HOW KNOWLEDGE ASSETS AFFECT PROFITABILITY AND MARKET VALUE OF LISTED DEPOSIT MONEY BANKS IN NIGERIA

ADESINA, Julius Babatunde[1]
NWIDOBIE, Barine Michael[2]

Abstract

The study examines the impact of knowledge assets on profitability and market value of listed deposit money banks (DMBs) in Nigeria for the period 2015 to 2021. Thirteen listed DMBs with reporting currency in Naira were used for the study. The total firm year for the study is 91. Multiple regression analysis was used as instrument of analysis. Chow test and Hausman test were conducted to determine the appropriate regression model. Results show that Value Added Intellectual Coefficient (VAIC) has a positive effect on market value and profitability of DMBs in Nigeria. The individual components, human assets efficiency (HAE) and structural assets efficiency (SAE) were found to have a positive effect, while total assets efficiency (TAE) has a negative impact on market value of deposit money banks in Nigeria. VAIC was found to have a positive effect on profitability of deposit money banks in Nigeria. With the consideration of the individual components, HAE and SAE have a positive effect on return on assets (ROA) and return on equity (ROE) but a negative effect on revenue growth (RG). TAE has a negative effect on ROA and ROE with a positive effect on RG of DMBs in Nigeria. To improve their profitability and thus their market value, deposit money banks are advised to step up development and training of their human resources, structures and processes, through the development of information technology, and customer relationship management.

Keywords: Deposit money banks, Intangible assets, Intellectual capital, Market value, Profitability, Total assets, Value added intellectual coefficient.

Introduction

The debate on non-inclusiveness of financial statements through the omission of intellectual capital in the financial statements has been going on for a long time (Lev &Zarowin, 1999; Lev, 2001; Lev &Radhakrishman, 2003). Lev (2001) studied the market-to-book value ratios of US Standard and Poor (S&P)

[1] Department of Accounting, Finance and Taxation, Caleb University, Imota, Lagos, Nigeria
[2] Department of Accounting, Finance and Taxation, Caleb University, Imota, Lagos, Nigeria

500 corporations for 1977 – 2001 and found that it increased from 1 to 5, indicating that about 80 per cent of firms' market value has not been captured in financial reporting. This inability of the financial statements variables to fully explain firm value is a reflection of the shift of the source of economic value creation from physical, tangible assets to intangible assets, such as knowledge assets which includes human assets and structural assets, comprising customers, processes, databases, brands and systems (Edvinsson& Malone, 1997), which have been found to be playing increasing roles in the creation of corporate sustainable competitive advantage (Kaplan & Norton, 2004).

Modern and emerging technologies, such as artificial intelligence and robotics, internet of things, cloud computing, etc., which is the controlling force of the fourth industrial revolution has further caused wide gap between market value and reported net assets of companies. Organisations are realising the fact their true value depends on knowledge assets much more than the assets reported on the statement of financial position currently. A study carried out by Aon and the Ponemon Institute in 2020, showed that intellectual component of firm's capital has been increasing over the years, while the value of physical assets continues a downward trend. Therefore, in today's knowledge economy, intellectual capital is a major driver of value creation for firms. In this context, intellectual capital means the knowledge and other intangibles assets that produce or create value in the present, or create value in the future (Viedma Marti, 2007).

Stewart (1997) opined that intellectual Capital (IC) is the knowledge and information that can create value-added efficiency to generate wealth for the company. Scholars usually divide intellectual capital into three main components, Human Capital, Structural Capital and Relational Capital (Holton &Yamkovenko, 2008; Yang and Lin, 2009; Mavridis&Kyrmizoglou, 2005; Tayles et al., 2007). Intellectual capital or Knowledge assets are intangible resources that are owned and used by firms to generate value through operational efficiency.

In the table below, Sveiby (1997), classified firm's assets, where intangible assets are used for intellectual or knowledge assets:

Equity (book value) Tangible assets minus visible debt.	Intangible Assets or Knowledge Assets (Result in stock price premium)		
	Organisational relationships (Brands, suppliers and customers management)	Organisational structure and processes (The organisation: management, legal structure, manual systems, attitudes, R&D, Software)	Individual competence (Education, experience)

Classification of firm's assets - Sveiby (1997)

IFAC (1998), also classified intellectual capital as follows:

Human capital (Human assets)	Relational (customer) capital (Relational assets)	Organisational (structural) capital (Structural assets)
● know-how ● education ● vocational qualification ● work-related knowledge ● occupational assessments ● psychometric assessments ● work-related competencies ● entrepreneurial elan, innovativeness, proactive and reactive abilities, changeability	● brands ● customers ● customer loyalty ● company names ● backlog orders ● distribution channels ● business collaborations ● licensing agreements ● favourable contracts ● franchising agreements	● patents ● management philosophy ● copyrights ● corporate culture ● design rights ● trade secrets ● information systems ● trademarks ● networking systems ● service marks ● financial relations

Classification of intellectual capital – IFAC (Dzinkowski, 1998)

Marr and Schiuma (2001) defined Knowledge assets as, a firm's assets which add value to the firm's important stakeholders, by increasing the firm's competitive advantage.

Drucker(1992) stated that today, old resources, physical and natural assets are giving way to knowledge assets. Powell and Snellman (2004) elucidated that in a knowledge-based economy, production and services depend on knowledge-intensive activities and support of technical and scientific advancement. This means that knowledge and competencies, rather than physical inputs are the main elements of the knowledge economy. Banking operation today is being driven by knowledge assets, competencies and capabilities more than physical infrastructure of branch locations.

Through developments in information and communication technology (ICT), the world has become a global market and competition has therefore, become global and firms are now deploying intellectual assets as vital resources to increase their capabilities to compete in the global market (García-Meca, 2005;

García-Meca&Martínez, 2007), optimise their performance and gain competitive advantage (Ousama et al., 2011a; Ousama et al., 2011b; Huang et al., 2013).

Starovic and Marr (2008), Pilkova *et al* (2013) see intellectual capital as a means (knowledge) to achieve an end or the end-product of a knowledge transformation process. This knowledge transformation processes have become the value drivers in the banking industry. Kamath (2014) opines that the banking operation is noted for huge investment in knowledge assets, which means that the banking operation is based more on knowledge, relationship and skills than being labour intensive (Branco et al., 2011; Muhammad & Ismail, 2009). Being a service industry, operations of banks involve closeness with customers and dependence, to a large extent, on their ability to use information and communication technology (ICT) for new product development, enhancement of old products and improvement in service delivery (Mention &Bontis, 2013).

Goh (2005) stated that not physical capital, though essential for banking operations, but knowledge assets have now become the main determinant of the extent of the effectiveness and efficiency of banks' service delivery. Also, the complexity of modern banking and more liberal environment of banking operation have further necessitated the development of intellectual knowledge, as competitiveness in the industry depends largely on human asset quality and the bank's ability to effectively deploy this (Muhammad & Ismail, 2009). Efficiency of intellectual knowledge resource is therefore, a critical resource banks can deploy for strategic creation of value for their stakeholders (Joshi et al., 2010).

Provision of service quality is now the fundamental goal of the banking subsector of the economy, source of competitiveness and value creation. Development in intellectual assets made the deployment of new banking models, such as virtual banking, online banking and direct banking possible. Modern banking is no longer driven by physical branch network, but by digital network, made possible by development in information and communication technology, which made financial services innovation and development of digital banking possible (Abu-Noman, 2013).

Therefore, this paper is set out to examine the level of contribution of knowledge assets to market value and profitability of listed DMBs in Nigeria. The study used the value-added approach and panel data to measure the impact of knowledge assets on profitability and market value of the Nigerian DMBs from 2015 to 2021.

At present, there seems to be no previous studies on the effect of knowledge assets on profitability and market value of deposit money banks in

Nigeria. The study is, therefore, significant as it will assist the banks' policy makers to understand the new source of key value driver in the sector.

The study proceeded as follows: the next section deals with theoretical framework and discussion of related literature, while section three deals with the methodology. Section four deals with analysis of data and discussion of results, while the last section, five, shows the conclusion from the study.

2.0 Theoretical framework and discussion of related literature

2.1 Theoretical review and hypotheses development

The underpinning theory for this study is the Resource-Based View (RBV) of the Firm or Resource-Based Theory (RBT). RBV was propounded by Penrose (1959) and later modified by Rumelt, 1984; Barney, 1991 and 1995; Dierick& Cool, 1989, cited by Stiles & Kulviachana (2008). RBV stipulates that it is of paramount importance for firms to acquire strategic resources, bundle them together in a strategic way to achieve organisational success. However, the theory made it clear that competitive advantage is not only achieved through traditional resources, such as natural resources, technology or economies of scale, which can easily be duplicated by other firms. Rather, competitive advantage is gained through strategic, rare and hard to imitate resources which are located within the organisation, such as intellectual asset which is an invisible asset (Itami, 1987). Wright *et al* (2001), emphasised the importance of resource-based view as they opined that it promotes management of the organisation's knowledge resources. Core – competence of firms has been found to be associated with human asset, where economic rents are attributed to people-embodied skills (Hamel &Prahalad, 1990). Ferreira and Fernandes (2017) opined that the resource-based view states that whenever firm resources are valuable, rare, non-replicable and non-replaceable; they become a source of continuous competitive edge through implementation of value creation strategies.

Peng et al (2007), see intellectual asset as a very important resource that can improve a firm's productive activities and generate value. While Roos et al (2005) opined that intellectual asset are resources that are not financial or tangible but are controlled by organisations as drivers of value creation. Intellectual asset has been broadly classified into three elements, as previously stated, i. e., human asset organisational asset and customer asset (Bontis et al., 2015; Nimtrakoon, 2015; Wang et al., 2014).

Scholars (Ahangar, 2011; Morris, 2015) explained that human asset (HA) relates to the effective management of employees' knowledge and competencies and improving these for continuing effectiveness and efficiency of the organisation. Structural asset (SA) refers to structures and processes put in place in the organization to promote effectiveness and efficiency. Relational asset (RA) concerns the connection the organisation maintains with its key partners, such as suppliers, customers, service providers, etc. (Kweh et al, 2014; Yu et al, 2015).

However, for this study, knowledge assets would be broadly classified as human assets (HA) and structural assets. Human assets are employee-dependent, such as employees' knowledge and competencies, commitment, motivation and loyalty, etc. According to Bontis (1999), human assets are recognised as being the heart of creating knowledge assets, but a distinctive feature of human assets is that it may disappear as employees exit. However, structural assets belong to firms; it refers to what cannot be taken away from the company when employees leave the organisation (Roos et al., 1997). It includes organisational structures and processes, policy and procedures, etc.

Though knowledge assets have been recognised as a key driver of firm's value and competitive edge, there has been no agreed appropriate measure of these assets. However, in this study, knowledge assets would be defined as a firm's human asset which comprises of the employees' knowledge and competencies and structural asset which refers to the organisation's structures, processes, relationships, etc. The measurement adopted by Pulic (2000a, b) would be used to measure the knowledge assets of the deposit money banks. To Pulic (2000a, b), the value of any firm is dependent on the firm's knowledge assets and the total assets (capital employed), as stated in the firm's statement of financial position. This measurement is referred to as value added intellectual coefficient (VAIC) (Pulic, 2000a, b). This indicates that the value added by the firm in its operations is determined by the efficiency at which the firm's knowledge assets (human assets and structural assets) and total assets are being deployed. This is measured by calculating the coefficient of the human assets, structural assets and total assets (capital employed) by the firm. The addition of these three measures is the value of VAIC and the higher the VAIC, the better the management's utilisation of the company's value creation potential.

Therefore, the following hypotheses would be tested:

H_0 Value added intellectual coefficient (VAIC) has no statistically significant effect on Nigeria DMB market-to-book value ratio.

According to Sulivan (1999), knowledge-based resource that can be converted into profits has the potential to increase firm's profitability. Therefore, banks can deploy knowledge assets to generate new and enhanced products that will result in new streams of revenue, hence increase their profitability and create value. Firms may use knowledge assets in a strategic manner to enhance firm profitability, which will lead to creation of value. The ratio of a firm's market price to book value, a ratio that explains that intangibles bring value to a firm because of increase in return on asset (ROA) as a measure of firm profitability, has been extensively used in the literature to examine its relationship with VAIC. Celenza and Rossi (2014), Forte et al. (2017), Ghosh and Maji (2015), Lin et al. (2017), Mehraliana et al. (2012), Nimtrakoon (2015) and Zeghal and Maaloul (2010) have used this measure. Also, other scholars (Joshi et al. 2013; Maji&Goswami, 2016; Ozkan et al.,2017; Pal &Soriya, 2012; Singh et al., 2016; Sriranga& Gupta, 2014; Smriti& Das, 2018; Zeghal&Maaloul, 2010) have also used this measure along with return on sales, return on equity and Tobin Q, as additional variables. It is therefore, hypothesised as follows:

H_{02}. Value added intellectual coefficient (VAIC) has no statistically significant effect on DMB profitability in Nigeria.

2.2 Empirical literature

Forte *et al* (2019) studied the impact of intellectual capital components on firms' market value and financial performance of Italian listed firms. They used market to book value ratio, ROA and growth in revenue as dependent variables and components of intellectual capital as independent variables. Ordinary Least Square (OLS) regression model was used to determine the impact of intellectual capital on market value and financial performance. Results show that the aggregate form of intellectual capital exerts a positive impact on firms' financial performance.

Singla (2020) investigated whether intellectual capital (IC) and its subcomponents enhance value and improve the profitability of real estate and

infrastructure firms in India. He measured IC through the value-added intellectual coefficient (VAIC^{TM}) model. The study further extends the VAIC^{TM} model by incorporating an additional component, social welfare efficiency (SWE). Panel data, based on data from 63 firms: (22 real estate and 41 infrastructure firms), for a period of 10 years (2008–2017) was used for the study. Results reveal that IC has a significant influence on the financial performance and market value of infrastructure firms, and capital-employed efficiency (CEE) positively affects the financial performance of both real estate and infrastructure firms.

Faqo et al (2021) investigated the mediating role of banking technology applications (BTA) in the relationship between intellectual capital (IC) components and bank service quality (BSQ) dimensions of commercial banks in Erbil city. The survey questionnaire was used as the method of primary data collection, while partial least squares– structural equation modeling (PLS-SEM) was used to analyse the data collected. They found out that BTA has significant impact on banks' service quality. They further discovered that BTA mediates between the effect of IC on banks' service reliability and tangibility, and ability to inspire trust and confidence of their customers.

Susanti et al. (2020) studied IC, market value and financial performance of firms and the impact of financial performance on firm value. The study was based on the goods and consumer sector and covers the period, 2013 – 2017. Method of analysis used is the Partial Least Square (PLS). Results show no significant impact of IC on firm value; however, IC has significant impact on financial performance which in turn has influence on firm value.

Eddine and Khedri (2021) investigated the moderating effect of corporate governance and the adoption of the new accounting standards on the relationship between firms' value and intellectual capital performance in Malaysian companies. Sample consists of 228 listed firms and the study period is 2011 - 2013. An index was constructed to assess corporate governance and the value added intellectual capital coefficient (VAIC) was used to asses IC performance (ICP). Regression models were employed to analyse the panel data consisting of the dependent and independent variables. Findings show an insignificant association between intellectual capital, performance and firms' market

capitalisation but become significant when it is moderated with corporate governance.

Shubita (2019) examined the impact of intellectual capital (IC) on market value of the Jordanian industrial firms. A sample of 73 Jordanian manufacturing shareholders companies was used and for the period 2005–2017. Data consists of 648 firm-year observations. Market value was measured using the market capitalisation over the total assets. Regression model was used as the tool of analysis. The results did not reveal any significant association of IC with the market value. However, human capital efficiency is associated with the market value, while structural capital efficiency and capital employed efficiency are not associated with the market value.

Salvia *et al* (2020) examined how intellectual capital impacts the firm value creation processes especially as firms globally has transit from manufacturing-based to a knowledge-based production. The study used a sample of 110 companies. They found that all the three components of IC (structural, human, social and relationship) have a significantly positive relationship with firm value.

Tayyem and Al-Mawali (2020) examined the association between intellectual capital efficiency and market to book value of listed non-financial firms on the Amman stock exchange for the period, 2013-2017. The sample for the study is all listed non-financial firms that disclosed required data which is related to the variables under study. They found a statistically significant association between the components of value added intellectual capital and the market to book value.

Zeng and Wudhikarn (2018) examined the influence of intellectual capital (IC) on firm's market value and financial performance of logistics industry companies listed on the Stock Exchange of Thailand (SET). They used ten years data set of logistics firms. Multiple linear regression was used to analyse the associations between IC and corporate performance. They found that VAIC and its three components are positively associated with firm's market value and performance, measured by returns on assets (ROA), but do not have positive influence on other financial performance measures, such as Return on equity (ROE), employee productivity (EP) and revenue growth (RG).

Ugwuanyi and Onyekwelu (2018) studied intellectual capital, revenue and market values of ICT firms in Nigeria. Data for the study, covering a ten-year period, 2004 – 2013, was sourced from annual reports of the three firms selected from the industry under study. Ordinary Linear Regression model was used as the method of data analysis. They found that intellectual capital has positive and insignificant relevance on revenue of ICT firms in Nigeria but has an insignificant relevance on share price of ICT firms.

Soewarnoa and Ramadhan (2020) examined the impact of ownership structure and intellectual capital on firm value with the firm's performance as an intervening variable. Sample was taken from the Indonesia Stock Exchange in 2016, consisting of 302 firms. Structural Equation Modelling (SEM) model was used as a method of analysis. They found that ownership structure can increase firm value and firm performance. Also, intellectual capital is able to increase firm value and performance, meaning that the Value Added Intellectual Coefficient (VAIC ^{TM}) has a positive impact on firm value. Also, ownership structure has a positive impact on firm performance, i. e., foreign ownership, managerial ownership and institutional ownership positively affect firm performance. Furthermore, they found that intellectual capital has a positive impact on firm performance and firm performance can increase firm value, indicating that firm performance fully mediates the impact of ownership structure and intellectual capital on firm value.

3.0 Methodology

The population for the study is all listed DMBs in Nigeria and the sample consists of all the subjects in the population. There are 14 DMBs listed on the Nigerian Exchange, however, one of the banks, Ecobank Transnational, was dropped from the study because its reporting currency is U. S. dollars, leaving 13 banks for the study. Data was sourced from the annual reports of the DMBs and from the Nigerian Exchange historical data repository, for the period 2015 to 2021, giving a total of 91 firm years. Panel data is employed as variables for the study covers seven years for each of the DMBs.

3.1 Measurement of variables

Modified Pulic (2000a) model of Value Added (VA) and Value Added Coefficient (VAIC) are used. Value added (VA) was defined by Pulic (2000a), as profits after tax (PAT) plus employee cost (EC), plus Depreciation (D), i. e., VA = PAT + EC + D. However, for this study, VA is measured as, OUT – IN, i.e., Output – Input.

Where:

Output is defined as net interest margin plus other income, i.e., NI + OI.

Input is defined as total expenses minus employees' costs.

While VAIC' for this study is defined as Human Assets Efficiency, plus Structural Assets Efficiency, plus Total Assets Efficiency, or expressed as:

VAIC = HAE + SAE + TAE or VAIC VA/HA + SA/VA + VA/TA

Where:

HAE is a measure of human assets efficiency, calculated by dividing the VA with HA, i.e. VA/HA.

HA is defined as employee cost.

TAE is total assets efficiency, which is calculated by dividing VA with TA, i.e. VA/TA. TA in accounting is the total investment in assets.

SAE is structural assets efficiency, which is calculated by dividing VA with SA, i.e. VA/SA.

The definition of VA is key to VAIC measurement model. Several scholars (Celenza & Rossi, 2014; Cenciarelli et al., 2018; Forte et al., 2017; Ginesti et al., 2018; Lin et al., 2017; Maji & Goswami, 2016; Sardo & Serrasqueiro, 2017; Singh et al., 2016; Sriranga & Gupta, 2014; Smriti& Das, 2018) have used Pulic's definition for VA in their respective studies, hence the adoption of Pulic's definition in this study.

3.2 Definition of variables

As in Pulic (2000a, b), variables for the study include four independent variables, viz:

I. Value added intellectual capital efficiency (VAIC), the aggregate of the three separate assets efficiency;

II. Total Assets Efficiency (TAE);

III. Human Assets Efficiency (HAE); and

IV. Structural Assets Efficiency (SAE).

The value added (VA), according to Riahi-Belkaoui (2003) would be calculated first, to be able to calculate the above variables. Then, total assets (TA), human assets (HA) and structural assets (SA) were calculated as follows:

TA = Total assets, both physical and financial capital; measured by total assets – intangible assets.

HA = Total investment on employees' salary, wages, etc.:

SA = VA - HA:

VAIC and its three components were then calculated as shown below:

TAE = VA/TA

HAE = VA/HA

SAE = VA/SA

VAIC = TAE + HAE + SAE:

The use of the above measurement methodology has some advantages as opined by Bontis, (1999) and Sullivan, (2000). This is because data are provided by financial statements that are more reliable than questionnaires since they would have been audited by professionally qualified public accountants.

3.3 Dependent variables

Dependent variables for the study are:

I. Market-to-book value ratios.

II. Profitability.

Market-to-book value ratio is calculated by dividing the market value (MV) with the book value (BV) of equity shares, as follows:

MV = Number of shares X Stock price at the end of the year:

BV = Shareholders' equity, where goodwill forms part of the shareholders' equity, it was subtracted from the book value.

Profitability is proxied with three variables, as shown below:

(1) Return on assets (ROA), which is measured by dividing the net income by total assets, i. e.

ROA = Net Income/Total Assets:

ROA shows how profitable a company is in relation to its total assets. It gives an idea of how efficient the management uses the company's assets to generate earnings.

(2) Return on equity (ROE), which is measured by dividing the net income with the shareholders' equity, i. e.

ROE = Net income/Shareholder's equity:

ROE shows an organisation's profitability by showing how much profit a company generates with the money the shareholders have invested.

(3) Growth in revenues (GR):

GR = {(Current year's revenues / Last year's revenues) – 1} X 100%

GR is the most traditional measure that indicates the growth of an organisation

3.4 Model specification

The multiple regression model is used for the study. Regression models 1, 3, 5 and 7 show the effect VAIC on the dependent variables in aggregate, while in regression models 2, 4, 6 and 8 VAIC was broken into its three components, that is HAE, SAE and TAE. The regression models are as follows:

$$M/B_{it} = \beta_0 + \beta_1 VAIC_{it} + \mu_{it} \quad \ldots\ldots 1$$

$$M/B_{it} = \beta_0 + \beta_1 HAE_{it} + \beta_2 SAE_{it} + \beta_3 TAE_{it} + \mu_{it} \quad \ldots\ldots 2$$

$$ROA_{it} = \alpha_0 + \alpha_1 VAIC_{it} + \mu_{it} \quad \ldots\ldots 3$$

$$ROA_{it} = \alpha_0 + \alpha_1 HAE_{it} + \alpha_2 SAE_{it} + \alpha_3 TAE_{it} + \mu_{it} \quad \ldots\ldots 4$$

$$ROE_{it} = \alpha_{it} + \alpha_1 VAIC_{it} + \mu_{it} \quad \ldots\ldots 5$$

$$ROE_{it} = \alpha_{it} + \alpha_1 HAE_{it} + \alpha_2 SAE_{it} + \alpha_3 TAE_{it} + \mu_{it} \quad \ldots\ldots 6$$

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$RG_{it} = \alpha_{it} + \alpha_1 VAIC_{it} + \mu_{it}$ ……..7

$RG_{it} = \alpha_{it} + \alpha_1 HAE_{it} + \alpha_2 SAE_{it} + \alpha_3 TAE_{it} + \mu_{it}$ ……..8

Where:

VAIC is value added intellectual capital coefficient;

HAE is human assets coefficient;

SAE is structural assets coefficient;

TAE is total assets coefficient;

ROA is returns on assets;

ROE is returns on equity;

RG is revenue growth; and

4.0 Data analysis and discussion of findings

4.1 Descriptive statistics of variables

Table 1: Descriptive statistics of variables.

	M/B	ROA	ROE	RG	VAIC	HAE	SAE	TAE
Mean	0.597922	0.017841	0.119494	82.90150	2.931109	38.317455	73.920928	2.811209
Median	0.450044	0.012885	0.095518	99.08304	1.931109	30.041000	32.562000	1.871109
Maximum	2.251582	0.065581	0.320796	0.000000	1.201410	1.0175308	3.0931808	1.172310
Minimum	-0.030700	-0.091003	-0.012132	-110.0936	59.185575	17.904927.	-12.445451	52.33136
Std. Dev.	0.474778	0.018666	0.078989	37.05293	2.661709	28.207909	83.044186	2.572209
Skewness	1.313062	-1.403373	0.502892	1.802260	1.159594	0.737643	1.226470	1.186612
Kurtosis	4.624088	14.78591	2.561655	4.257115	3.732245	2.354060	3.397051	3.823785
Jarque-Bera	36.15046	556.5615	4.564207	55.25556	22.42703	9.834465	23.41188	23.92851
Probability	0.000000	0.000000	0.102069	0.000000	0.000013	0.007319	0.000008	0.000006
Sum	54.41087	1.623553	10.87399	-7544.037	2.664511	3.492209	6.730109	2.562211
Sum Sq. Dev.	20.28730	0.031358	0.561539	123562.8	6.382520	7.162316	6.212217	5.961120
Observations	91	91	91	91	91	91	91	91

Author's Compilation 2022

Note: M/B (Market-to-book value ratio), ROA (Return on asset), ROE (Return on equity), RG (Revenue growth), VAIC (Value added intellectual coefficient), HAE (Human assets coefficient), SAE (Structural assets coefficient) and TAE (Total Assets coefficient**)**

Table1 above shows the descriptive statistics used in the study. M/B has a mean value of 0.59%, median value of 0.45%, and standard deviation has a variation value of 0.47%. ROA has a mean value of 0.01%, median value of 0.01%, and standard deviation of 0.01%. ROE has a mean value of 0.11%, median value of 0.09%, and standard deviation of 0.07%. RG has a mean value of 82.90%, median value of 99.08%, and standard deviation of 37.05%. VAIC has a mean value of 2.93%, median value of 1.93%, and standard deviation of 2.66%. HAE has a mean value of 38.31%, a median value of 30.04% and standard deviation of 28.20%. SAE has a mean value of 73.92%, median value of 32.56%, and standard deviation of 83.04%. TAE has a mean value of 19.06%, a median value of 5.02%, and standard deviation of 42.65%.

The minimum value and maximum value of the variables are as follows: M/B has a minimum value of -0.03 and a maximum value of 2.25. ROA has a minimum of -0.09 and a maximum value of 0.06. ROE has a minimum of -0.01 and a maximum value of 0.32. RG has a minimum of -110.09 and a maximum value of 0.00. VAIC has a minimum 59.18 and maximum 1.20. HAE has a minimum value of 17.90 and a maximum value of 1.01. SAE has a minimum value of -12.44 and a maximum value of 3.09. TAE has a minimum value of 52.33 and a maximum value of 1.17.

Table 2: Correlation Matrix

	M/B	ROA	ROE	RG	VAIC	HAE	SAE	TAE
M/B	1.000000							
ROA	0.648955	1.000000						
ROE	0.692474	0.756817	1.000000					
RG	-0.146669	-0.054224	-0.063663	1.000000				
VAIC	0.010341	0.297516	0.428499	0.267261	1.000000			
HAE	-0.021582	0.246001	0.366718	0.126410	0.904371	1.000000		
SAE	0.365671	0.636465	0.735063	0.085594	0.792425	0.629413	1.000000	
TAE	-0.000861	0.284781	0.415885	0.272552	0.999826	0.905033	0.781233	1.000000

Author's Compilation 2022

The table (table 2) above shows the relationship between the dependent variables and independent variables in the study. M/B (Market-to-book value ratio) has a positive relationship with VAIC at 0.01, SAE at 0.36 while it has a negative relationship with HAE and TAE at -0.02 and 0.00 respectively. This means that a

1.0% increase in VAIC will increase M/B by 0.01 and a 1.0% increase in SAE will increase M/B by 0.36, while a 1.0% increase in HAE will decrease M/B by 0.02 but TAE has no effect on M/B. ROA has a positive relationship with VAIC at 0.29, HAE at 0.24, SAE at 0.63 and TAE at 0.28. That is, a 1.0% increase in VAIC, HAE, SAE and TAE will increase ROA by 0.29, 0.24, 0.63 and 0.28 respectively.ROE has a positive relationship with VAIC at 0.42, HAE at 0.36, SAE at 0.73 and TAE at 0.41. That is, a 1.0% increase in VAIC, HAE, SAE and TAE will increase ROE by 0.42, 0.36, 0.73 and 0.41 respectively. RG has a positive relationship with VAIC at 0.26, HAE at 0.12, SAE at 0.08 and TAE at 0.27. That is, a 1.0% increase in VAIC, HAE, SAE and TAE will increase RG by 0.26, 0.12, 0.08 and 0.27 respectively.

Regression analysis results

After carrying out the Hausman test, the random effect model was used to analyse the regression models 1 to 6, while the fixed effect model was considered appropriate for models 7 and 8. The various regression tables are shown in the appendix as tables 3 – 10

Table 3 (in the appendix) shows that VAIC (Value added intellectual coefficient), in its aggregated form, has a statistically insignificant positive effect on M/B (Market-to-book value ratio) of deposit money bank in Nigeria, and a percentage increase in VAIC will lead to 1.8 percent increase in M/B. The means that VAIC (Value added intellectual coefficient) has insignificant effect on the market value of deposit money banks in Nigeria. However, when the individual components of VAIC is considered, table 4 (in the appendix), results reveal that HAE (Human assets coefficient) has a statistically insignificant positive relationship with M/B of DMBs in Nigeria as a percentage increase in HAE will lead to 5.31 increase in M/B. SAE (Structural assets coefficient) has a statistically significant positive relationship with M/B of DMBs in Nigeria and a percentage increase in SAE will lead to 5.73 increase in M/B. TAE (Total assets coefficient) has a statistically significant negative relationship with M/B of DMBs in Nigeria, a percentage increase in TAE will lead to 1.97 decrease in M/B. This means the human asset coefficient, structural asset coefficient, and total assets coefficient have effect on market value of deposit money banks in Nigeria. This is consistent with Susanti et al (2020) and Tayyem and Al-Mawali (2020).

In model 3, table 5 (in the appendix), ROA is the dependent variable and the aggregated VAIC is the independent variable, result shows that VAIC has a statistically significant positive effect on ROA of DMBs in Nigeria and a percentage increase in VAIC will lead to 2.09 increase in ROA. The means that VAIC (Value added intellectual coefficient) has significant effect on the profitability of DMBs in Nigeria. This result agrees with the findings of Forte *et al* (2019), Susanti*et al* (2020) and Zeng and Wudhikarn (2018). When the components of VAIC are considered, table 6 (in the appendix), results show that HAE has a statistically significant positive relationship with ROA of DMBs in Nigeria and a percentage increase in HAE will lead to 2.83 increase in ROA. SAE has a statistically significant positive relationship with ROA of DMBs in Nigeria and a percentage increase in SAE will lead to 2.58 increase in ROA. TAE has a statistically significant negative relationship with ROA of DMBs in Nigeria and a percentage increase in TAE will lead to 7.25 decrease in ROA. This means that the HAE and SAE drive the profitability of DMBs while TAE does not drive profitability of DMBs in Nigeria. This is consistent with Forte *et al* (2019), Singla (2020) and Susanti*et al* (2020).

Model 5, (table 7, in the appendix) shows the effect of VAIC, in aggregated form, on ROE of DMBs, result shows that VAIC has a statistically significant positive effect on ROE of DMBs in Nigeria and a percentage increase in VAIC will lead to 1.27 increase in ROE. When each component of VAIC were regressed on ROE, table 9 (in the appendix), results show that HAE has a statistically significant positive relationship with ROE of DMBs in Nigeria and a percentage increase in HAE will lead to 1.22 increase in ROE. SAE has a statistically significant positive relationship with ROE of DMBs in Nigeria and a percentage increase in SAE will lead to 1.08 increase in ROE. TAE has a statistically significant negative relationship with ROE of DMBs in Nigeria as a percentage increase in TAE will lead to 2.67 decrease in ROE. This is consistent with the results obtained when ROA was considered above.

In model 7, table 9 (in the appendix), the effect of VAIC, aggregated, on RG was considered, Result shows that VAIC has a statistically significant positive effect on RG of DMBs in Nigeria as a percentage increase in VAIC will lead to 1.54 increase in RG. The means that VAIC (Value added intellectual coefficient) has

significant effect on the financial performance of DMBs in Nigeria. However, in model 8, table 10 (in the appendix) when the components of VAIC were regressed on RG, results reveal that HAE has a statistically significant negative relationship with RG of DMBs in Nigeria and a percentage increase in HAE will lead to 2.06 decrease in RG. SAE has a statistically significant negative relationship with RG of DMBs in Nigeria and a percentage increase in SAE will lead to 3.26 decrease in RG. TAE has a statistically significant positive relationship with RG of DMBs in Nigeria and a percentage increase in TAE will lead to 3.17 increase in RG.

These results are consistent with Zeghal and Maaloul (2010) and Smriti and Das (2018) who opined that value creation is through an efficient development and use of knowledge assets rather than through an efficient use of physical assets. Knowledge assets have therefore, become strategic resources that could be leveraged on to improve profitability and thus increase value.

4.3 Research results and policy implications of findings

VAIC was used to measure knowledge assets to investigate the effect of knowledge assets on the market value, proxied by market to book value ratio (M/B), and profitability, proxied by returns on assets (ROA), returns on equity (ROE) and revenue growth (RG) of listed deposit money banks in Nigeria.

Results show that VAIC has a positive impact on market value and profitability of deposit money banks in Nigeria. Furthermore, among the individual components human assets efficiency (HAE) and structural assets efficiency (SAE) have a positive effect, while total assets efficiency (TAE) has a negative impact on market value of listed DMBs in Nigeria. Also, VAIC has a positive effect on profitability, proxied by ROA, ROE and RG, when taken in aggregated form, of listed deposit money banks in Nigeria. While, when the individual components are considered, HAE and SAE have a positive effect on ROA and ROE but a negative effect on RG. TAE has a negative effect on ROA and ROE with a positive effect on RG of listed DMBs in Nigeria.

The direct implications for the managers of deposit money banks in Nigeria is that they have to step up development and training of their human resources, structures and processes, through the development of information technology, and customer

relationship management to improve their profitability and thus their market value.

5.0 Conclusion

This study contributes to the literature by examining listed deposit money banks in Nigeria for the period, 2015 to 2021, to extend the knowledge about the role of knowledge assets as a driver of profitability and market value in Nigeria.

It is concluded that knowledge assets play significant role in creating value for the shareholders of listed deposit money banks in Nigeria, as a driver of profitability which in turn improves the market value of listed deposit money banks in Nigeria. Thus, in accordance with resource-based view theory, profitability of deposit money banks in Nigeria is more stimulated by effective and efficient development and use of knowledge assets, such as skills, competencies, experiences and knowledge (HAE) and infrastructure capabilities and relationships (SAE) rather than efficiency of tangible assets (TAE) (Zeghal and Maaloul; 2010, Smriti and Das, 2018).

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Appendix

Regression Analysis

Model One

$$M/B_{i,t} = \left(\alpha_0 + \beta_1 VAIC_{i,t} + \mu_t\right) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 1$$

Table 3: Random Effect Model

Variable	Coefficient	Std.Error	t-Statistic	Prob
C	0.592526	0.075246	7.874489	0.0000
VAIC	1.848112	1.912311	0.096712	0.9232
Cross-section random			0.000000	0.0000
Idiosyncratic random			0.481625	1.0000
R-squared		0.500107	Mean dependent var	0.597922
Adjusted R-squared		0.511128	S.D dependent var	0.474778
S.E of regression		0.477413	Sum squared resid	20.28513
F-statistics		0.009519	Durbin-Watson stat	0.342162
Prob(F-statistic)		0.922496		
R-squared		0.500107	Mean dependent	0.597922
Sum squared resid		20.28513	Durbin-Watson	0.342162

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Model Two

$$M/B_{i,t} = \left(\alpha_0 + \beta_1 HAE_{i,t} + \beta_1 SAE_{i,t} + \beta_1 TAE_{i,t} + \mu_t\right) \ldots\ldots\ldots\ldots\ldots\ldots 2$$

Table 4: Random Effect Model

Variable	Coefficient	Std.Error	t-Statistic	Prob
C	0.526431	0.071680	7.344224	0.0000
HAE	5.310909	3.583409	1.481486	0.1421
SAE	5.733309	8.298210	6.914610	0.0000
TAE	-1.978410	4.898111	-4.037158	0.0001
Cross-section random			0.000000	0.0000
Idiosyncratic random			0.390007	1.0000
R-squared		0.360865	Mean dependent var	0.597922
Adjusted R-squared		0.338826	S.D dependent var	0.474778
S.E of regression		0.386055	Sum squared resid	12.96632
F-statistics		16.37383	Durbin-Watson stat	0.628737
Prob(F-statistic)		0.000000		
R-squared		0.360865	Mean dependent	0.597922
Sum squared resid		12.96632	Durbin-Watson	0.628737

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Model Three

$$ROA_{i,t} = (\alpha_0 + \beta_1 VAIC_{i,t} + \mu_t) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4$$

Table 5: Random Effect Model

Variable	Coefficient	Std.Error	t-Statistic	Prob
C	0.011738	0.002829	4.148746	0.0001
VAIC	2.097312	7.176313	2.909234	0.0046
Cross-section random			0.000000	0.0000
Idiosyncratic random			0.018109	1.0000
R-squared		0.488515	Mean dependent var	0.017841
Adjusted R-squared		0.478274	S.D dependent var	0.018666
S.E of regression		0.017921	Sum squared resid	0.028582
F-statistics		8.642911	Durbin-Watson stat	0.825106
Prob(F-statistic)		0.004183		
R-squared		0.488515	Mean dependent	0.017841
Sum squared resid		0.028582	Durbin-Watson	0.825106

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Model Four

$$ROA_{i,t} = (\alpha_0 + \beta_1 HAE_{i,t} + \beta_1 SAE_{i,t} + \beta_1 TAE_{i,t} + \mu_t) \ldots\ldots\ldots\ldots\ldots\ldots 5$$

Table 6: Random Effect Model

Variable	Coefficient	Std.Error	t-Statistic	Prob
C	0.008331	0.002366	3.521033	0.0007
HAE	2.837310	1.181910	2.392237	0.0189
SAE	2.587310	2.742611	9.423574	0.0000
TAE	-7.258312	1.617312	-4.488880	0.0000
Cross-section random			0.000000	0.0000
Idiosyncratic random			0.012873	1.0000
R-squared		0.551154	Mean dependent var	0.017841
Adjusted R-squared		0.535677	S.D dependent var	0.018666
S.E of regression		0.012719	Sum squared resid	0.014075
F-statistics		35.61018	Durbin-Watson stat	1.626232
Prob(F-statistic)		0.000000		
R-squared		0.551154	Mean dependent	0.017841
Sum squared resid		0.014075	Durbin-Watson	1.626232

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Model Five

$$ROE_{i,t} = (\alpha_0 + \beta_1 VAIC_{i,t} + \mu_t) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 6$$

Table 7: Random Effect Model

Variable	Coefficient	Std.Error	t-Statistic	Prob
C	0.082297	0.011325	7.266561	0.0000
VAIC	1.273311	2.871112	4.429582	0.0000
Cross-section random			0.000000	0.0000
Idiosyncratic random			0.072490	1.0000
R-squared		0.483612	Mean dependent var	0.119494
Adjusted R-squared		0.474439	S.D dependent var	0.078989
S.E of regression		0.071770	Sum squared resid	0.458434
F-statistics		20.01675	Durbin-Watson stat	0.254266
Prob(F-statistic)		0.000023		
R-squared		0.483612	Mean dependent	0.119494
Sum squared resid		0.474439	Durbin-Watson	0.254266

Author's Compilation, 2022

Model Six

$$ROE_{i,t} = (\alpha_0 + \beta_1 HAE_{i,t} + \beta_1 SAE_{i,t} + \beta_1 TAE_{i,t} + \mu_t) \ldots\ldots\ldots\ldots\ldots\ldots 7$$

Table 8: Random Effect Model

Variable	Coefficient	Std.Error	t-Statistic	Prob
C	0.067711	0.009109	7.433713	0.0000
HAE	1.227809	4.553310	2.677866	0.0089
SAE	1.082209	1.055710	10.28373	0.0000
TAE	-2.677811	6.212212	-4.289661	0.0000
Cross-section random			0.000000	0.0000
Idiosyncratic random			0.049560	1.0000
R-squared		0.636046	Mean dependent var	0.119494
Adjusted R-squared		0.623496	S.D dependent var	0.078989
S.E of regression		0.048468	Sum squared resid	0.204374
F-statistics		50.68045	Durbin-Watson stat	0.541693
Prob(F-statistic)		0.000000		
R-squared		0.636046	Mean dependent	0.119494
Sum squared resid		0.204374	Durbin-Watson	0.541693

Author's Compilation, 2022

Model Seven

$$RG_{i,t} = (\alpha_0 + \beta_1 VAIC_{i,t} + \mu_t) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 8$$

Table 9: Fixed Effect Model

Variable	Coefficient	Std.Error	t-Statistic	Prob
C	-127.9476	8.760928	-14.60434	0.0000
VAIC	1.542208	2.747509	5.611028	0.0000
Cross-section fixed(dummy variables)				
R-squared		0.402325	Mean dependent var	-82.90150
Adjusted R-squared		0.484536	S.D dependent var	37.05293
S.E. of regression		33.45992	Akaike info criteri	9.999212
Sum squared resid		86206.58	Schwarz criteri	10.38550
Log likelihood		-440.9641	Hannan-Quinn criter	10.15505
F-statistic		2.566665	Durbin-Watson stat	1.459221
Prob(F-statistic)		0.005357		

Source: Author's Computation, 2022

Model Eight

$$RG_{i,t} = \left(\alpha_0 + \beta_1 HAE_{i,t} + \beta_1 SAE_{i,t} + \beta_1 TAE_{i,t} + \mu_t\right) \ldots\ldots\ldots\ldots\ldots\ldots\ldots 9$$

Table 10: Fixed Effect Model

Variable	Coefficient	Std.Error	t-Statistic	Prob
C	-69.12827	27.78416	-2.488046	0.0151
HAE	-2.062206	1.072306	-1.928965	0.0575
SAE	-3.261507	1.867307	-1.754623	0.0834
TAE	3.177208	6.652209	4.759563	0.0000
Cross-section fixed(dummy variables)				
R-squared		0.464797	Mean dependent var	-82.90150
Adjusted R-squared		0.437757	S.D dependent var	37.05293
S.E. of regression		32.34963	Akaike info criteri	9.949359
Sum squared resid		78487.39	Schwarz criteri	10.39083
Log likelihood		-436.6958	Hannan-Quinn criter	10.12746
F-statistic		2.871503	Durbin-Watson stat	1.572821
Prob(F-statistic)		0.001343		

Source: Author's Computation 2022