firm size and leverage are found to be positively correlated with IC. There is no statistically significant link concerning IC and either independent directors or female directors, according to the verdicts of this study. Saruchi et al. also analyzed the impact of board characteristics on IC in Pakistani commercial banks (2019). The verdicts show that both larger boards and more diverse boards improve IC. Shahzad et al. (2019) tested the effect of women's presence on corporate boards on IC at 5,879 US companies. In other words, the authors conclude that there is a link concerning the two.

From 2014 to 2019, Abdulkarim et al. (2020) analyzed annual reports from GCC-listed firms to determine the effect of board characteristics on IC. Evidence suggests that larger boards generate more IC. For 86 banks traded on the Gulf markets over a (5) five-year period, Aljuaidia (2020) investigated the connection concerning the board of directors and IC (2014 to 2018). Findings indicate a robust positive correlation between board size and IC. From 2008-2017, Aslam and Haron (2020) analyzed the impact of corporate governance on IC in 129 Islamic banks from 29 OIC member countries. The findings indicated that CG measures do explain the breadth and depth of IC, particularly board size and non-executive directors. For the years 2012-2016, Dalwai and Mohammadi (2020) looked into the connection concerning IC and corporate governance at 31 publicly traded firms in Oman's financial sector. According to the verdicts, boards that are larger in terms of membership tend to have greater IC.

Dashtbayaz et al. (2020) analyzed the impact of corporate governance on IC at 132 firms listed on the Tehran Stock Exchange concerning 2013 and 2016. The verdicts showed that an independent board has a negative effect on IC. The authors also found that independent boards were associated with higher levels of human capital. Mardini and Lahyani (2020) investigated the impact of corporate governance on IC at non-financial SPF-120 French listed firms This research finds that gender diversity in corporate governance has an impact on IC. Nadeem (2020) looked at IPO brochures from 2009-2017 in China to see how board gender diversity affected IC. According to the data, there is a positive correlation concerning BGD and IC, female independent directors have a negative effect on IC, and businesses with two or more women on their boards have a stronger BGD–IC correlation.

Tran et al. (2020) looked at 45 publicly traded Vietnamese companies, analyzing their corporate governance and IP from 2011-2018. There are negative effects of corporate governance traits on IC, according to the data. Vitolla et al. (2020) conducted research into the relationship concerning boards of directors and IC. They found a positive correlation concerning IC and board size, independence, and gender. Also, during the years 2015-2018, Widiatmoko et al. (2020) looked into the impact of corporate governance on the IC of companies included in the Indonesian Corporate Governance Forum (FCGI). The findings indicated that good corporate governance increases IC.

During the years 2015-2019, Ali and Oudat (2021) analyzed the connection concerning board characteristics and IC at seven Bahraini commercial banks. They discovered that IC was significantly correlated with board size, independence, and firm size. In any case, there was no discernible difference in board performance based on gender. Asare et al. (2021) analyzed the board structures and IC of 366 banks in 26 African countries. Independence of the board of directors is inversely related to the amount of IC a company has. It was also found that bank IC is independent of board size and gender diversity. For their study, Chandraratne et al. (2021) looked at 30 non-financial companies listed on Sri Lanka's Colombo Stock Exchange, and they analyzed the relationship concerning board characteristics and IC. The findings suggested that a greater representation of women on boards would increase a company's IC. Firm leverage was found to significantly reduce IC.

Herli et al. (2021) used large and small capital firms in Indonesia to compare the effect of the board of directors on IC. They discovered that while gender did not play a role in the success of large-capital firms, it did play a role in the success of small-capital ones. Indonesian researchers Kusumawardani et al. (2021) looked into the link concerning board diversity, autonomy, and IC. From 2008-2017, 323 non-profits across 7 industries were analyzed for their public listing performance. Researchers found that larger boards had a positive, statistically significant effect. Board dynamics and IC in Mauritius: a study by Mooneeapen et al (2021). From 2014 to 2017, they analyzed data from 120 firm years of companies trading on the New York Stock Exchange. IC is inversely related to board independence and positively related to board gender diversity. An inverse correlation concerning IC and board size was not observed. Scafarto et al. analyzed the correlation concerning board traits and IC at 113 nonfinancial firms trading on the Italian Stock Exchange concerning 2011 and 2016. (2021). Findings were inconsistent, as shown by the data.

Using a sample of 903 firms over the course of a year from the Tehran Stock Exchange and a sample of 280 firms over the course of a year from the Iraq Stock Market, Shaval and Rouhi (2021) analyzed the connection concerning board characteristics and the IC of companies trading on the Iranian and Iraqi stock markets concerning 2012 and 2018. The findings demonstrated a strong correlation concerning board make-up and IC. In contrast to Iran, where a positive and statistically significant correlation concerning board independence and IC has been found, this correlation is negative in Iraq. Smriti and Das (2021) analyzed 272 Indian companies listed on the National Stock Exchange concerning 2007 and 2019 to find out how gender diversity on boards affected the companies' IC. The study found that having more women in leadership roles greatly improved VAIC. From 2014-2019, Oktaviana and

Setiawan (2022) analyzed the impact of board characteristics on IC at Islamic banks in Indonesia, Malaysia, and Bangladesh. Board size had no effect on IC at Islamic banks in Indonesia, Malaysia, and Bangladesh, but gender diversity did.

In light of the aforementioned reviews of the empirical literature, the following hypotheses are put forward:

H_1: Board size is related to IC

H_2: Board independence is associated to IC

H_3: Board gender is linked to intellectual capital

H_4: Board equity ownership is interrelated with intellectual capital

This paper's theoretical foundation is the Agency Theory. The company's board of directors and shareholders entrust management with the company's intellectual property. Shareholders establish the board of directors, while management uses intellectual capital to further the company's mission.

The Methodology

This article uses Agency Theory to outline a framework for the interplay concerning the board of directors and intellectual property. The terms "board of directors" and "intellectual capital" are used; the former refers to factors such as board size, independence, gender, and equity ownership, while the latter includes the efficiency of employed capital and human and structural capital. We used a relational research strategy for this investigation. There are 156 companies represented by active quotes on the floor of the Nigerian Exchange Group. After excluding 44 companies that had been suspended due to violations of listing criteria, delisting proceedings, and other factors, the final sample size was 112 for 2012 through 2021. We carefully select each piece of information from yearly reports and accounts. Hypotheses are examined using panel multiple regression with controls for factors such as company size, leverage, and listing age. Modifications were made to the model from Tran et al. (2020) to account for the presence of control variables.

$$INCP_{i,t} = \beta_0 + \beta_1 BSIZ_{i,t} + \beta_2 BIND_{i,t} + \beta_3 BGND_{i,t} + \beta_4 BESO_{i,t} + \beta_5 LAGE_{i,t} + \beta_6 FSIZ_{i,t} + \beta_7 LEVG_{i,t} + \varepsilon_{i,t}$$

Whereas:

INCP = Intellectual capital is the sum of human, structural capital and capital employed efficiency (Wang, 2013; Yahaya, 2019).

β_0 = Constant.

$\beta_{1\text{-}7}$ = Coefficients.

BSIZ = Board size (total number of directors, Hatane et al., 2019).

BIND = Board independence (number of non-executive directors divided by board size, Shaval & Rouhi, 2021).

BGND = Board gender diversity (number of female directors divided by board size, Chandraratne et al., 2021; Mooneeapen et al., 2021; Smitri & Das, 2021).

BESO = Board shareholding (shares held by directors divided by the numbers of shares, Shaval & Rouhi, 2021).

LAGE = Years of listing (number of years a company is quoted, Ali & Oudat, 2021).

FSIZ = Firm size (natural log of total asset, Ali & Oudat, 2021).

LEVG = Leverage (total liabilities over total assets, Chandraratne et al., 2021).

ε = Error term

i, = Firm script (112)

t = Time script (10)

The Findings

This section of the article presents the article's empirical findings. Therefore, descriptive statistics for the model variables are provided in Table 1.

Table 1
Descriptive Statistics

Variable	Obsv.	Mean	Std. Dev.	Minn	Maxm
INCP	1,120	7.995	4.674	.37	37.07
BSIZ	1,120	8.971	2.729	4	16
BIND	1,120	59.435	18.042	0	90
BGND	1,120	9.069	7.846	0	30
BESO	1,120	12.545	19.758	0	78.2
LEVG	1,120	77.772	24.72	31.53	247.85
LAGE	1,120	26.75	11.586	12	48
FSIZ	1,120	7.717	.529	5.97	9.03

Source: STATA 14

Table 1 shows the number of observations is 1120 (112 x 10). The figure is the same for the variables suggesting that the data is balanced for all the variables. Intellectual capital averages 7.995 with a standard deviation of 4.674 and ranges concerning .37 and 37.07. Similarly, board size averages 9 with a standard deviation of 3 and ranges concerning 4 and 16. Board independence averages 59% with a standard deviation of 18% ranges concerning 0% and 90%. It means that some organizations do not have non-executive directors, which is against the law. In terms of female directors, Table 1 indicates that it averages 9% with a standard deviation of 8% and ranges concerning 0% and 30%. Again, it means that some organizations do not have female directors on board at all. Also, board share ownership averages 12.5% with a standard deviation of 20% and ranges concerning 0% and 78%. This indicates that the standard deviation is high because it is greater than the average. On the control variables, Table 1 shows that leverage averages 78% with a standard deviation of 25% and ranges concerning 32% and 248%. These figures confirm that Nigerian corporations are highly geared. Listing age averages 27 years with a standard deviation of approximately 12 years and ranges concerning 12 years and 48 years. These figures confirm that the listing age is within the correct period. Finally, firm mass averages 7.7 with a standard deviation of .529 and ranges concerning 5.97 and 9.03. Table 2 is a connection milieu.

Table 2
Link Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) INCP	1.000							
(2) BSIZ	0.040	1.000						
	(0.690)							
(3) BIND	-0.115	-0.089	1.000					
	(0.246)	(0.368)						
(4) BGND	0.142	-0.119	-0.119	1.000				
	(0.150)	(0.230)	(0.230)					
(5) BESO	0.063	-0.141	0.130	0.220*	1.000			
	(0.525)	(0.155)	(0.190)	(0.025)				
(6) LEVG	-0.214*	-0.131	-0.462*	0.205*	-0.167	1.000		
	(0.029)	(0.185)	(0.000)	(0.037)	(0.089)			
(7) LAGE	0.210*	-0.020	0.098	0.386*	0.211*	-0.110	1.000	
	(0.033)	(0.841)	(0.320)	(0.000)	(0.032)	(0.266)		
(8) FSIZ	0.154	0.623*	-0.127	0.110	0.042	-0.070	0.294*	1.000
	(0.120)	(0.000)	(0.200)	(0.264)	(0.672)	(0.480)	(0.002)	

**** p<0.01, ** p<0.05, * p<0.1*
Source: STATA 14

The results in Table 2 shows that board size is positively (.040) related to the intellectual capital, though not significant (.690). However, it shows that board independence is negatively (-.115) related to intellectual capital (.246), but also not significant. Table 1 shows that board gender is positively (.142) related to intellectual capital (.150) but not significant. Similarly, it shows that board ownership is

positively (.063) related to intellectual capital but not significant (.525). By implication, it means that all measures of board of directors in this study are not significant. On the control variables, leverage is negatively (-.214) related to intellectual capital but significant (.029). However, listing age has positive (.210) and significant (.033) impact on intellectual capital. Finally, firm size has positive (.154) and insignificant (.120) impact on intellectual capital. Table 3 presents the results of OLS regression in order to the authors test regression diagnostics.

Table 3
OLS Regression Results

INCP	Cof.	St.Er.	t-val.	p-val.	[95% Co	Interval]	Sig
BSIZ	-.13	.22	-0.59	.556	-.567	.307	
BIND	-.07	.028	-2.49	.014	-.126	-.014	**
BGND	.073	.064	1.13	.262	-.055	.201	
BESO	-.007	.024	-0.30	.764	-.054	.04	
LEVG	-.068	.021	-3.21	.002	-.11	-.026	***
LAGE	.051	.045	1.15	.254	-.037	.14	
FSIZ	.814	1.169	0.70	.488	-1.508	3.135	
Constant	10.368	8.314	1.25	.215	-6.135	26.87	
R^2		0.161	Number of obsv.			1,120	
F-test		2.632	Prob > F			0.016	

**** p<.01, ** p<.05, * p<.1*
Source: STATA 14

Table 3 is intended to serve as a starting point for conducting regression diagnostics, thus no additional explanation is necessary. The first diagnostic test for regression in this study is the non-standard and important data test. In Figure 1, we can see the obtained outcomes.

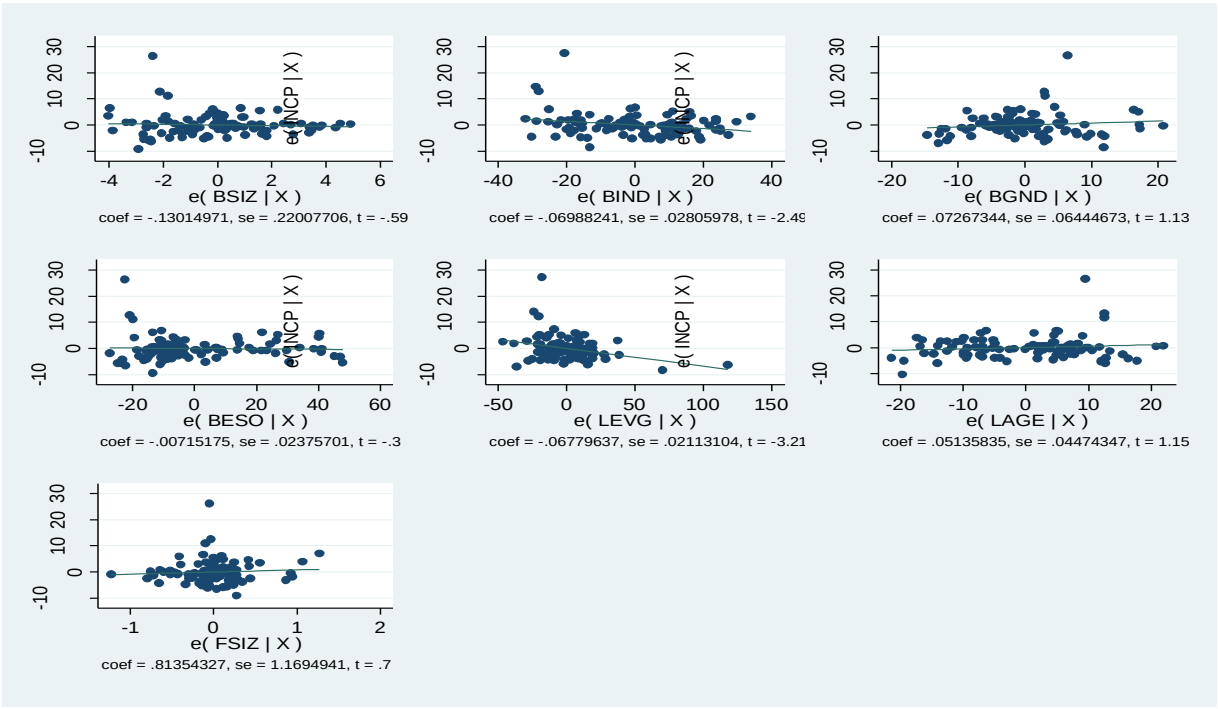


Figure 1: Unusual and Influential Data Test
Source: STATA 14

Closer inspection of the graph reveals that the majority of the information is normally distributed. As a result, there does not appear to be any unusually influential data. The normality test for residuals is shown in Table 4.

Table 4
Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
e	1,120	0.969	2.662	2.177	0.015

Source: STATA 14

Data in Table 4 indicates that the residual is not regularly distributed. That's why we have to do certain data transformations. Table 5 displays the outcomes of possible transformations to normalize the data.

Table 5
Options for Transformation of Data for Normality of Residual

Transformation	formula	chi2(2)	P(chi2)
cubic	e^3	13.41	0.001
square	e^2	2.61	0.272
identity	e	10.40	0.006
square root	sqrt(e)	33.87	0.000
logarithm	log(e)	68.34	0.000
1/(square root)	1/sqrt(e)	.	0.000
inverse	1/e	.	0.000
1/square	1/(e^2)	.	0.000
1/cubic	1/(e^3)	.	0.000

Source: STATA 14

According to Table 5, the residual can be transformed into a regularly distributed distribution by squaring it. Like we said before, this number is used to guarantee that the model is BLUE. To prevent unstable coefficients and inflated standard errors, a multicollinearity test should be conducted. The results of a multicollinearity test based on an inflated variance component are shown in Table 6.

Table 6
Checking Multicollinearity Results

Independent and Control Variables	V.I.F.	1/V.I.F.
FSIZ	2.001	.5
BSIZ	1.889	.529
LEVG	1.429	.7
LAGE	1.407	.711
BIND	1.342	.745
BGND	1.339	.747
BESO	1.154	.867
Mean VIF	1.509	

Source: STATA 14

According to Table 6, there is no evidence of multicollinearity. The results of a test for homoscedasticity of the residual are shown in Table 7.

Table 7
Cameron & Trivedi's decomposition of IM-test

Source	chi2	df	p
Heteroskedasticity	44.110	35	0.139
Skewness	12.230	7	0.093
Kurtosis	1.200	1	0.273
Total	57.530	43	0.068

Source: STATA 14

According to Table 7, the model is homoscedasticity since the p-value is not statistically significant (p =.139). The results of our equality tests for linearity are shown in Figure 2.

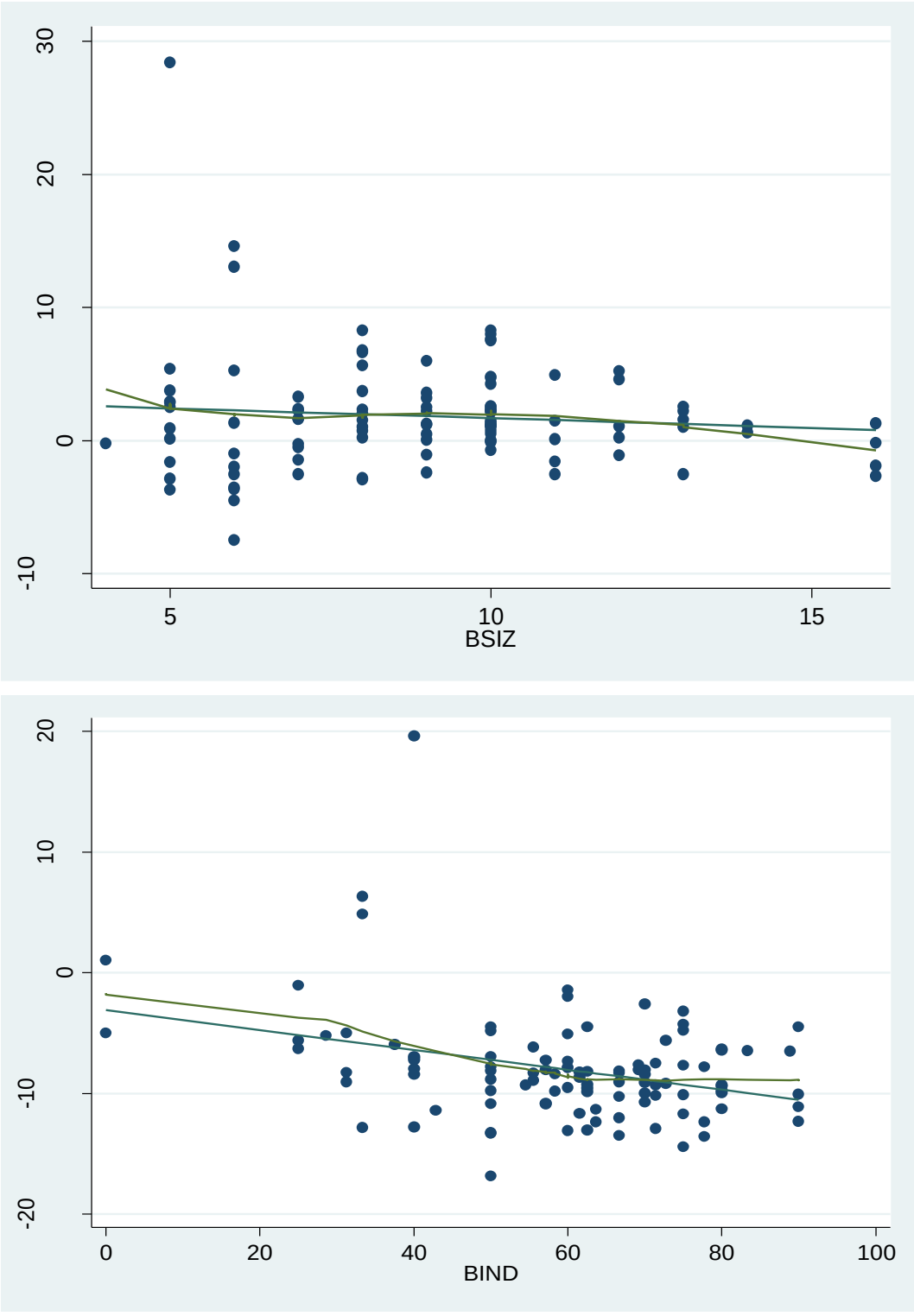
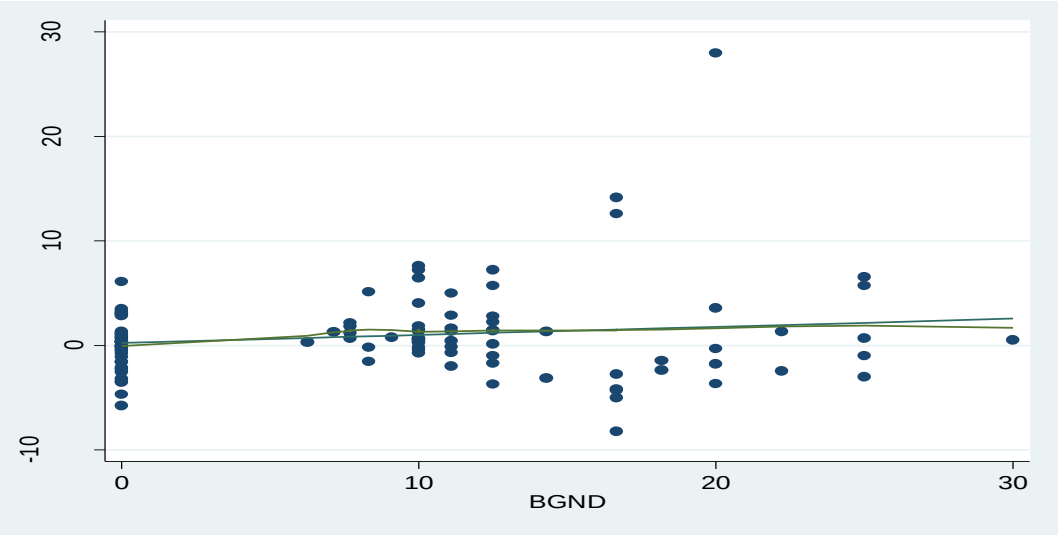


Figure 2a: Checking for Linearity
Source: STATA 14



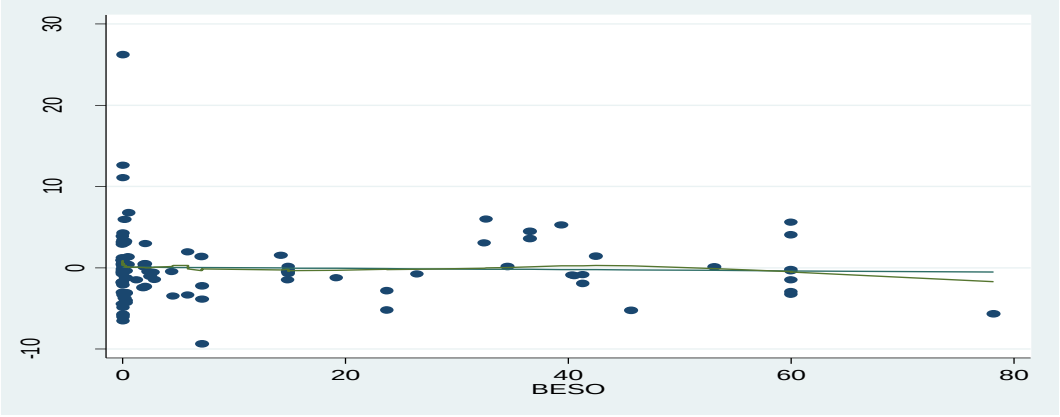


Figure 2b: Checking for Linearity
Source: STATA 14

If you take a quick look at the graphs, you can see that they are not perfectly linear. The evidences, however, are too small to seriously challenge the model. We also check to see if the number of variables in the model is adequate, or if more need to be added or removed. The results are shown in Table 8.

Table 8
Model Specification Test Results

Source	SS	d f	MS	Number of OBS = 104		
Model	386.544	2	193.272	Prob>F = .000		
Residual	1863.812	101	18.454	R-squared = .172		
Total	2250.356	103	21.848	Root MSE = 4.296		
INCP	Coef.	Std.Err.	t	P>t	95%	Interval]
_hat	-0.187	1.061	-0.180	0.860	-2.291	1.917
_hatsq	0.080	0.070	1.150	0.255	-0.059	0.219
_cons	4.092	4.024	1.020	0.312	-3.890	12.075

Source: STATA 14

Since P>t for hatsq =.255, we know there is no error in the model specification. When trying to figure out if there is a mistake in the model specification, the omitted variable test is the last step. Results are summarized in Table 9.

Table 9
Omitted Variable Test

Ramsey RESET test using powers of the fitted values of INCP
Ho: model has no omitted variables
F(3, 93) = 0.87
Prob > F = 0.4599

Source: STATA 14

Data in Table 9 does not support the hypothesis of a model specification error. Therefore, it is likely that the model of the paper is correctly specified. Due to the panel nature of the data used in the paper, we also perform a panel effect test to determine the best model for conducting the final analysis. The p-value for the panel effect is not statistically significant, so these findings dismiss this possibility. For this reason, we present the model's results using ordinary least square regression. The final model results are shown in Table 10.

Table 10
Final Ordinary Least Square Results

INCPR	Cof.	St.Er.	t-val.	p-val.		Sig
BSIZ	-2.32	.24	-9.65	.000		***
BIND	-1.167	.031	-38.07	.000		***
BGND	1.143	.07	16.23	.000		***
BESO	-.124	.026	-4.80	.000		***
LEVG	-.941	.023	-40.76	.000		***
LAGE	.821	.049	16.80	.000		***
FSIZ	10.992	1.277	8.60	.000		***
Constant	115.163	9.081	12.68	.000		***
R^2		0.973	Number of obvs.		1,120	
F-test		493.723	Prob > F		0.000	

**** p<.01, ** p<.05, * p<.1*

Source: STATA 14

The size, independence, and share ownership of the board all have a negative effect on intellectual capital, as shown in Table 10. The gender composition of boards, however, has a positive and statistically significant impact on the value of intellectual property. Based on these findings, we accept all four hypotheses. The result is consistent with the research of Hatane et al. (2019) and Shaval and Rouhi (2019) when considering board size. Results for board independence and equity ownership are consistent with those found in studies by authors such as Al-Musalli and Ismail (2012), Rasmini et al. (2014), Tejedo-Romero et al. (2017), Dashtbayaz et al. (2020), Asare et al. (2021), Mooneeapen et al. (2021), and Shaval and Rouhi (2019). It is consistent with studies by der Zahn and Mitchell (2004), Kamath (2019), Shahzad et al. (2019), Dalwai and Mohammadi (2020), Abdulkarim et al. (2020), Mardini and Lahyani (2020), Vitolla and colleagues (2020), Mooneeapen and colleagues (2021), Smitri and Das (2021), and Oktaviana and Setiawan (2021) regarding the impact of gender on intellectual capital (2022). Listing age and firm size both have a positive and significant effect on intellectual capital, which serves as a control variable. This finding is consistent with the findings of Ramini et al. (2014), Rodriques et al. (2017), Esmaeili et al. (2018), Rahman et al. (2019), and Ali and Oudat (2021). However, there is strong evidence that leverage reduces the value of intellectual capital. It is consistent with the findings of Chandraratne et al. (2021). Furthermore, the Model's Prob>F is statistically significant, which indicates that the model is fit. An R^2 of 97.3% indicates that the independent and control variables together account for 97.33% of the variance in IC.

Conclusion and Recommendations

The aim of this piece is to analyze how Nigerian publicly traded companies' boards of directors affect their intangible assets. We conclude that factors like the number of directors, their gender, their level of independence from management, and the number of shares they personally own all play a role in a company's intellectual capital. How long a company has been publicly traded, how large the company is, and how much debt the company has all have an impact on its intellectual capital. We suggest that shareholders and authorities cut back on the number of directors, particularly non-executive ones, and on the amount of equity held by directors. However, we suggest that more women join the board of directors through recruitment or appointment. Experience has shown that the control variables are important, as does the company sizes. The results show that most Nigerian corporations have substantial debt loads, so borrowing and gearing should be drastically reduced. Inadequacies of this article are not confined to the country of focus alone. Companies whose stock is traded on the Nigerian Exchange Group should be aware that their information may be vulnerable due to the country's status as a developing economy with a stock market still in its infancy. The study's findings are also related to the research strategies and statistical models used. When all is said and done, the scope of this research is strictly limited to companies trading on the floor of the Nigerian Exchange Group. However, the results are relevant for traders, analysts, shareholders, and government agencies who oversee the financial markets.

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