International Journal of Research in Social Science and Humanities (IJRSS)

E-ISSN : 2582-6220

DOI: 10.47505/IJRSS.2022.V3.6.3

Volume 3 (6) June -2022

Empirical Evaluation of Effects of Intellectual Capital Efficiency on Firm's Value in Some Selected Listed Firms on Nigerian Exchange Group

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ABSTRACT

This contemporary world of economy driven by information and communication technology (ICT) has at its heart the dynamic force of knowledge and human capital development, pivotal to a standard capital market of a world class, has become a very vital and precious asset to organisations. This study examined the effect of Intellectual Capital Efficiency on Firm's Value in Some Selected Listed Firms on Nigerian Exchange Group. Data for the study were extracted from annual reports and accounts of thirty one selected companies for the period 2016-2021. Data for Intellectual Capital Efficiency proxy by Modified Value Added Intellectual Coefficient (M-VAIC=HCE,SCE,RCE and CEE) and Firm's value estimated by Market to Book Value(M/BV), Earnings Per Share (EPS) and Tobin Q (TQ) were extracted from the annual reports and accounts of selected companies. Three research hypotheses were formulated and tested adopting both descriptive statistics and simple regression techniques (OLS) with the aid of Stata 13.0 software. The findings revealed that M-VAIC have positive and significant effect on M/BV,EPS and TQ of Some Selected Listed Firms. Also, the introduced control variable (firm size) has a positive relationship and significant effect M/BV,EPS and TQ of Some Selected Listed Firms in Nigeria. Consequent upon this study, it was recommended that the importance of the intellectual capital should not be undermined and the mechanism, through which intellectual and human capital flow should be developed, maintained and improved; Since ICE has been shown to be the key driver of value creation, deliberate efforts should be made to grow IC of firms by first recruiting very competent staff, train and motivate them. Companies must strategically and deliberately train and retain staff for a long time to avoid losing the intellectual assets possessed by them, which could stimulate better future value and firms should invest in knowledge capital (that is intellectual capital), information technology (ICT) that can help they increase in their structural capital by harnessing information technology.

Keywords: *Knowledge Capital, Intellectual Capital Efficiency, Value Creation, Tobins Q, Value Added Intellectual Coefficient,*

1.0 INTRODUCTION

This contemporary world of economy driven by information and communication technology (ICT) has at its heart the dynamic force of knowledge and human capital development, pivotal to a standard capital market of a world class, has become a very vital and precious asset to organisations. Scholars like Salman, Mansor, Babatunde, and Tayib, (2012) have argued that there is urgent needs to depicting intellectual mean in a company's financial reports. According to Ahangar (2011) in order to achieve going concern and increase productivity, all companies across the globe depend heavily on Intellectual Capital (IC). In light of the evolving global economy and commercial environment, knowledge-based management has rendered old-fashioned accounting systems less beneficial than before. Brooking went further to prove that not only did the old-fashioned accounting system doesn't reflect the true picture of the company but also that it may mislead investors and other applicable stakeholders by making economic decisions that are not viable (Brooking as cited in Ahangar (2011). Thus, to keep up with the market, the accounting profession needs to create a complex platform for capturing different types of intellectual capital. The human, structural, and relational aspects can be quantified to provide better information and moves investors who want much more in-depth understanding. Failure to recognise these IC components in monetary terms is by implication neglecting the huge quantum of impalpable values and investments incurred by enterprises in the accessions and development of intellectual properties. This practice according to Ofurum, Onuaha, and Nwaekpe (2018) has not only resulted in the undervaluation of enterprises but also very often left a huge gap existing between the market and book values of firms. Berzkalne and Zelgalve (2014) argued that the efficiency and overall profitability of corporate organisations depends greatly on the capability to recognize and quantify intellectual capital and knowledge assets in company's financial statement. Intellectual Capital is critically important to a firm as it

helps drive revenue and other valuable investment measures. This position was substantiated by scholars that described IC as a means of facilitating corporate values in organisations (Henry, 2013; Berzkalne & Zelgalve, 2014). However, studies like Mojtahedi (2013) as well as Saeed, Farahmand and Khorasani (2013) documented that IC has been the key factor why some firms enjoy competitive advantage over their contemporaries.

On the contrary, other few studies such as Ewereoke (2018) could not document any relationship between intellectual capital and firms' performance. It was however documented by Puntilo in 2009 that intellectual capital measured by structural capital has an inverse relationship between metrics of M/BV ratio. Furthermore, Zou and Huan (2011) and Anuonye (2015) argued that CEE and SCE correlate negatively while HCE correlate positively with Technical Efficiency and that intellectual capital components are not only positive with EPS but correlate insignificantly in Nigeria respectively. It was also observed from foreign studies that many scholars have focused on the issue of the relationship between intellectual capital and firm value. Critical review of the works of Randa and Solon (2012); Nikmah and Aida (2015) (citing Sudibya & Restuti, 2014) and Berzkalne and Zelgalve (2014) showed that the relationship existing between intellectual capital and firm value is significantly positive while contrasting results; indirect relationship was obtained by Sunarsih and Mendra (2012) and Muna (2014) between intellectual capital and firm value. This empirical gap created by these studies became the underpinning on which this study is built. While it is believed that the differences in results of previous studies may be attributable to economy differences, differences in the indicators and metrics used to measuring intellectual capital and the firm value of companies as well as the scope of their studies; there is need for empirical inquiry with evidence from Nigeria context, a developing economy.

The work of establishing the connection between the metrics of Intellectual Capital Efficiency (ICE) and that of Corporate valuation (Firm Value) has yet to be completed, as evidenced by the preceding submissions. Studies have been conducted on the effects of ICE components on company value, but these studies are limited to specific foreign countries. There needs to be more research done in emerging nations like Nigeria on this topic since majority of studies were similarly skewed toward evaluating the impact of intellectual capital on financial performance, with little or no studies on the Effect of Intellectual Capital Efficiency on Firm Value (Corporate Valuation) in Nigeria, to the best of our knowledge. This, we believe, is more comprehensive and applicable to investment decisions. Knowledge assets and information-driven economies have become critical to business value; that's why this study is important in the era of knowledge assets and information which are consistently regarded as key and fundamental to corporate value creation, and thus the justification for this study. This study is designed to assess how Intellectual Capital Efficiency impacts on Firm's Value in Some Selected Listed Firms on Nigerian Exchange Group (NGX Group). The following hypotheses in null form have been formulated to guide this study toward achieving the set objectives.

Ho_1: Intellectual Capital Efficiency (ICE) does not significantly affect Market to Book Value Ratio of Some Selected Listed Firms on Nigerian Exchange Group (NGX Group).

Ho_2: Intellectual Capital Efficiency (ICE) has no significant relationship with Earnings per Share of Some Selected Listed Firms on Nigerian Exchange Group (NGX Group).

Ho_3: Intellectual Capital Efficiency (ICE) has no significant relationship with Tobin Q of Some Selected Listed Firms on Nigerian Exchange Group (NGX Group).

This study has dual contribution as it does not only provide the empirical evidence in the Academics but also it has practical managerial value in context of investment and human capital development and its implications. The findings of this study would also provide hints to listed companies which face the difficulty in leveraging and managing the intangible assets corresponding to the globalization era of technology and knowledge-based economy.

2.0 REVIEW OF RELATED LITERATURE

2.1 Conceptual Framework

2.1.1 Intellectual Capital (IC)

The idea of intellectual capital (IC) is subjective, abstract, invisible and tough to define. The determination of IC differs depending on the point of view from which it is defined. Intellectual capital does not have standard measurement and valuation like the other physical assets. For instance, it is difficult to know who owns the brand or knowledge of the company, and at which price? In buying or selling physical capital in most cases, there is always an evidence of the item as well as the price but that is not possible with customer relationships or professional skills which are a product of education or many years of experience. In general, physical capital (e.g. plant and machinery) is designed to fulfill solely one purpose at a particular time, whereas the brand and/or trademark is available for many people through diverse channels. (Puusa as cited in Melendez, 2017)

DOI: 10.47505/IJRSS.2022.V3.6.3

Many scholars have developed various means to clarify the special features of Intellectual Capital. One of the most used division of intellectual capital in academic studies is the development of Value Platform by Petrash (1996) (see Figure 2.1). The Value Platform divides intellectual capital into three components by their nature and collectively they shape the subsequent formula: *Intellectual Capital = Human Capital + Organizational Capital + Customer Capital*

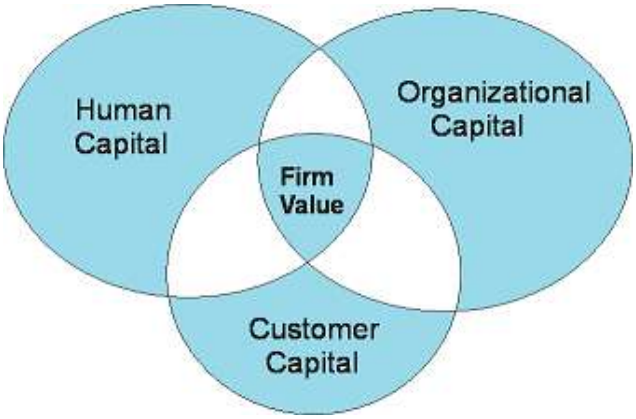

Figure 2.1: The Value Platform

The Value Platform depicts the interrelationships among human capital, organizational capital, and customer/relational capital. The dotted triangle represents the information drift in the company. Petrash aptly conceptualize that each 'capital' is an independent entity and there must be a flow of information (knowledge) from one unit to another in order to create value in a firm (Petrash 1996). He further expound that intellectual capital consists of human capital, organizational capital, and customer capital. The Human capital according to his study, is the knowledge that individuals possess while organizational capital is the knowledge that has been entrenched within organization in form of structures, processes and culture. Lastly, customer capital is the customer's appreciation concerning the value obtained from doing business with an organization.

Intellectual capital can be seen as the entirety of components that can provide a competitive advantage for a firm; intangible resources ranging from knowledge, technology used by the company, financial information to Human Resources experiences that will result in the creation of value added for the company. Recalling Pulic (2004), intellectual capital consists of two main components viz: Human Capital (HC) which is the employees' knowledge and Structural Capital (SC) which is the totality of the organisation's knowledge assets (database, organizational charts, process manuals, strategies etc.) that increases the value of the firm above the nominal value. (Bontis as cited in Ulum, 2008).

2.1.2 Intellectual Capital Measurement

Considering the intangible nature and difficulties in measuring IC, researchers and practitioners developed several methods of valuation for IC. Based on the nature of the information used in valuation, they can be categorized as follows: (1) Market capitalization methods e.g Tobin's Q; (2) Return on capital employed methods e.g Market Value Added and Economic Value Added (3) Scoring methods e.g Skandia Navigator, Balanced Scorecard, IC Index; (4) methods based on Direct calculation methods e.g Technology Broker, Inclusive Valuation Methodology; (5) Value-added methods e.g the Value Added Intellectual Coefficient, etc.

2.1.3 Intellectual Capital Efficiency (ICE)

Sequel to inadequate provisions of accounting standards on IC, accounting and finance experts have been prompted to create different models of measuring and reporting IC (Ulum, Ghozali, & Purwanto, 2014). Ulum (2008) argues that VAIC™ does not measure IC; however, it does measures the impacts (the efficiency) of IC management. The hypothesis here is that if a company has good IC and manages it well, then there would certainly be an impact (efficiency). In measuring the efficiency of intellectual capital, Pulic (2004) built a model called VAIC^{TM} composed of Intellectual Capital Efficiency (ICE) and Capital Employed Efficiency (CEE) where Human Capital Efficiency (HCE) and Structural Capital Efficiency (SCE) are the two constituents of Intellectual Capital Efficiency (ICE). Shiri, Mousavi, Pourreva, and Ahmadi (2012) expressed that VAIC cannot measure all components of IC; that VAIC can only measure two components namely human capital and structural capital, that it cannot measure relational capital. The development of the Modified VAIC (MVAIC) by Ulum in 2014 has enhanced the relational capital efficiency (RCE) that was hitherto missing. According to Ulum, Riziquiyah, and Jati (2016), it is one of the formulas to measure the efficiency of relational capital. RCE measures the firm's performance as a harmonious relationship between the company and

DOI: 10.47505/IJRSS.2022.V3.6.3

its partners (Sawarjuwono & Kadir, 2003). This study used the M-VAIC model which comprises HCE, SCE, and RCE that form ICE.

2.1.4 Modified Value Added Intellectual Coefficient (M-VAIC)

In order to evaluate the Value Added (VA) and the ability to generate revenue, companies can use the M-VAIC model (Ulum, 2014). It is mainly calculated by taking into account the four components that form our efficiency indicators; human capital efficiency (HCE), structural capital efficiency (SCE), relational capital efficiency (RCE) and capital employed efficiency (CEE). Subsequent to Pulic (2004), VA is calculated as Operating Profit (OP) plus Employee Cost (EC) plus Depreciation (D) and Amortization (A). One major component of M-VAIC is human capital, which contributes to the operational efficiency and value for the organization. Human capital is defined as the ability of employees to contribute to the value creation process (Pulic, 2004). The work of Becker, Huselid and Ulrich (2001) revealed that employee expenditures on human competences can lead to higher performance in an organization and that human capital's proxies are labor costs (HCE) or salaries and employee benefits (HC). Structural capital is an important tool for organizations. Tan, Plowman, and Hancock (2007) emphasized that organisations need to have supportive culture, intellectual property, and values in order to create value for the company. In the absence of Structural Capital, employees will not be able to maximize the potential they have while working. Structural capital reduces costs by eliminating expenses and makes an organization's supportive culture stronger. The ICE ratio is a comparison between HCE and SCE in value creation--the more input for HCE, the less expenditure for SCE. where SC is VA minus HC. HCE, SCE, and RCE together will result in Intellectual Capital Efficiency (ICE). M-VAIC is also evaluated by the associated financial capital. Intellectual capital can't create value unless it has most have physical and financial capital (Ulum 2004), and the more efficiently they're used, the better M-VAIC will be; thus affirming the earlier position of Makki and Lodhi in 2008 which found that an organization's intellectual capital can't generate value in the system without financial and physical assets. It means that better utilization of these assets will help increase the organisational's performance and value. Ulum (2014) proposes a way the intellectual capital efficiency can be accounted for in firms with an indicator of relational capital (RC). RC is embedded in marketing costs and communication channels, most notably relationships with other leaders in that industry and trade. It is a bridge and catalyst, one of the main factors in determining intellectual capital into market value and consequently business performance. It was documented in 2009 by Namazi and Ibarahimi that RC is all about a company's marketing channels, and how knowledge of those channels influences their relationship with customers.

Thus: **M-VAIC= ICE = f (HCE+SCE+RCE) + CEE**

Where:

M-VAIC	=	Modified VAIC
ICE	=	Intellectual Capital Efficiency
HCE	=	Human Capital Efficiency
SCE	=	Structural Capital Efficiency
RCE	=	Relational Capital Efficiency
CEE	=	Capital Employed Efficiency

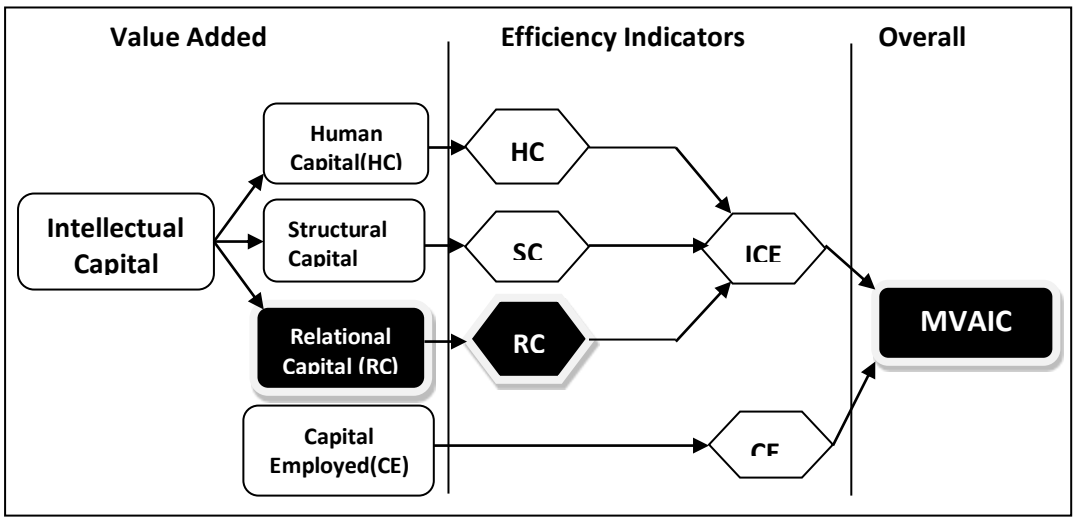

Figure 2.2: Modified Value Added Intellectual Coefficient formula

DOI: 10.47505/IJRSS.2022.V3.6.3

2.2 Firm Value

The value of a firm is reflected in the stock its price. A company that has a great value is known by its competitive attraction among investors. The company's value in this study was measured using market to book value ratio (M/BV), Earnings per share (EPS) and Tobin Q. (Sudibya and Restuti, 2014). M/BV describes the given market premium on the intellectual capital of the company. High M/BV means that company has a stock price that is greater than the book value per share. Agus Sartono believes that companies with higher stocks reflect the ability to create value. Companies that create value provide hope in the form of greater profits for their shareholders (Agus Sartono cited in Sudibya and Restuti, 2014).

2.2.1 Intellectual Capital Efficiency and Firms' Market to Book Value Ratio of Firms:

The IASB (2010) in noting the place of Intellectual Capital Efficiency (ICE) in the enhancement of firms' market to book value ratio simply argued that if the market value of an entity is worth more than its assets, part of this difference is contributed by its knowledge-based intellectual capital. Edvinsson and Malone (1997) also attributed the gap often observed between firm's book and market value as Intellectual Capital Efficiency (ICE) while Maditinos, Chatzoudes, Tsairidis, and Theriou (2011) affirmed that a method for determining the intellectual (intangible) assets of a company is to compare market to book value of the firm.

2.2.2 Intellectual Capital Efficiency and Firms' Earnings per Share:

Earnings are profits after tax which is attributed to ordinary shares. Earnings are therefore argued to have been stimulated when components of intellectual capital efficiency are judiciously utilized. Brookings as cited by Sofian, Rasid, and Mehri (2011) postulates that greater value of companies were formerly represented by physical capital while lesser estimates of current business value come from intellectual capital but that the inverse is true for today's businesses.

2.2.3 Intellectual Capital Efficiency and Tobin Q:

Firm value as measured by Tobin Q is a manifestation of stock price changes as a result of the efficiency of Intellectual Capital. Resource theory explains that companies managed and exploited intellectual resources that both can achieve competitive advantage and value added (Solikhah, 2010). Vendor who has a competitive advantage will create market perception of the company's high value because it is believed that companies have a competitive advantage to compete and survive in the dynamic business environment (Randa & Ariyanto, 2012). Chen, Cheng, and Hwang (2005) opined that a higher price would be paid by investors for shares that the company has the intellectual resources more than companies with low intellectual resources and that the price paid by the investors is a reflection of the value of the company. This is evidenced by the results of Chen et al. (2005) which indicate that IC has a significant impact on financial performance and firm's value.

2.3 Theoretical Framework

2.3.1 Resources Based Theory (RBT)

Resource-Based Theory which was first presented by Wernerfelt (1984) is centred on how the firm can manage her resources and continue to enjoy competitive advantage. RBT proposes that a company is endowed resources to make a competitive advantage; able to manage itself achieve an exceptional long-term performance. Ulum (2014) documented that a rare and valuable resources can be managed to create a competitive advantage so that the owned resources will be durable and cannot be easily copied, transferred or substituted.

RBT aptly describe the relationship between intellectual capital efficiency and firm value from different perspectives. From the perspective of intellectual capital, intangible assets of companies are classified into three main categories: human capital, structural capital, and customer capital (Bontis as cited in Ulum, 2014). According to Pulic (2004), every company has its unique knowledge, skills, values and solutions (intangible resources) capable of being changed into a 'value' in the capital market. Efficiently managed intangible resources enhance companies' competitive advantage leading to increase productivity and its market value.

2.3.2 Stakeholder Theory

The stakeholders proposed by Freeman and Reed (1983) state that the stakeholders are groups and individuals who can influence the achievements of company goals or those who are affected by company activities while they're trying to reach their goals. Organizations should carry out activities important to their stakeholders and report back to them to keep everybody happy.

To explain the relationship of ICE and firm value, the arguments for stakeholder theory can be found from two fields. This is best described in Deegan (2004) as cited by Nikma and Aida (2015). The first is the ethics field, which argues that all stakeholders have the right to fair treatment by the organization and managers should manage for the benefit of all stakeholders. The second field is managerial; the managerial argument of stakeholder theory views that the stakeholders' ability to influence corporate management should be seen as a control over resources needed by an organization. These resources are needed by the company in

DOI: 10.47505/IJRSS.2022.V3.6.3

order to create value added that will increase the firm value in capital market, which is what defines stakeholders. That is, with maximum management, firms can increase their capital value in the marketplace. (Watts & Zimmerman, 1986; Ulum, 2008)

2.4 Empirical Review

Ahangar (2011) investigated the relation between IC and financial performance of Iranian companies from 1980 -2009 using VAICTM method and multiple regression. The findings revealed that IC influences profitability and productivity.

Oneyekwelu and Ubesie (2013) evaluated the effect of intellectual capital on corporate valuation on pharmaceutical companies in Nigeria using Pulic (2000) VAIC with a sample of 6 firms from 2004-2013. The results show that HCE is positively significant on MBV while SCE is negatively insignificant on EPS.

Berzkalne and Zelgalve (2014) evaluated the relationship between intellectual capital and company value from 2005 – 2011 using a sample of 64 firms. The result could not establish any relationship among "value added intellectual coefficient" and company value rather it has mixed findings.

Zarei, Shamszadeh and Zarei (2015) studied the effects of intellectual capital on financial performamnce of Iranian banks from 2004 – 2013 with a sample of 14 firms using VAIC method. The regression result showed that HC, CE and SC have positive and significant effect on ROA, ROE and ATO.

Anuonye (2015) analysed the influence of intellectual capital efficiency of insurance companies with 18 sample firms in Nigeria using 150 questionaires and it was concluded that HCE, SCE and RCE have insignificant relationship with EPS

Nuryaman (2015) examined the impact of the intellectual capital on the firm's value with the financial performance for the year 2012 with a sample of 93 manufacturing companies listed in Indonesia stock exchange. Findings showed that intellectual capital has a positive and significant impact on firm value and profitability.

Ulum, Rizqiyah and Jati (2016) evaluated the intellectual capital performance (ICP) of financial and non-financial firms in Indonesia with 50 firms from 2007 – 2014 using Ulum (2014) MVAIC model. It was concluded that Non-financial firms has higher ICP compared to finanacial firms.

Ewereoke (2018) examined the effects of IC on performance of listed firms in Nigeria with 40 sampled firms from 2001 – 2015 using the Pulic (1998) model in OLS. It was concluded that Intellectual Capital significantly affect company process and MBV but same does not significantly effect of Intellectual Capital on Asset Turnover (ATO).

3.0 METHODOLOGY

3.1 Research Design

This study adopted the Ex-post facto research design. The study adopted the Ex-post facto research design since the research relied on historical data generated from annual reports and accounts of Some Selected Listed Firms on Nigerian Exchange Group (NGX Group) as well as data from the publications of the Nigerian Exchange Group (NGX Group). These data were considered credible since they have been audited and filed with the Securities and Exchange Commission. For the purpose of conducting the study; Market to Book Value ratio (M/BV), Earnings per share (EPS) and Tobin Q were used to measure the Dependent Variable (Firm's Value) while the Modified Value Added Intellectual Coefficient (M-VAIC) was used to measure the Independent variable (Intellectual Capital Efficiency) using time-series cross-sectional multiple regressions.

3.2 Population of Study

The population of the study consists of all the companies listed on the Nigerian Exchange Group (NGX Group) as at 2021. The selected companies in each sector will be the focal of this study from the period of the adoption of the International Financial Reporting Standard (IFRS) in Nigeria, which is from 2012. Availability and accuracy of the data is very crucial for studies of this nature. Therefore, the study came up with some filters in order to generate accurate analysis. Firms that did not meet any of these criteria were excluded.

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3.3 Sample Size Determination

In determining the sample size of the study, a systematic elimination and stage wise sampling method has been used. The study was carried out between the years 2016 and 2021. Samples for the study were selected from all firms listed on the Nigerian Exchange Group (NGX Group) for the time period mentioned above. The firms selected as sample should have all the following eligibility conditions:

1. Given the time period, the company is listed on the Exchange Group prior to 2012, and until the end of 2021, it has not been removed from the list of companies.

2. Due to the lack of clear boundaries between operating and financing activities, financial companies (investment companies, financial intermediation, holding companies, and leasing), and also because they have different reporting structures, these companies are excluded from the sample.

3. In the study period, the company should not be operating loss in its fiscal year-end audited income statement.

4. The fiscal year of the selected firm shall not be changed during the years under review.

5. Only companies with updated information on financial statement up to 2021 with the Nigerian Exchange Group (NGX Group) are selected.

Considering the above mentioned, from all the 171 listed firms on Nigerian Exchange Group (NGX Group), 157 firms were listed prior to 2012. From these firms, 49 firms are financial companies which are removed from research sample and 12 firms have operating loss are removed, 28 firms changed their fiscal year while 37 firms have not updated 2021 financial statement and finally 31 firms are selected as eligible sample for this study are shown in Appendix I of this report

3.4 Method of Data Collection

The data for the study were secondary data, that is, data were sourced from the annual reports of Some Selected Listed Firms on Nigerian Exchange Group (NGX Group) under study for a period of six years (2016 - 2021).

The study used two sets of data from the financial statements for all observations: the first was the data used to measure the Intellectual Capital Efficiency (ICE); company's ability to create value-added (VA) which is the Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE), Relational Capital Efficiency (RCE), and Capital Employed Efficiency (CEE) while the second was the data used to measure Firm's Value. All data were derived from the statement of comprehensive income, statement of financial position and notes to the accounts.

3.5 Techniques of Data Presentation and Analysis

1. Tables: A good table should contribute to the process of analysis and valid generalization of findings inherent in the original data (Osaze & Izedonmi, 2008).
2. Test of Hypotheses: The technique used in analyzing the formulated hypotheses for this study is the multiple regression and correlation coefficient technique, done with the aid of Stata 13.0 software.
3. Decision Rule: The decision rule is based on the computed P-value, if the P-value is less than the Alpha (α) value of 0.05 Reject the Null Hypothesis. If the P-value is greater than the Alpha (α) value of 0.05 Accept the Null Hypothesis.

3.6 Description of Variables

3.6.1 Dependent variable

The dependent variable in this study is the firm value measured using Market to Book Value ratio (M/BV), Earnings per share (EPS) and Tobin Q.

Market to Book Value Ratio:

$$M/BV = \frac{MV}{BV}$$

Where:

MV = No of shares * Stock price at the year end.

BV = Book value per share

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Earnings per Share (EPS):

$$\textbf{EPS} = \frac{\text{PAT- Preference dividend- minority interest}}{\text{No of Ordinary Shares in Issue}}$$

Where:

PAT = Profit after Tax

Tobin's Q ratio:

In this study Tobin's Q ratio will be obtained as follow:

$$\textbf{TQ} = \frac{\text{VOCS+ EMVOPS+ BVLT+BVCL}}{\text{BVTA}}$$

Where:

VOCS	=	The value of common stock at the end of year.
EMVOPS	=	The estimate market value of preferred stock at the end of year.
BVCL	=	The book value of current liabilities at the end of year.
BVTA	=	The book value of total assets at the end of year.

3.6.2 Independent Variable

The independent variable in this study is the intellectual capital measured by the efficiency of intellectual capital in the creation of value added using VAICT measurements that have been modified (M-VAIC) by Ulum (2014). M-VAIC calculation results are categorized into four categories:

1) Top performers - M-VAIC value above 3.50
2) Good performers - M-VAIC value between 2.5 and 3.49
3) Common performers - M-VAIC value between 1.5 and 2.49
4) Bad performers - M-VAIC value below 1.5.

Company that fall into Top Performers category indicated as a company that can manage and exploit their intellectual capital very efficiently in order to create value added. Meanwhile, the companies that fall into lowest category, which is Bad Performers indicated as a company that cannot take advantage of their intellectual capital efficiently to create value added.

The formula to calculate M-VAIC is as follows (Ulum, 2014):

M-VAIC = HCE + SCE + RCE + CEE

Where:

HCE	=	Human Capital Efficiency = VA / HC
VA	=	Value Added = OP + EC + D + A
OP	=	Operating Profit
EC	=	Employee Cost
D	=	Depreciation
A	=	Amortization
HC	=	Human Capital, in the form of wages and salaries
SCE	=	Structural Capital Efficiency = SC / VA
SC	=	Structural Capital = VA-HC
RCE	=	Relational Capital Efficiency = RC / VA
RC	=	Relational Capital, in the form of marketing costs
CEE	=	Capital Employed Efficiency = VA / CE
CE	=	Capital Employed available for funds (equity)

3.7 Model Specification

Time-series longitudinal (panel) data multiple regressions of Some Selected Listed Firms on Nigerian Exchange Group (NGX Group) across all the years under review was used to analyze the relationship between the components of Intellectual Capital Efficiency (ICE) and Firm's Value variables over the period under review. To determine the effects of Intellectual Capital Efficiency (ICE) on Firm Value, the researcher regressed the intellectual capital efficiency coefficients on M/BV, EPS and Tobin Q.

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M-VAIC model is adopted for this study as earlier stated. The choice of this model is in line with previous studies (e.g. Ulum, 2014). The model used in this research is as follows:

$$Y = \beta_0 + \beta_1 M\text{-}VAIC + \mu_{it}$$

Where:

Y = Firm Value (dependent variable)

M-VAIC = Intellectual Capital Efficiency (independent variable)

β_0 = Constant term (intercept)

β_1 = Coefficient of Intellectual Capital Efficiency

μ = Error term (stochastic term)

Explicitly, the equation can be defined as:

Firm Value = f (M-VAIC) + μ_{it}

Whereas, M-VAIC = HCE + SCE + RCE + CEE.

In testing each of the formulated hypotheses of this study, a control variable was introduced into the models and the relationship between the dependent and the independent variable was expressed in different models. Thus, in representing other equations with variables of the construct while taking the control variable into consideration, the following models were therefore developed to guide the test of the formulated hypotheses:

$M/BV_{it} = \beta_0 + \beta_1 M\text{-}VAIC_{it} + \beta_2 SIZE_{it} + \mu$ - - - - (1)

$EPS_{it} = \beta_0 + \beta_1 M\text{-}VAIC_{it} + \beta_2 SIZE_{it} + \mu$ - - - - (2)

$TQ_{it} = \beta_0 + \beta_1 M\text{-}VAIC_{it} + \beta_2 SIZE_{it} + \mu$ - - - - (3)

Variable Definition

M/BV_{it} = Market to Book Value for firm *i* in year *t*

EPS_{it} = Earnings per share for firm *i* in year *t*

TQ_{it} = Tobin Q for firm *i* in year *t*

The framework of the study is depicted below:

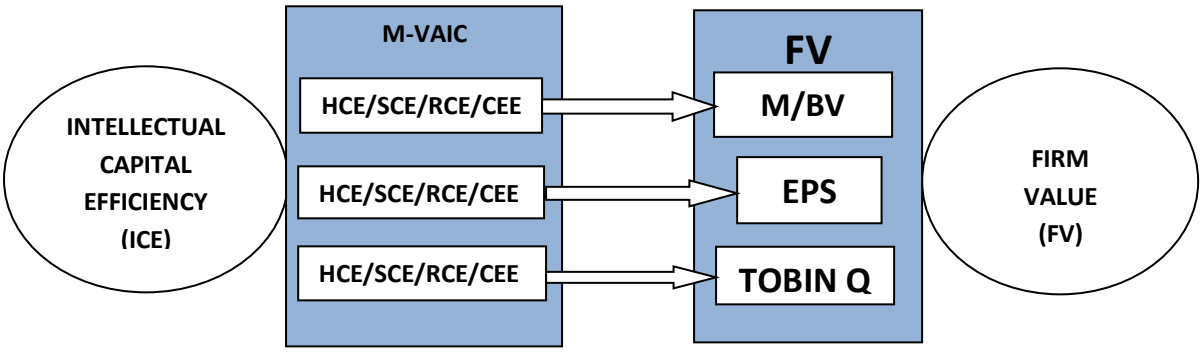

Figure 3.1. Conceptual Model for Intellectual Capital Efficiency and Firm Value

4.0 DATA PRESENTATION AND ANALYSIS OF RESULTS

4.1 Presentation of Data

This section dealt with the presentation of data obtained in the study. For this purpose, company specific data were obtained for the period 2016 - 2021. The data obtained from the financial statements of the sampled companies are shown in Appendix II of this report. Results from the analyses are presented in tabular forms in the following sections.

DOI: 10.47505/IJRSS.2022.V3.6.3

4.1.1 Descriptive Statistics

The results of the descriptive statistics of the variables are presented in Table 1 below:

Table 4.1: Summary of Descriptive Statistics of the Variables of the Study

stats	mbv	eps	tq	mvaic	size
mean	3.614355	3.596962	1.925645	7.576129	6.332527
sd	5.483643	7.31118	1.835218	6.529923	1.361339
skewness	2.949762	2.735204	2.823842	.1581233	-.0310691
kurtosis	12.00274	14.5695	11.4446	14.94227	2.203602
min	.2	-24.2	.28	-34.18	2.26
max	34.33	43.58	11.78	34.66	8.89
N	186	186	186	186	186

Source: Researcher's Computation From STATA 13.0 Version, 2018.

Table 4.1 shows the summary of descriptive statistics of the variables of concern in this study. The dependent variable (firm value) is measured by Market to Book Value of shares (MBV), Earnings Per Share (EPS) and Tobins' Q (TQ) while the independent variable (Intellectual Capital) is measured by the Modified Value Added Intellectual Coefficient (M-VAIC). In this study, a control variable (firm size) measured as the log of total assets (SIZE) was however introduced. As evidenced from the results in Table 4.1, it was observed that MBV recorded a mean and standard deviation of 3.614355 and 5.483643 respectively. Note that while the mean explains the average amount of values recorded for the data on each variable, the standard deviation (sd) measures the level of variability of the data. The minimum and maximum values reported during the period under review for MBV were 0.2 and 34.33. The highest amount of MBV of 34.33 was recorded by Forte Oil (AP) Plc in 2018.

The results of the descriptive statistics for other measures of the dependent variables as shown in the table however reveal that EPS has a mean and standard deviation of 3.596962 and 7.31118 with -24.2 and 43.58 as the minimum and maximum values respectively. TQ recorded values of 1.925645 and 1.835218 as mean and standard deviation respectively with minimum and maximum values of 0.28 and 11.78 respectively. The minimum value of 0.28 was recorded by Beta Glass Nigeria Plc in 2017 while the maximum value of 11.78 was recorded by Chemical and Allied Product Plc in 2016.

In a similar vein, the result of the descriptive statistics for the independent variable alongside the control variable was presented in Table 4.1. Accordingly, from the result, we observe that M-VAIC recorded a mean and standard deviation of 7.576129 and 6.529923, with maximum and minimum values of 34.66 and -34.18 respectively. The relative level of dispersion recorded for this variable could be accounted for by the nature of earnings recorded by the different firms which to some extent could be accounted for by the size or nature of their businesses. Interestingly, the maximum and minimum values of 34.66 and -34.18 were respectively found in the 2017 annual reports of Dangote Sugar and Eternal Oil Plc.

With respect to the control variables (Size), it could be observed that the firm size (size) had a lower standard deviation of 1.361339. The recorded figures for maximum and minimum values for size were 8.89 and 2.26 respectively. The largest value of 8.89 for firm size was found in the books of Lafarge Cement Wapco Nig in 2019, while the minimum value of 2.26 was recorded by University Press Plc in 2016. The skewness which measures the asymmetry in the series has values above 0 in all cases (dependent and independent variables) which indicate that the series is skewed to the right. The Kurtosis which measures the asymmetry within the series also indicates that the MBV, EPS, TQ, M-VAIC and SIZE satisfy this condition.

4.1.2 Correlation Analysis

The results of the correlation analysis usually present ranges of numbers with designated signs that helps to tell the direction of relationship between pairs of variables under investigation. The coefficients for each pair of variables enables any researcher to determine whether two paired sets of variables such as earnings per share are moving in the same or opposite direction. Coefficients with positive signs are indications of positive relationship whereas coefficients with negative signs are indicants of possible negative relationship between variables. The implication of negative relationship means that a unit increase in one variable leads to decreases in the other variable. However, when the correlation coefficient is close to 0, there is no evidence of any relationship. Noteworthy, where a pair of independent and/or control variables obtains coefficient of 0.8 and above, it is a sign of the presence of multicollinearity among the data set for such variables (Molyneux, Nguyen and Zhang, 2014).

With the above in mind, the data obtained for all the variables were subjected to a correlation analysis and the result is shown in the table below:

DOI: 10.47505/IJRSS.2022.V3.6.3

Table 4.2. Result of Correlation Analysis

	mbv	eps	tq	mvaic	size
mbv	1.0000				
eps	0.3470	1.0000			
tq	0.8822	0.3943	1.0000		
mvaic	0.0889	0.1691	0.1014	1.0000	
size	0.2769	0.1476	0.3183	-0.0864	1.0000

Source: Researcher's Computation From STATA 13.0 Version, 2018.

Table 4.2 presents the correlation matrix for the entire variable set. As indicated above, the explanatory variable (M-VAIC) had positive relationship with measures of the dependent variable (MBV, EPS and TQ). In a similar vein, the control variable (SIZE), also had positive relationship with measures of the dependent variable (MBV, EPS and TQ). The correlation coefficient (Pearson *R*) between M-VAIC and measures of the dependent variables (MBV, EPS and TQ) are 0.0889, 0.1691 and 0.1014 respectively. It could be observed that the correlation coefficient between the independent variable (M-VAIC) and the control variable (SIZE) is negative (-0.0864), thus indicating a negative relationship.

A further cursory look at the results in Table 4.2 indicated that with the coefficient between the independent variable (M-VAIC) and the control variable (SIZE), signals of the existence of multicollinearity could not be spotted. This is evident in the value of the Pearson Correlation (Pearson *R*) that was obtained (-0.0864). Since this value is not close to or above the benchmark of about 0.80 and above, we thus argue that the explanatory variables used in this study do not have issues of multicollinearity. To confirm this assertion, the variables were subjected to multicollinearity test and the results are as shown in Table 4.3 below.

4.1.3 Result of Multicolinearity Test Using VIF

This section reports the result of the test for the presence or otherwise of multicollinearity among the independent variables. To achieve this, the Variance Inflation Factor (VIF) test was conducted and the result is hereafter presented.

Table 4.3: Variance Inflator Factor Results for Independent Variables

Variable	VIF	1/VIF
mvaic	1.01	0.992532
size	1.01	0.992532
Mean VIF	1.01	

Source: Researcher's Computation From STATA 13.0 Version, 2018.

From Table 4.3, the range of VIF for the explanatory variables did not exceed the standardized VIF level (1.01<10.00), suggesting the absence of multicollinearity among the explanatory variables. This result therefore confirms that the models in this study are fit.

4.1.3 Result of the Test of Heteroscedasticity

To further confirm the fitness of the models in this study, the data were also subjected to tests for heteroscedasticity using the Breusch-Pagan/Cook Weisberg Test and the result is presented in Table 4.4.

Table 4.4: Result for Breusch-Pagan/Cook Weisberg Test

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of mbv

         chi2(1)      =    31.32
         Prob > chi2  =   0.0000
```

Source: Author's Computation From STATA 13.0 Version, 2018.

DOI: 10.47505/IJRSS.2022.V3.6.3

As evident in Table 4.4, the chi2(1) of the fitted values for the variables is 31.32 with a p-value of 0.0000. This result thus confirms the absence of heteroscedasticity problem in the data set. With the above results, the regression outcome in the subsequent section of this report can be relied upon.

4.1.4 Panel Unit Root Test

Before the data of this study were used to estimate the specified models, they were subjected to panel data stationarity tests. This was done in a bid to establishing if their variances and covariances were relatively constant over the study period. Impliedly, panel unit root test was used to analyse whether the variables are stationary or not and was also used to indicate their order of integration.

The condition of covariance stationarity is a necessary requirement for determining the ability of the specified models to estimate the relationship between the variables of concern in this study. In this regard, several optional available tests like the Levin Lin Chu (LLC) test; the Harris-Tzavallis test, Hadri-LM stationarity test and the Im-Pesaran-Shin (IPS) test were employed. A description of these tests of panel unit roots and cointegration can be found in Asteriou and Hall (2007). The result of the panel unit root test is shown in the table below:

Table 4.5 Summary of Panel Unit Root Test Result

Level for MBV		
	Stationarity	**Probability**
Levin-Lin-Chu (LLC) (Adjusted t*)	-23.3655	0.0000
Harris Tzavalis	0.1481	0.0000
Hadri LM	0.2352	0.4070
Fisher-type (Modified inv. chi-squared)	11.0270	0.0000
Level for EPS		
	Stationarity	**Probability**
Levin-Lin-Chu (LLC) (Adjusted t*)	-54.0671	0.0000
Harris Tzavalis	-0.1717	0.0000
Hadri LM	2.0631	0.0196
Fisher-type (Modified inv. chi-squared)	7.9002	0.0000
Level for TQ		
	Stationarity	**Probability**
Levin-Lin-Chu (LLC) (Adjusted t*)	-6.3629	0.0000
Harris Tzavalis	-0.1642	0.0053
Hadri LM	0.7975	0.2126
Fisher-type (Modified inv. chi-squared)	18.6118	0.0000
Level for M-VAIC		
	Stationarity	**Probability**
Levin-Lin-Chu (LLC) (Adjusted t*)	-25.1324	0.0000
Harris Tzavalis	-0.0539	0.0000
Hadri LM	2.5240	0.0058
Fisher-type (Modified inv. chi-squared)	9.0219	0.0000
Level for SIZE		
Levin-Lin-Chu (LLC) (Adjusted t*)	-10.6709	0.0000
Harris Tzavalis	0.0609	0.0000
Hadri LM	3.0200	0.0013
Fisher-type (Modified inv. chi-squared)	-1.9982	0.9772

Source: Researcher's Computation From STATA 13.0 Version, 2018.

The result for the panel unit root test for all the variables indicated that majority of the tests indicate that all the variables were stationary at level. Thus, all the variables are integrated at level which permits the estimation of the models in this study.

DOI: 10.47505/IJRSS.2022.V3.6.3

Table 4.6: Summary of Kao Residual Cointegration Test Result

ADF	t-Statistic	Prob
	-14.37132	0.0000
Residual variance	0.120174	
HAC variance	0.066850	

Source: Researcher's Computation From STATA 13.0 Version, 2018.

The result of the Kao residual cointegration test with probalility of 0.0000 indicates the rejection of the null hypothesis of no cointegrating relationship among the variables.

4.2 Analysis of Ordinary Least Square (OLS) Results

In this study, OLS results were used to ascertain if there is any significant relationship between the independent variable and measures of the dependent variable of the selected firms during the period 2012-2017.

Table 4.7: OLS Result for Market To Book Value (MBV) and Intellectual Capital (M-VAIC)

Source	SS	df	MS		
				Number of obs	= 186
				F(2, 183)	= 8.99
Model	497.732717	2	248.866359	Prob > F	= 0.0002
Residual	5065.28079	183	27.67913	R-squared	= 0.0895
				Adj R-squared	= 0.0795
Total	5563.01351	185	30.0703433	Root MSE	= 5.2611

mbv	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
mvaic	.095443	.059458	1.61	0.110	-.0218683	.2127542
size	1.154786	.2852015	4.05	0.000	.5920805	1.717492
_cons	-4.421449	1.93756	-2.28	0.024	-8.244278	-.5986206

Source: Researcher's Computation From STATA 13.0 Version, 2018.

In Table 4.7, we presented the OLS result and it was observed that the values of the R-squared and adjusted R-squared were 0.0895 and 0.0795 respectively. This indicates that the independent variable (M-VAIC) explains about 7.95% of the systematic variation of the dependent variable (MBV) in the model for the sampled period (2012-2017). The F-statistics (df=2, 183, = 8.99) with a p-value of 0.0002 shows that the result is significant at 5 percent level, suggesting that M-VAIC appears to have a significant influence on Market-To-Book Value (MBV) of firms and was statistically significant at 5%.

In this study, effort was also made to analyse the statistical link between Earnings Per Share (EPS) and Intellectual Capital Efficiency (M-VAIC). The result of this analysis is thus presented in Table 4.8.

DOI: 10.47505/IJRSS.2022.V3.6.3

Table 4.8: OLS Result for Earnings Per Share (EPS) and Intellectual Capital (M-VAIC)

Source	SS	df	MS	Number of obs =	186
				F(2, 183) =	5.33
Model	544.764661	2	272.382331	Prob > F =	0.0056
Residual	9344.10513	183	51.0606838	R-squared =	0.0551
				Adj R-squared =	0.0448
Total	9888.86979	185	53.4533502	Root MSE =	7.1457

eps	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
mvaic	.2051188	.0807564	2.54	0.012	.0457854	.3644522
size	.8775619	.3873636	2.27	0.025	.1132888	1.641835
_cons	-3.514228	2.631614	-1.34	0.183	-8.706434	1.677978

Source: Researcher's Computation From STATA 13.0 Version, 2018.

In Table 4.8, we presented the OLS result for Model II of this study, and it was found that the values of the R-squared and adjusted R-squared were 0.0551 and 0.0448 respectively. This implies that in Model II, the independent variable (M-VAIC) explains about 4.48% of the systematic variation of EPS for the sampled period (2012-2017). This is an indication that about 4.48% of the variation in the EPS of the sampled firms is accounted for by changes in M-VAIC. The F-statistics (df=2, 183, f-ratio=5.33) with a p-value of 0.0056 further shows that the relationship is significant at 5 percent; thereby suggesting that M-VAIC has significant influence on the EPS of the sampled firms.

Additionally, on the basis of Model III, the relationship between intellectual capital efficiency (M-VAIC) and tobins'Q (TQ) was also examined. The result of this analysis is however presented in Table 4.9.

Table 4.9: OLS Result for Tobins'Q (TQ) and Intellectual Capital Efficiency (M-VAIC)

Source	SS	df	MS	Number of obs =	186
				F(2, 183) =	12.25
Model	73.5597181	2	36.779859	Prob > F =	0.0000
Residual	549.524659	183	3.00286699	R-squared =	0.1181
				Adj R-squared =	0.1084
Total	623.084377	185	3.36802366	Root MSE =	1.7329

tq	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
mvaic	.0364931	.019584	1.86	0.064	-.0021464	.0751326
size	.4442436	.0939385	4.73	0.000	.2589018	.6295854
_cons	-1.164016	.6381855	-1.82	0.070	-2.423164	.0951317

Source: Researcher's Computation From STATA 13.0 Version, 2018.

In Table 4.9, we presented the OLS result that analyses the statistical link between Tobins'Q (TQ) and intellectual capital efficiency (M-VAIC). Interestingly, the obtained R-squared and adjusted R-squared were 0.1181 and 0.1084 respectively. This means that the independent variable (M-VAIC) explains about 10.84% of the systematic variation in the dependent variable (TQ) for the sampled period (2012-2017). The F-statistics (df=2, 183, f-ratio=12.25) with a p-value of 0.0000 clearly suggests that at 5% significance level, a significant relationship was established between the Tobins'Q of the sampled firms and the value of their M-VAIC.

DOI: 10.47505/IJRSS.2022.V3.6.3

4.3 Test of Research Hypotheses

In this section, the results of the tests of hypotheses were presented and discussed. Note that the error term (μ_{it}) in the formulated models designed to form the basis of the test of hypotheses in this study is a composite error term, and there is the possibility that it could be correlated with the regressors in the models, thereby leading to a violation of one of the major assumptions of the classical least squares model, which states that the error term, is not correlated with any of the regressors in a linear model. The consequences of the violation of this assumption are that the estimated coefficients will be biased and inconsistent (Gujaratti, 2013). If this happens, the covariance of the true error term is represented in the following equation:

Cov $(V_{it}, V_{is}) = \sigma^2 u$, for $t \neq s$ - (4)

When the condition stated in equation (4) subsists, the unobserved heterogeneity factor will induce autocorrelation in the errors, with the consequence of reducing the forecasting usefulness of the estimated model. In order to account for the unobservable or heterogeneity effect which is common with panel data, possible approaches/analysis available to researchers are:

a) Fixed Effects Model
b) Random Effect model

In view of the above, the fixed effect and random effect analyses were conducted and the result of the Hausmann Test was employed to select the test result upon which the decision on accepting or rejecting the tested hypotheses shall be based on.

4.3.1 Hypothesis One

H_{O1}: Intellectual Capital Efficiency (ICE) does not significantly affect Market to Book Value ratio of selected listed firms in Nigeria.

Table 4.10: Results of Model I (MBV and M-VAIC)

Dependent Variable: Market to Book Value Ratio (MBV)						
Estimator	**OLS (Obs.=186)**		**FE (Obs.=186)**		**RE (Obs. =186)**	
Variable	**Coef.**	**Prob.**	**Coef.**	**Prob.**	**Coef.**	**Prob.**
MBV	-4.422** (-2.28)	0.024	8.02612 (19.19)	0.98	-1.78703 (-0.50)	0.618
M-VAIC	0.09544 (1.61)	0.110	.0127321 (0.26)	0.794	.024379 (0.52)	0.605
SIZE	1.1548* (4.05)	0.000	-.711915 (-0.55)	0.581	.823792 (0.24)	0.131
R-Squared	0.0895					
R-Squared Adj.	0.0795					
Prob. F.	0.0002					
F(2, 183)	8.99*					
R-Squared (within)			0.0025		0.0005	
R-Squared (between)			0.1040		0.1224	
R-Squared (overall)			0.0709		0.0842	
Wald Ch2(2)					2.49	
Prob. Ch2					0.2878	
Hausman Test			Chi2(2) = 2.70		Prob>Chi2= 0.2588	
F test that all u_i=0: F(30, 153) = 11.39			**Prob > F = 0.0000**			

Source: Researcher's Computation via STATA 13.0 * significant at 1% level ** at 5% level

Items in parentheses are t-ratios; Z-test in parentheses, bold face; MBV =Market to Book Value Ratio; M-VAIC= Intellectual Capital Efficiency; SIZE=Firm size

Table 4.10 presents the results of Ordinary Least Square (OLS), Fixed Effect (FE) and Random Effect (RE) for Market to Book Value ratio (MBV) and intellectual capital efficiency (M-VAIC) of the entire panel data. In Model I, the output of OLS indicates that MBV has a larger beta coefficient in absolute terms than M-VAIC and SIZE. Beta value shows the degree to which the explanatory variable affects the dependent variable. Judging from the OLS result, the coefficient of MBV is -4.422 with a t-value of -2.28. The result further reveals that about 8% variation of MBV was accounted for by M-VAIC which was however controlled for by SIZE.

DOI: 10.47505/IJRSS.2022.V3.6.3

Furthermore, MBV has beta coefficient of 8.02612 from the FE result. This figure is higher than the -1.78703 beta coefficient that was obtained from the RE result for MBV. The z-values of MBV obtained for FE and RE respectively were 19.19 and -0.50, though both were not significant at 1% levels.

The result of the t-tests for MBV as indicated in the OLS result was -2.28. The purpose of the t-test is to ascertain the individual significance of the explanatory variable. For t-test, any value less than 2 is not significant. The results of the Hausman test revealed a chi2(2) value of 2.70 while the corresponding p-value is 0.2588. This implies that the Fixed Effect (FE) result is more reliable than Random Effect (RE) in explaining the relationship between MBV and M-VAIC. Hausman test was performed to determine the model that is more efficient. If Probability (P) value is significant, then, RE is more efficient than FE and vice versa. Also, Wald test provides a likelihood-ratio test of the model's adequacy. On the basis of the aforesaid, the test of hypothesis one of this study was based on the result of the Fixed Effect Model.

Thus, since F test that all u_i=0: F(30, 153) = 11.39 and Prob > F = 0.0000, this study therefore accepts the alternate hypothesis and rejects the null hypothesis that intellectual capital efficiency does not significantly affect Market to Book Value ratio of selected listed firms in Nigeria. The conclusion is that intellectual capital efficiency significantly affects Market to Book Value ratio of selected listed firms in Nigeria.

4.3.2 Hypothesis Two

H_{O2}: Intellectual Capital Efficiency (ICE) has no significant relationship with Earnings Per Share of selected listed firms in Nigeria.

Table 4.11: Results of Model II (EPS and M-VAIC)

Dependent Variable: Earnings Per Share (EPS)						
Estimator	**OLS (Obs.=186)**		**FE (Obs.=186)**		**RE (Obs. =186)**	
Variable	**Coef.**	**Prob.**	**Coef.**	**Prob.**	**Coef.**	**Prob.**
EPS	-3.514 (-1.34)	0.183	19.2764 (1.82)	0.071	1.65033 0.34)	0.736
M-VAIC	.20512** (2.54)	0.012	.058903 (0.93)	0.353	.077471 (1.25)	0.211
SIZE	.87756** (2.27)	0.025	-2.54649 (-1.52)	0.130	.823792 (0.24)	0.774
R-Squared	0.0551					
R-Squared Adj.	0.0448					
Prob. F.	0.0056					
F(2, 183)	5.33*					
R-Squared (within)			0.0206		0.0040	
R-Squared (between)			0.0271		0.1067	
R-Squared (overall)			0.0161		0.0524	
Wald Ch2(2)					1.63	
Prob. Ch2					0.4433	
Hausman Test			Chi2(2) = 5.48		Prob>Chi2= 0.0646	
F test that all u_i=0: F(30, 153) = 12.91			**Prob > F = 0.0000**			

Source: Researcher's Computation via STATA 13.0 * significant at 1% level ** at 5% level

Items in parentheses are t-ratios; Z-test in parentheses, bold face; MBV =Market to Book Value Ratio; M-VAIC= Intellectual Capital Efficiency; SIZE=Firm size

Table 4.11 presents the results of Ordinary Least Square (OLS), Fixed Effect (FE) and Random Effect (RE) for Earnings Per Share (EPS) and Intellectual Capital Efficiency (M-VAIC) of the entire panel data. In Model II, the output of OLS indicates that EPS has a small beta coefficient in absolute terms than M-VAIC (0.20512) and SIZE (0.87756). Beta value shows the degree to which the explanatory variable affects the dependent variable. Judging from the OLS result, the coefficient of EPS is -3.514 with a t-value of -1.34. The result further reveals that about 4.48% variation of EPS was accounted for by M-VAIC which was however controlled for by SIZE.

DOI: 10.47505/IJRSS.2022.V3.6.3

Furthermore, EPS has beta coefficient of 19.2764 from the FE result. This figure is higher than the 1.65033 beta coefficient that was obtained from the RE result for EPS. The z-values of EPS obtained for FE and RE respectively were 1.82 and 0.34, though both were not significant at 1% levels.

The result of the t-tests for EPS as indicated in the OLS result was -1.34. The purpose of the t-test is to ascertain the individual significance of the explanatory variable. For t-test, any value less than 2 is not significant. The Hausman test was again performed to determine the model that is more efficient in explaining the relationship between the variables of concern in Model II (EPS and M-VAIC).The results of the Hausman test revealed a chi2(2) value of 5.48 with a corresponding p-value of 0.0646. This implies that the Fixed Effect (FE) result is more reliable than Random Effect (RE) in explaining the relationship between EPS and M-VAIC. On the basis of the aforesaid, the test of hypothesis one of this study was based on the result of the Fixed Effect Model.

Thus, since F test that all u_i=0: F(30, 153) = 12.91 and Prob > F = 0.0000, this study therefore accepts the alternate hypothesis and rejects the null hypothesis that intellectual capital efficiency has no significant relationship with the earnings per share of selected listed firms in Nigeria. The conclusion is that intellectual capital efficiency has significant relationship with the earnings per share of selected listed firms in Nigeria.

4.3.3 Hypothesis Three

H_{O3}: Intellectual Capital Efficiency (ICE) has no significant relationship with Tobins'Q of selected listed firms in Nigeria.

Table 4.12: Results of Model II (TQ and M-VAIC)

Dependent Variable: Tobins'Q (TQ)						
Estimator	**OLS (Obs.=186)**		**FE (Obs.=186)**		**RE (Obs. =186)**	
Variable	**Coef.**	**Prob.**	**Coef.**	**Prob.**	**Coef.**	**Prob.**
TQ	-1.16402 (-1.82)	0.070	5.58794* (2.66)	0.009	.902804 (0.75)	0.452
M-VAIC	.03649 (1.86)	0.064	.01131 (0.90)	0.369	.013176 (1.05)	0.293
SIZE	.44424* (4.73)	0.000	-.591862 (-1.79)	0.076	.145758 (0.80)	0.425
R-Squared	0.1181					
R-Squared Adj.	0.1084					
Prob. F.	0.0000					
F(2, 183)	12.25*					
R-Squared (within)			0.0257		0.0002	
R-Squared (between)			0.1227		0.1579	
R-Squared (overall)			0.0932		0.1179	
Wald Ch2(2)					1.70	
Prob. Ch2					0.4276	
Hausman Test			Chi2(2) = 12.51**		Prob>Chi2= 0.2019	
F test that all u_i=0: F(30, 153) = 21.81			**Prob > F = 0.0000**			

Source: Researcher's Computation via STATA 13.0 * significant at 1% level ** at 5% level

Items in parentheses are t-ratios; Z-test in parentheses, bold face; MBV =Market to Book Value Ratio; M-VAIC= Intellectual Capital Efficiency; SIZE=Firm size

Table 4.12 presents the results of Ordinary Least Square (OLS), Fixed Effect (FE) and Random Effect (RE) for Earnings Per Share (EPS) and Intellectual Capital Efficiency (M-VAIC) of the entire panel data. In Model III, the output of OLS indicates that TQ has a smaller beta coefficient in absolute terms than M-VAIC (0.03649) and SIZE (0.4424). Beta value shows the degree to which the explanatory variable affects the dependent variable. Judging from the OLS result, the coefficient of TQ is -1.16402 with a t-value of -1.82. The result further reveals that about 10.84% variation of TQ was accounted for by M-VAIC which was however controlled for by SIZE.

Furthermore, TQ has beta coefficient of 5.58794 from the FE result, and is significant at 1%. This figure is higher than the 0.902804 beta coefficient that was obtained from the RE result for TQ. The z-values of EPS obtained for FE and RE respectively were 2.66 and 0.75, though both were not significant at 1% and 5% levels.

DOI: 10.47505/IJRSS.2022.V3.6.3

The result of the t-tests for TQ as indicated in the OLS result was -1.82. The purpose of the t-test is to ascertain the individual significance of the explanatory variable. For t-test, any value less than 2 is not significant. The Hausman test was again performed to determine the model that is more efficient in explaining the relationship between the variables of concern in Model III (TQ and M-VAIC). The results of the Hausman test revealed a chi2(2) value of 12.51 with a corresponding p-value of 0.2019. This implies that the Fixed Effect (FE) result is more reliable than Random Effect (RE) in explaining the relationship between EPS and M-VAIC. On the basis of the aforesaid, the test of hypothesis one of this study was based on the result of the Fixed Effect Model.

Thus, since F test that all u_i=0: F(30, 153) = 21.81 and Prob > F = 0.0000, this study therefore accepts the alternate hypothesis and rejects the null hypothesis that intellectual capital efficiency has no significant relationship with the Tobins'Q of selected listed firms in Nigeria. The conclusion is that intellectual capital efficiency has significant relationship with the Tobins'Q of selected listed firms in Nigeria.

4.4 Discussion of Findings

The results from both the descriptive and inferential statistics via the Ordinary Least Square (OLS), Fixed and Random Effects (FE and RE) have some insightful revelations. From the result if the descriptive statistics, we observe from Table 4.1 that MBV recorded a mean and standard deviation of 3.614355 and 5.483643 respectively. Also, EPS was found to have a mean and standard deviation of 3.596962 and 7.31118 with -24.2 and 43.58 as the minimum and maximum values respectively. TQ recorded values of 1.925645 and 1.835218 as mean and standard deviation respectively with minimum and maximum values of 0.28 and 11.78 respectively. Also from the result of the descriptive statistics, it was observed that M-VAIC recorded a mean and standard deviation of 7.576129 and 6.529923, with maximum and minimum values of 34.66 and -34.18 respectively. The relative level of dispersion recorded for this variable could be accounted for by the nature of intellectual capital efficiency recorded by the different firms which to some extent could be accounted for by the size or nature of their businesses. The results for skewness and kurtosis which measures the asymmetry in, and within the series had values above 0 in all cases (dependent and independent variables) which indicate that the data for the series were skewed to the right.

Additionally, the results of the correlation analysis indicated that the explanatory variable (M-VAIC) had positive relationship with measures of the dependent variable (MBV, EPS and TQ). In a similar vein, the control variable (SIZE) was also found to have positive relationship with measures of the dependent variable (MBV, EPS and TQ). The results of the correlation matrix also proved that there were no signs of the presence of multicollinearity among the dataset for this study. This position was further confirmed by the result of the heteroscedasticity test along with the test for multicollinearity.

With respect to the test of hypotheses, we noticed that in Model I, the output of OLS presented a higher value of beta coefficient in absolute terms for MBV than that reported for M-VAIC and SIZE. Furthermore, the results of the Hausman test revealed a chi2(2) value of 2.70 while the corresponding p-value is 0.2588, thus indicating that the Fixed Effect (FE) result was more reliable than Random Effect (RE) in explaining the relationship between MBV and M-VAIC. On the basis of the test of hypothesis using the FE result, this study argued that since the F test that all u_i=0: F(30, 153) = 11.39 and Prob > F = 0.0000, the null hypothesis that intellectual capital efficiency does not significantly affect Market to Book Value ratio of selected listed firms in Nigeria was thus rejected, leading to the conclusion that intellectual capital efficiency significantly affects Market to Book Value ratio of selected listed firms in Nigeria. This finding is in consonance with those of Veltri and Silvestri (2011) and Pal and Soriya (2012).

However, in testing hypotheses 2, it was observed from the results presented in Table 4.11 that the output of OLS presents smaller beta coefficient in absolute terms for EPS than that presented for M-VAIC (0.20512) and SIZE (0.87756). Judging further from the OLS result, the coefficient of EPS is -3.514 with a t-value of -1.34. Since the results of the Hausman test also revealed a chi2(2) value of 5.48 with a corresponding p-value of 0.0646, the test of hypothesis 2 was based on the result of the FE model. On the basis of this, since the F test that all u_i=0: F(30, 153) = 12.91 and Prob > F = 0.0000, this study thus accepts the alternate hypothesis and rejects the null hypothesis that intellectual capital efficiency has no significant relationship with the earnings per share of selected listed firms in Nigeria. The rejection of the null hypothesis led to the conclusion that intellectual capital efficiency has significant relationship with the earnings per share of selected listed firms in Nigeria. This finding corroborates the findings of Solikhah (2010).

Finally, it was observed from the results in Table 4.12 that with respect to Model III, the output of OLS indicates that TQ has a smaller beta coefficient in absolute terms than M-VAIC (0.03649) and SIZE (0.4424). Judging from the OLS result, it could be deduced that about 10.84% variation of TQ was accounted for by M-VAIC which was however controlled for by SIZE. Also, TQ was found to have a beta coefficient of 5.58794 from the FE result, and is significant at 1%. This figure is higher than the 0.902804 beta coefficient that was obtained from the RE result for TQ. In determining the model that is more efficient in

DOI: 10.47505/IJRSS.2022.V3.6.3

explaining the relationship between the variables of concern in Model III (TQ and M-VAIC), the hausman test was conducted and the result indicated that the FE result was more reliable than the RE result. On this note, given that from the result of the FE, since F test that all u_i=0: F(30, 153) = 21.81 and Prob > F = 0.0000, this study therefore accepts the alternate hypothesis and rejects the null hypothesis that intellectual capital efficiency has no significant relationship with the Tobins'Q of selected listed firms in Nigeria. This however led to the conclusion that that intellectual capital efficiency has significant relationship with the Tobins'Q of selected listed firms in Nigeria.

5.0 CONCLUSION AND RECOMMENDATIONS

This study therefore assessed the relationship between intellectual capital efficiency (measured by the M-VAIC) and firm value of selected listed firms in Nigeria. The results from the test of hypotheses however proved that in Nigeria, intellectual capital efficiency has significant relationship with measures of firm value (market to book value, earnings per share and Tobins'Q). This confirms the argument that the overall workforce of organizations is the major driving force of the performance of firms which ultimately have multiplier effect on firm value.

On the basis of the aforesaid, this study concludes that since intellectual capital efficiency significantly affects measures of firm value, for firms to survive and operate efficiently, there is therefore the need for an increased investment in their respective intellectual and human capital as it is believed that this will guarantee sustainability and the enhancement of the overall value of the firm in future.

On the basis of the findings of the study, the following recommendations are provided:

1. Overall, this study affirms a significant impact of intellectual capital efficiency on firm's value of some listed firms in Nigeria. As a result, the importance of intellectual and creative capital should not be overlooked, and the approach for how it flows should be created, maintained and improved.
2. Management of the organization should ensure workers are highly qualified, making a deliberate effort to train and retain staff in order to foster success. It is clear that ICE drives value creation, so there should be strategies designed to not only make leaders competent, but to also keep them in their positions for a long time
3. More attention should be given to the human side of the intellectual capital and reliance should not strictly be focused on the numeric evaluation and improvement. Firms should invest in education and relevant programmes that can help them increase in their structural capital by harnessing information technology.

5..1 Contribution to Knowledge

This study has contributed to knowledge in the following ways:

1. This work has been able to affirm that with the Modified Value Intellectual Coefficient (M-VAIC) model of measuring intellectual capital efficiency, firms can create value that would enhance stakeholders' interests and general organizational sustainability of firms in Nigeria.
2. Most research efforts in this area have mostly been conducted in developed economies with concentration on few components of intellectual capital (human capital efficiency and structural capital efficiency), but this work has actually concerned itself on taking a holistic look on how the overall measure of intellectual capital efficiency of firms (gauged by the modified value added intellectual coefficient – M-VAIC) would affect the value of firms especially in developing economies (Nigeria in particular).
3. It is hoped that this study has depicted the genuineness of the ICE development condition in one of the most affluent countries in Africa and the study does not only contribute to the knowledge of IC research in Nigeria, but also highlights the needs for business managers and governments to pay more attention to the cultivation of IC as a strategic asset to sustain in a knowledge-based economy.

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DOI: 10.47505/IJRSS.2022.V3.6.3

APPENDIX I

LIST OF SAM*-

PLED COMPANIES IN THIS STUDY

S/N	NAME OF SELECTED LISTED FIRMS	SECTOR
1	Livestock Feeds	Agriculture
2	Okomu Oil Palm	Agriculture
3	Presco	Agriculture
4	Cement Comy Of Northern Nig	Construction
5	Lafarge Cement Wapco Nig	Construction
6	Dangote Sugar	Consumer
7	Flour Mills Of Nigeria	Consumer
8	Nascon Allied	Consumer
9	Nestle Nig	Consumer
10	Nigeria Breweries	Consumer
11	Nigerian Enamelware	Consumer
12	Pz Cussons	Consumer
13	Unilever Nig	Consumer
14	Glaxosmithkline Nig	Healthcare
15	Berger Paints Nig	Industrial
16	Beta Glass Company	Industrial
17	Chemical & Allied Product	Industrial
18	Cutix	Industrial
19	Greif Nig	Industrial
20	Conoil	Oil and Gas
21	Eternaoil	Oil and Gas
22	Forte Oil (Ap)	Oil and Gas
23	Mobil Nig	Oil and Gas
24	Mrs(Texaco Chevron)	Oil and Gas
25	Total Nigeria	Oil and Gas
26	Aluminium Extrusion Indus	Resources
27	B.O.C Gases Nig	Resources
28	Ikeja Hotel	Services
29	National Aviation Handling	Services
30	Redstar Express	Services
31	University Press	Services

Source: Nigerian Exchange Group (NGX Group) (2021)

DOI: 10.47505/IJRSS.2022.V3.6.3