Ontology of Knowledge-Based Capital Management and Performance of Deposit Money Banks (DMBs) in Nigeria

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Abstract

The continued decline in economic conditions and political environment has heightened the mass exit of experienced and skilled professionals from Nigeria in search of greener pastures in other countries even as the proliferation of knowledge and information technology is advancing the economies of the world. The objective of this study is to examine the sensitivity of knowledge-based capital management on the performance of deposit money banks (DMBs) in Nigeria. The specific objectives of the study are: to ascertain the effect of human capital efficiency; structural capital efficiency; and relational capital efficiency on the return on capital employed by deposit money banks in Nigeria from 2012 to 2021. The study adopted an *ex-post facto* research design, and data were generated from the audited annual reports. Panel-corrected standard errors (PCSEs) regression was used to analyse the data. The results revealed statistically significant positive effects of human capital efficiency on return on capital employed by DMBs in Nigeria; and a significant negative effect of structural capital and relational capital efficiencies on return on capital employed by DMBs in Nigeria. These findings imply that human capital drives efficiency in knowledge-based capital; however, proper integration of all components of knowledge capital in a coherent knowledge management strategy is desirable.

Keywords: knowledge-based capital, human capital efficiency, structural capital efficiency, relational capital efficiency, return on capital employed

Introduction

The proliferation of the knowledge economy is one of the most important changes that struck the world in recent times. Today, knowledge and intellectual resources have become the company's most valuable assets. According to Si (2019) as machines substituted manual labour in the industrial revolution of the 18th century that is how knowledge is gradually replacing the traditional factors of production. Modern information infrastructures that can facilitate effective communication, dissemination, and processing of information and knowledge are rapidly evolving. Thus, the social focus has significantly shifted to improving the knowledge and intellectual resources to boost value addition, drive efficiency and empower financial development (Saddam, 2020). In this regard, Sira *et al.* (2020) argued that every economy must pay attention to knowledge and its creation, preservation, and transfer to stand competitive and successful. As a result, research on knowledge and intellectual capital is deepening in the academic arena.

Knowledge-based capital (KBC) is the organizational value added when the organization's intellectual assets are leveraged (Abualoush *et al.*, 2018). It is the stock of available knowledge assets in an organization (Seleim & Khalil, 2011). Recent literature has classified the KBC of firms into three dimensions namely human capital, structural capital, and relational capital (Ozkan *et al.*, 2017; Sardo & Serrasqueiro, 2017; Mulyasari &

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Murwaningsari, 2019). Human capital is the sum of employees' knowledge, competence, wisdom, attitude, skills, commitment, innovativeness, and experience (Attar *et al.*, 2019). This asset is so unique because it is domiciled in the human mind.

Structural capital (SC) is the pile of knowledge for the organization (Amin *et al.*, 2018). When individuals consistently work together, they build an internal structure (Sveiby, 2001). This internal structure may include business concepts, business models organizational culture, computerized information systems, administrative systems, patents and so on. Relational capital (RC) is the knowledge assets embedded in the customers' relationship and interactions with the outside environment (Sira *et al.*, 2020). This external structure consists of relationships with customers, suppliers, and the reputation of the firm. This intellectual attribute shapes the public perception of the firm and builds corporate reputation (Oyedokun & Saidu, 2018). Depending on the effectiveness of the management strategy, it can be good or bad and changes over time. Some of these relationships can be converted into the legal property such as trademarks and brand names (Sveiby, 2001).

Hence, business managers are confronted with the dilemma of how to effectively internalize human knowledge in the organizational structure and harmonize investments in all facets of knowledge capital to drive efficiency and sustainable long-term competitiveness. To this end, Haghshenes and Barzegar (2014) argued that the performance of a business depends on its stock of knowledge capital and the organizational capabilities to utilize them as assets. The above assertion suggests that effective knowledge capital management is synonymous with superior performance. Others believed that business performance improves because of the interaction between the components of knowledge capital (McDowell *et al.*, 2018; Benevene *et al.*, 2019; Radianto & Gumant, 2019; Githaiga, 2019; Febrian *et al.*, 2020). The thesis behind these arguments is that efficiency in human capital, structural capital, and relational capital do have little value separately, but jointly they strongly affect corporate performance (Amin *et al.*, 2018).

For this reason, competition among organizations and geographical boundaries presently is not only limited to traditional production factors but more intense and profound competition trends on knowledge assets and intangible intellectual resources such as information, intelligence, and knowledge. For instance, knowledge and experience are rooted in the human mind and usually, the organization will lose this kind of capital when experienced or talented employees decide to leave the organization, retire or resign. Thus, organizations require an effective knowledge management strategy to tap the experience of these staff and minimize the disruption in the quality of services their imminent departure could bring. Unfortunately, most organizations' management lacks the understanding of the full perspective of knowledge management strategy and may fail to coordinate the stock of the intellectual resources the organizations possess into a coherent strategy (Sveiby, 2001).

In Nigeria, the persistent dwindling economic condition and insecurity reinforced by the uncertainties surrounding the political environment have heightened the mass exodus of experienced and skilled professionals in search of greener pastures in other countries; a situation which was described as "Japa syndrome or brain drains". This situation has grossly affected the knowledge base of several sectors in Nigeria with the financial institutions receiving the worst hit because of the level of innovations and information technology advancement at the core of their business models. Despite the overwhelming consensus that firms with greater knowledge-based capital perform better, the extant empirical studies on the connection between knowledge capital management on corporate performance from non-financial sectors and other economies provide bags of inconsistent outcomes. There is also a dearth of empirical evidence on the effect of knowledge capital management on the corporate performance of deposit money banks (DMB) in Nigeria.

Hence, it became critical to examine the ontology of knowledge capital management domain towards corporate performance which has been a debate of contemporary thinking in the circle of intellectual capital research in recent times. The specific objectives are to:

i.   Ascertain the effect of human capital efficiency on the return on capital employed by DMBs in Nigeria
ii. Evaluate the effect of structural capital efficiency on the return on capital employed by DMBs in Nigeria
iii. Examine the effect of relational capital efficiency on the return on capital employed by DMBs in Nigeria

Literature Review

Knowledge-based capital (KBC) is the organizational value added when the organization's knowledge assets are leveraged (Abualoush *et al.,* 2018). It refers to the accumulated knowledge of a firm which is embedded in the people, know-how, machine, technologies, and routines, which is constantly deepened by information flow (Laperche *et al*., 2011 in Jegede *et al*., 2020). Miller and Atkinson (2015) defined KBC as an investment in assets that generate future economic returns for firms. It consists of investments in knowledge-related areas that do not fit into the conventional class of physical assets (OECD, 2013). Kozak (2011) believed that it is intellectual resources that are valuable, rare, and impossible to copy or replace and a source of long-lasting competitive advantage. In this context, many scholars and practitioners look at the concept from a national and regional perspective (Amin *et al.,* 2018).

From the organizational point of view, the significance of assessing business investments in KBC has increased because shreds of evidence have shown that innovation-led growth is supported by investments in a broader range of intangible assets beyond research and development expenditure (Andrews & de Serres, 2012; Siedschla *et al.,* 2017). Unlike tangible assets that deteriorate with time and usage, various components of knowledge resources improve with usage and time. For instance, employee skills and professionalism is expected to grow with commitment in time and opportunities; as a result, KBC is expected to offer open-ended timeframe benefits depending on the organizations' ability to invest and utilize the knowledge assets.

Following the contributions of previous studies and the OECD, significant progress has been recorded in measuring knowledge-based capital. But extensively, the methodological frameworks, the Value Added Intellectual Capital (VAIC^{MT}) model put forward by Pulic (2000) have been employed mostly among researchers from an accounting background. Similarly, the concept of knowledge capital has been decomposed into several components by different authors from different perspectives. However, the classification into human capital, structural capital, and relational capital has gained much recognition in the recent literature (Ozkan *et al.,* 2017; Sardo & Serrasqueiro, 2017; Mulyasari & Murwaningsari, 2019).

Human capital (HC) concerns the totality of the capacity of the individuals working in an organization. According to Attar *et al*. (2019), human capital is the summation of employees' knowledge, competence, wisdom, attitude, skills, commitment, innovativeness, and experience. As individuals, we develop from both professional and personal angles, through life experiences, training and education programs. At the same time, organizations spend much time and resources developing management expertise and training their employees in business-specific areas to add to the intellectual capacity of their enterprise. This knowledge capital is very unique as it exists in certain workers and usually, the organization will lose this kind of capital when experienced or talented employees decide to leave the organization or retire.

Studies from the intellectual capital arena have argued that investment in human capital is the total annual expenditure on employees' value proposition such as personnel costs, recruitment and training expenses, education, and other human capital-related costs (Pulic, 2000). Organizations have also realized that they can enjoy the full value of this unique knowledge asset when the employees are willing and eager to utilize their skills, competencies and experience in full capacity. Therefore organizations introduced such salary schemes competitively friendly within their industry, welfare schemes, benefit plans, and friendly working conditions to minimize employee turnover and increase human capital efficiency. Human capital efficiency is an indicator of the value-added efficiency of human capital.

Rodger (2003) defined structural capital as knowledge captured, internalized, and institutionalized within the organizational process, structure, and culture. Structural capital is everything that is left when the employees leave the organization. It can be viewed as tacit knowledge which has been codified into explicit knowledge, which forms part of the organizational capital that will remain definitely with the company after an employee leaves. Structural capital aims to facilitate the transfer of knowledge and information and to drive development and innovativeness. Firms that have excellent structural capital will allow their workers to try new things, make mistakes, and learn from the mistakes (Bontis, 1998 in Gogan *et al.*, 2015).

This concept has been described in several ways in previous studies such as brands, patents, trademarks, and copyrights; process, culture, infrastructure, and capabilities (Rodger, 2003); knowledge, strategies, creation, manuals, networks, technologies, procedures, resources, training, capabilities, internal and information (Gogan *et al.*, 2015). In practical terms, Rodgers (2003) summarized that it involves all channels (communication systems, distribution channels, marketing, and competitive channels) through which individual knowledge is turned into organizational property. The organization for Economic Corporation and Development [OECD] (2013) states that structural capital is the net worth of the organization when human capital is isolated.

Baygi *et al.* (2011), and Raza (2013) defined relational capital as the sum of all assets that organize and manage a firm's relationship with its environment. The success of every business is dependent on its ability to create and sustain all relationships (formal and informal, temporal and permanent) that build a business (Hormiga *et al.*, 2011; Febrian *et al.*, 2020). This knowledge capital is built from internal and external relationships which capture the intellectual attributes of knowledge embedded in customers' relations and interactions with the outside environment (customers, competitors, suppliers, government) that mould public perceptions of the firm and corporate reputation (Oyedokun & Saidu, 2018). Given the above, relational capital is concerned with customer loyalty, negotiating capacity, customer satisfaction, interaction with employees, customers and suppliers, firms' image, and licensing agreements. Relational capital efficiency (RCE) is an indicator of the value-added of relational capital which represents the expenditure on advertisements, promotions, marketing, customer relation, and so on.

Corporate performance is the measure of the efficiency of corporate management to utilize organizational resources to create wealth. To measure corporate performance, previous studies have employed accounting and market-based techniques such as return on assets and return on equity (Githaiga, 2019; Nguyen, 2020; Trans & Vo, 2020); return on capital and Tobin Q (TQ) (Sherif, 2016); net interest margin and profit margin (Haris *et al.*, 2019). Like other accounting-based techniques, return on capital employed (ROCE) is a profitability metric that indicates a firm's efficiency in earning profits from its capital employed. The ROCE is a unique profitability ratio that reflects long-term prospects for a company as it shows asset performance while taking long-term financing into account. Mathematically, it

is a measure of the profit generated per unit of capital employed. This is shown by the function below:

ROCE = Earnings before Interest and Tax (EBIT) / Capital Employed

Theoretically, this study is underpinned by the Knowledge-based theory (KBT) propounded by Sveiby Karl-Erik in 2001 to guide firms in strategy formulation. Sveiby argued that there are nine knowledge transfer-enabling activities that exist in every organization aimed towards improving the people's ability to act within and outside the organization. These basic assumptions are the transfer of knowledge among individuals, from individual to external structure, from external structure to individual competence, from individual competence to internal structure, and from the internal structure to individual competence, within the external structure, from external to the internal structure, from internal to external and within internal structure.

Figure 1 presents the diagrammatical representation of KBT.
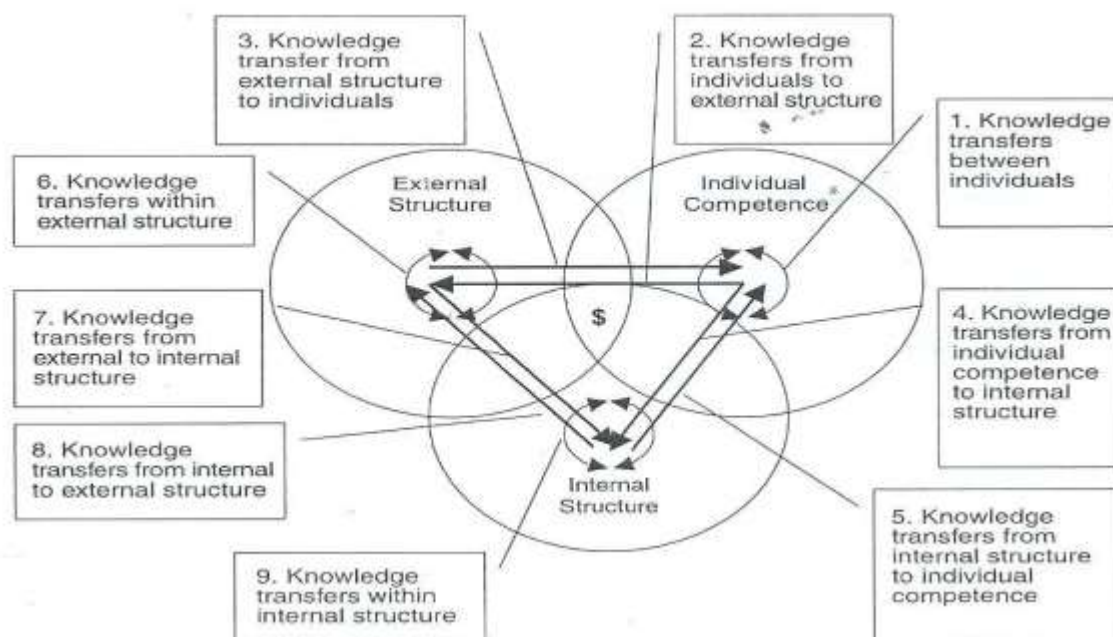
Figure 1: The Knowledge Management Theory for Firm Strategy
Source: Adopted from Sveiby, 2001

This theory provides a perfect explanation of the interactions among the components of knowledge-based capital that drive effective performance. It provides the framework for a perfect understanding of the full perspective of knowledge management and explains how these nine knowledge backbones could be coordinated into a coherent strategy for effective performance and competitive advantage.

Empirically, a good number of scholars have invested efforts to establish empirically the nexus between knowledge-based capital and the performance of firms across the globe. The relationship between human capital efficiency and organizational performance was found to be mixed in the study of listed industrial goods companies in the Nigerian Exchange Group (NGX) from 2009 to 2014 by Danjuma and Ajike (2016). The results revealed a positive significant relationship between human capital efficiency and return on asset and earnings per share; and a negative but insignificant relationship between human capital efficiency and lag (VAHC) and employee growth. The result of the study conducted by Rahim *et al.* (2017) that investigated the relationship between human capital efficiency and the performance of the

technology companies listed on the Bursa Stock Exchange in Malaysia revealed that human capital efficiency has a significant positive influence on return on assets.

Eletu and Ukoha (2017) provide evidence of a strong correlation between all dimensions of human capital and corporate performance. The study employed Spearman's Rank Order Correlation Coefficient to investigate the nexus between human capital development and firm performance in the foods and beverages companies in Port Harcourt, Nigeria. In Indonesia, Radianto and Gumanti (2019) used a survey design to evaluate the relationship between human capital and the performance of Indonesian universities and found that human capital does not have a direct relationship with performance but affects performance through customer capital. Whereas in Vietnam, Tran and Vo (2020) employed ex-post facto design and Generalized Method Moments (GMM) analysis to provide strong evidence that human capital contributes significantly to corporate performance across all sectors in an emerging market.

A study conducted in Iran by Soheyli *et al.* (2014) employed a survey approach to investigate the relationship between intellectual capital and the performance of firms in Yazd Tile. The result of the single variable regression, confirmatory factor analysis and PLS technique showed that intellectual capital efficiency in general has a direct and no significant relationship between structural capital and firm performance. Sherif (2016) employed ex-post facto design and panel multiple regression techniques to examine the impact of intellectual capital (IC) on the performance of listed insurance companies. The results showed that structural capital has a significant impact on performance measured by return on asset, return on capital, Tobin Q, return on equity, revenue growth opportunities and employee productivity. Haris *et al*. (2019) also found that human capital efficiency and capital employed efficiency have a statistically significant positive impact on profitability; structural capital efficiency had a statistically significant negative impact on the profitability of banks in Pakistan. Nazir *et al*. (2020) found that intellectual capital efficiency measured by VAIC has a significant positive relationship with return on assets and return on equity, but human and structural capital efficiencies do not affect the profitability of banks in Pakistan.

In Portugal, Lopes-Costa and Munoz-Canavate (2015) sampled 167 managers in the hospitality sector to interrogate the impact of relational capital on the performance of service firms. The study used descriptive statistics; a one-factor model, three corrected-factor models, and four corrected-factor models. The results of the study provide evidence of a negative insignificant relationship between relational capital and corporate performance of service firms in the Greater Lisbon and Setubal Peninsula areas of Portugal. Also, the results in the study of Datta and De (2017) that assessed the connection between relational capital and the performance of listed Bell-metal Clustered firms in India found that the individual components of relational capital and overall relational capital index have a significant positive impact on the firm's performance. Likewise, the results of the study conducted by Iazzolino *et al*. (2018) that investigated the correlation between relational capital and the performance of firms in Italy showed a significant relationship between both internal and external relational capital and firm performance indices.

Examining the effect of diversification and relational capital on the performance of listed Chinese commercial banks, Chu *et al*. (2019) revealed that non-interest income to total income has a positive impact on return on the asset; the interaction between non-interest income to total income and the relationship capital index impact negatively on return on capital while non-interest income to total income and relationship capital index has a negative U shape on return on asset (ROA). Similarly, Febrian *et al*. (2020) found that SME networking significantly mediates the relationship between the relational capital and market performance of firms SMEs in three islands such as Kalimantu, Java, and Sumatra in Indonesia.

Methodology

An *ex-post facto* research design was adopted for this study. *Ex-post facto* research design is an ideal technique for conducting business and social research when the investigation seeks to reveal possible relationships by observing an existing condition or state of affairs relying on existing facts with previous deeds. The study focused on the effect of human, structural, and relational capital on the return on employed by the deposit money banks in Nigeria. The population of the study consists of twenty-two (27) deposit money banks (DBMs) of the commercial bank category in Nigeria as of 31st December 2021. The top ten (10) DMBs that control above 72% of the total industrial assets, 65% of deposits in the vaults, and 66% of the total loans were selected for the study. The data was sourced from the audited annual financial statements and accounts of the selected DMBs.

The study employed descriptive statistics and pairwise correlations. Diagnostic tests of normality, heteroskedasticity, multicollinearity and serial autocorrelation were also conducted. Panel-corrected standard errors (PCSEs) regression of the ordinary least square was used to test the hypothesis. Subsequently, we accept the alternate hypothesis (H_1) when the coefficient for the repressor is either positive or negative, the modulus of the t-Statistic > 2.0 and the P-value of the t-Statistic < 0.05. Otherwise, we reject the alternative (H_1) and uphold the null hypothesis (H_0).

The study adopted and modified the econometric model as used in Kurfi *et al*. (2017) and Zulkifli *et al*. (2017).

Financial leverage, firm size and firm age were introduced as control variables empirical evidence from previous studies suggest that these variables exerted a significant effect on financial performance (Zulkifli *et al*., 2017; Kurfi *et al*., 2017; Ibrahim & Ogwuche, 2018; Tran & Vo, 2020) therefore, the regression equations of this study are as follows:

$$\text{roce}_{it} = \beta_0 + \beta_1 \text{hce}_{i,t} + \beta_2 \text{sce}_{i,t} + \beta_3 \text{rce}_{i,t} + \beta_4 \text{flev}_{i,t} + \beta_5 \text{firmz}_{i,t} + \beta_6 \text{fage}_{i,t} + \varepsilon i,t \quad (1)$$

Where: roce = Return on capital employed; hce = Human capital efficiency; sce = Structural capital efficiency; rce = Relational capital efficiency; flev = Financial Leverage; firmz = Firm size; and fage = Firm age.

The VAIC^{TM} model put forward by Pulic (2000) was employed to calculate the efficiency coefficient of the knowledge capital components. These are presented in Table 1.

Table 1: Description of Variables in the Model

Type	Name	Measurement	Proxy
Dependent Variable	Return on capital employed	$\dfrac{PBIT}{Capital\ Employed}$	Corporate performance
Independent Variables	Human capital efficiency	$\dfrac{VA}{HC}$	Human capital
	Structural capital Efficiency	$\dfrac{VA-(HC+RC)}{VA}$	Structural capital
	Relational capital efficiency	$\dfrac{RC}{VA}$	Relational capital
Control Variables	Firm Size	Natural Log of Total Assets	
	Financial Leverage	$\dfrac{Total\ Debt}{Total\ Asset}$	
	Firm age	Natural Log of Firm age	

Source: Authors' Compilations (2023)

Results

Data Analysis

Table 2: Summary Statistics and Normality Tests of Variables

Variable	Obs	Mean	Std. Dev.	Min	Max	Skewness/Kurtosis tests ------ joint ------		Shapiro-Wilk W
						chi2(2)	Prob>chi2	Prob>z
roce	100	0.0541	0.0914	-0.0095	0.3730	48.34	0.0000	0.0000
hce	100	3.1138	1.4431	1.3872	8.5575	38.64	0.0000	0.0000
sce	100	0.5842	0.1234	0.2721	0.8542	0.12	0.9420	0.5321
rce	100	0.0437	0.0350	0.0000	0.1876	39.92	0.0000	0.0000
flev	100	0.7180	0.1099	0.1482	0.8765	41.79	0.0000	0.0000
firmz	100	14.5904	0.8525	12.3449	16.1055	2.95	0.2293	0.0500
fage	100	3.5517	0.6361	2.5393	4.8363	10.15	0.0062	0.0000

Source: Authors' STATA 14.2 Outputs, 2023

The summary statistic shows the mean and the standard deviation, minimum and maximum values of the data. Precisely, Table 2 shows that the mean of return on capital employed, human capital efficiency, structural capital efficiency, relational capital efficiency, financial leverage, log of firm size and firm age (in log form) of the selected banks are 0.0541, 3.1138, 0.5842, 0.0437, 0.7180, 14.5904 and 3.5517 respectively. The standard deviation which measures the dispersion from the mean indicated more volatility of human capital efficiency, firm size and firm age. While the min and max present the minimum and maximum values of the processed values of the variables.

The outcome of the skewness and kurtosis test as confirmed by the Shapiro-Wilk W test provide evidence of non-normality of the variables except for structural capital efficiency and firm size that tends towards normality at 5% significant levels.

The Pearson correlation coefficients measure the degree of relationship between the different variables. The probability of each correlation coefficient is beneath each variable. Further, the P-values that are less than 5% show strong statistical significance.

Table 3: Correlation Matrix of the roce, hce, sce, rce, flev, fsize and fage

	roce	hce	sce	rce	flev	firmz	fage
roce	1.0000						
hce	0.8686*	1.0000					
	0.0000						
sce	0.6369*	0.8519*	1.0000				
	0.0000	0.0000					
rce	-0.0518	-0.0866	-0.3391*	1.0000			
	0.6091	0.3915	0.0006				
flev	0.0063	0.1078	0.1258	0.1973*	1.0000		
	0.9501	0.2859	0.2123	0.0491			
firmz	0.0531	0.2727*	0.4474*	-0.1877	0.2666*	1.0000	
	0.5995	0.0061	0.0000	0.0615	0.0073		
fage	-0.4367*	-0.4033*	-0.2996*	-0.1967*	-0.1137	0.2460*	1.0000
	0.0000	0.0000	0.0025	0.0498	0.2600	0.0136	

Source: Authors' STATA 14.2 Outputs, 2023

Table 3 portrays a non-significant relationship between relational capital, financial leverage and firm size and return on capital employed. It also revealed a very strong association between human capital, structural capital and firm age, and return on capital employed at 5% significance levels.

Breusch-Pagan/Cook-Weisberg test was employed to ascertain whether or not the standard deviation of the data over the period is statistically constant (heteroskedasticity problem). Breusch-Pagan/Cook-Weisberg test assumes the p-value of above the significant levels to be free from heteroskedasticity problems among the dataset. In this case, the result shows a Prob>chi2 = 0.0000 which is very significant. This result signifies the presence of a heteroskedasticity problem on the dataset. If this is not corrected, it leads to biased standard errors. It was controlled by employing the robust command while regressing to arrive at robust standard errors (Montgomery & Peck, 2007). The result of the Ramsey Reset test shows F (3, 00) = 30.32 with a P-value (0.0000) which implies that the model is not over-specified or under-fitted. The Levin-Lin-Chu unit-root test based on Augmented Dickey-Fuller (ADF) for all the variables revealed that all the variables are stationary at lag 1 except for the natural logarithm of firm size which shows the element of unit root even at lag 3. The result of the multi-colinearity test shows a range of 1.19 to 6.22 with an average of 2.84 which indicated the absence of multi-colinearity in the dataset.

The Breusch and Pagan Lagrangian Multiplier (LM) test shows $chi^2 (1) = 33.07$ and $Prob > chibar^2 = 0.0000.$ The null hypothesis of the LM test is that variances across entities are zero which means no statistically significant difference across units (no panel effect). In this case, we reject the null hypothesis; therefore we can run the random effects rather than simple ordinary least squares. The result of the Hausman test shows $chi^2 (8) = 3.51$ and $Prob. > chi^2 = 0.7429.$ Since the p-value is > 0.05, we conclude that the random effect is more appropriate. The outcome of the Wooldridge test for autocorrelation in panel data reveals a highly significant p-value (Prob > F = 0.0000) which indicates the presence of first-order autocorrelations in the model. In this case, Blackwell (2005) held that panel corrected standard errors (PCSEs) regression estimator suits best to small panels and accounts for finite sample bias while producing panel-corrected standard errors that allow heteroskedasticity and correlation within panels. Hence, Prais-Winsten regression, correlated panels corrected standard errors (PCSEs) was employed.

The R-squared of this model is 0.8185 with an F-statistics of 152.39 and a p-value of 0.0000. In specific terms, it suggests that the regressors in the model; *human capital efficiency, structural capital efficiency, relational capital efficiency, financial leverage, firm size, and firm age* have approximately 82% explanatory powers statistically significant in explaining changes in the return on capital of DMBs in Nigeria.

Thus, the ***Regression Equation for the All-inclusive Model*** is represented as:

$$roce = \textbf{0.19870} + \textbf{0.07543}hce - \textbf{0.29210}sce - \textbf{0.27856}rce - \textbf{0.03111}flev - \textbf{0.00920}firmz - \textbf{0.01128}fage$$

Test of Hypotheses
   Hypothesis One
 H_0: Human capital efficiency has no significant effect on the return on capital employed by DMBs in Nigeria.
 H_1: Human capital efficiency has a significant effect on the return on capital employed by DMBs in Nigeria.

Table 4: Panel Regression Results of Knowledge-based Capital, Control Variable and Return on Capital Employed of DMBs in Nigeria

roce	Random Effect				Fixed Effect				Preferred Model: PCSEs			
	Coef.	*Std. Err.*	*z*	*P>|z|*	*Coef.*	*Std. Err.*	*t*	*P>|t|*	*Coef.*	*Panel-corrected Std. Err.*	*z*	*P>|z|*
hce	0.00412	0.00436	0.95	0.344	-0.00584	0.00370	-1.58	0.119	*0.07543*	*0.00952*	*7.92*	*0.000**
sce	0.02874	0.04366	0.66	0.510	0.06187	0.03423	1.81	0.074**	*-0.29210*	*0.07413*	*-3.94*	*0.000**
rce	-0.00226	0.06942	-0.03	0.974	-0.00433	0.05367	-0.08	0.936	*-0.27856*	*0.10714*	*-2.60*	*0.009**
flev	-0.01038	0.02552	-0.41	0.684	-0.02009	0.02011	-1.00	0.321	*-0.03111*	*0.01617*	*-1.92*	*0.054***
firmz	0.01008	0.00523	1.92	0.054**	-0.00217	0.00662	-0.33	0.744	*-0.00920*	*0.00434*	*-2.12*	*0.034**
fage	-0.04966	0.01705	-2.91	0.004*	0.01423	0.02716	0.52	0.602	*-0.01128*	*0.00439*	*-2.57*	*0.010**
_cons	0.06139	0.04332	1.42	0.156	0.03180	0.03270	0.97	0.334	*0.19870*	*0.06120*	*3.25*	*0.001*
Significance levels 0.05*, 0.10**												
R-sq:			*0.3667*				*0.3382*				*0.8185*	
F(6,84)			*14.55*				*0.83*				*152.39*	
Prob > F			*0.024*				*0.5478*				*0.0000*	
rho			*0.86375*				*0.98733*					

Source: Authors' STATA 14.2 Outputs, 2023

Table 4 indicates that a unit change in human capital efficiency will increase the return on capital employed by 0.00952. Precisely, this variable exhibited a very strong positive influence on return on capital employed with p-value = 0.000. Since the p-value < 0.05 at 0.000, and z-statistic > |2| at 7.92, we accept the alternate hypothesis and conclude that human capital efficiency very significantly affects the level of return on capital employed of DMBs in Nigeria. The findings of this study supported the finding of the studies conducted by Danjuma and Ajike (2016), Rahim, et al (2017) Eletu and Ukoha (2017), and Nguyen (2020) that found a positive significant relationship between human capital efficiency and performance.

Hypothesis Two
H0: Structural capital efficiency has no significant effect on the return on capital employed by DMBs in Nigeria.

H1: Structural capital efficiency has a significant effect on the return on capital employed by DMBs in Nigeria.

Table 4 depicts that a unit change in structural capital efficiency will decrease the return on capital employed by 0.29210. Specifically, this variable exhibited a strong negative influence on return on capital employed with *p-value = 0.000*. Since the p-value < 0.05 at 0.021, and z-statistic > |2| at -2.60, we accept the alternate hypothesis and conclude that structural capital efficiency very significantly affects the level of return on capital employed of DMBs in Nigeria. This finding negates the submissions in the studies conducted by Yudawisastra *et al.* (2018) who found that structural capital has a significant positive influence on performance and Nazir *et al*. (2020) who found that structural capital does not affect financial performance. The result of this study also supported the findings of studies conducted by Xu and Wang (2018) and Haris *et al*. (2019) that suggested that structural capital has a statistically significant negative impact on profitability.

Hypothesis Three
H0: Relational capital efficiency has no significant effect on the return on capital employed by DMBs in Nigeria.

H1: Relational capital efficiency has a significant effect on the return on capital employed by DMBs in Nigeria.

Table 4 shows that unit changes in relational capital efficiency will decrease the return on capital employed by 0.27856. In particular, this variable exhibited a strong negative effect

on return on capital employed with *p-value = 0.009*. Since the p-value < 0.05 at 0.009, and z-statistic > |2| at -2.60, we reject the null hypothesis and conclude that relational capital efficiency exerted a very significant effect on the return on capital employed of DMBs in Nigeria.

Conclusion

The study dealt with scientific analysis of the effect of knowledge-based capital on the corporate performance of DMBs in Nigeria. Specifically, the study interrogated the effect of human capital, structural capital and relational capital efficiencies on the return on capital employed by DMBs in Nigeria from 2012 to 2021. We found that human capital efficiency has a significant positive effect while structural capital and relational capital efficiencies have a significant negative effect on the return on capital employed by DMBs in Nigeria. These findings imply that human capital drives efficiency in knowledge-based capital but there is a need to integrate all components of knowledge capital in a coherent knowledge management strategy guided by business sustainability principles.

Recommendations are made based on these findings as follows:

Based on the findings of this study, this study recommends integrated knowledge management strategies that will improve individual knowledge, internalize individual knowledge into the organizational structure, coordinate investments in information systems and communication infrastructure that provide linkage between employees, customers, and other stakeholders, and coordinate the stock of the intellectual resources organizations possess into a coherent strategy. We recommend that DMBs should:

i. DMBs should re-evaluate their employee value proposition to increase the retention period of skilled and experienced staff in other to sustain their human capital efficiency.
ii. DMBs should install a structure that will facilitate knowledge creation, knowledge transfers, storage and preservation, sharing and application to improve the structural capital base of the banks.
iii. DMBs should increase their focus on corporate sustainability performance principles that provide reasonable mutual understanding, respect, and trust; and harmonious and friendly relationships that manifested from the interaction between internal and external stakeholders.

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