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Intellectual Capital and Performance of Financial Institutions Quoted in the Nigerian Stock Exchange

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This study investigated the influence of various dimensions of intellectual capital on financial institutions' performance measured by their profit after tax over the study period of 2010 to 2023. The study employed the stationarity test, the panel regression test in its pooled, random, and fixed effects variants, followed by the co-integration test, error correction model, and stacked Granger Causality model. It was discovered that Human Capital and Green Intellectual Capital Expenditures have a positive and significant influence on Profit after selecting financial institutions. However, an inverse but insignificant influence of Structural capital expenditure on Profit after Tax in the selected financial institutions was found. The study also found a negative and significant influence of Relational capital on Profit after Tax in the selected financial institutions. It is recommended that financial institutions should re-evaluate their provisions on structural capital and relational capital which have not fared well in this study. Consequently, the need to formulate an appropriate investment policy on intellectual capital that would cover the identified components becomes not

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only important but urgent. Judicious application of the provisions to the various components should not only be pursued vigorously but seen as very fundamental to the profitability of financial institutions.

Keywords: Intellectual capital; profit after tax; human capital expenditure; structural capital expenditure; relational capital expenditure & green Intellectual capital.

1. INTRODUCTION

The world economies today are fast becoming knowledge-based economies through innovations and technological advancement. Knowledge has become the new frontier in corporate management because value can be generated through intangible assets not often reflected in the financial statements. Onyekwelu, Okoh, and Iyidiobo [1] assert that "in recent years there has been a growing realization that a company's stock to intangible assets is a key contributor to its capacity to secure a sustainable competitive advantage". "Knowledge based intangibles in particular are recognized to be central to the value creation process. Such assets have increasingly been referred to by a new term that of intellectual capital, progressive and forward-looking firms realize that this is an integral part of completely understanding the performance of their firms. Knowledge-based resources are the main source for businesses for catalyzing and sustaining competitive advantage in a dynamic business environment" as explained by Ikapel [2].

"The Finance profession is currently more than ever being challenged to reinvent itself. This move emanates from the inherent deficiencies of conventional financial scopes and fields, which have failed to recognize the intangibles/knowledge acquired by organizations as non-current assets" Onyekwelu, Osi` & Ugwuanyi [3]. "Therefore, there is a need for a more elaborate platform of financial reporting that could capture knowledge and other Intellectual Capital (IC) Components (Human, Structural, and Relational/Customer Capital) in quantitative terms in financial information for informed decision-making. The continuous exclusion of these Intellectual Capital components implies the neglect of the enormous intangible assets and their values and investments incurred by firms in the acquisitions and development of intellectual properties in order to distinguish them from the financial capital that has traditionally provided the foundations for wealth creation. Intellectual capital refers to a much wider range of assets than those normally" as clarified by Onyekwelu [1].

This practice has aptly culminated in the undervaluation of firms and the often-huge gap that often exists between *book value* and *market value* of firms. The reward earned by firms through their investment in intellectual properties is often attributed to intellectual capital and this is argued to be a major value creator. Edvinsson & Malone [4] submitted that "Intellectual Capital accounts for the enormous gap between the market value and book value of firms in the knowledge-based and technology-driven industry such as the pharmaceuticals industry and this they therefore attributed the missing value in the financial statements to 'Intellectual Premium' otherwise 'Intellectual Capital'. In view of the above is the emergence of intellectual capital discourse accompanied by the drive to establish new metrics that can be used to record and report the value attributable to intellectual capital. It is time for traditional financial and management accounting practice to adapt to the new terrain". "At the 2006 Meeting of the OECD Council at the Ministerial Level, Ministers noted the growing importance of intellectual assets for sustained economic growth and the need for improved measurement of these assets as an input to the process of policy formation. There is scant agreement as to what extent our current understanding of intellectual capital (IC) is new" [5]. Yet IC, in one form or another, is implicated in recent economic, managerial, technological and sociological development in a manner previously unknown and largely unforeseen.

Given the above background, the main objective of this study is to examine the effect of intellectual capital on financial institutions' performance in the Nigerian stock exchange.Precisely, we focused on evaluating intellectual capital in relation to three components, namely Human Capital Efficiency, Structural Capital Efficiency, Relational Capital, and Green Intellectual Expenditures in Nigeria.

To put the paper into proper perspective, it is divided into 5 Sections. Section 1 introduced the study while Section 2 reviewed it. Methodology is captured in Section 3 and Section 4 provided the

analyses of data. Discussion, conclusion and recommendations were treated in Section 5.

2. LITERATURE REVIEW

2.1 Conceptual/Theoretical Foundations

Intellectual capital is relatively new in Nigerian Finance and Banking literature in particular and Management Sciences in general. As an important resource, it has not been taken very serious among our firms and deliberately seen as a critical asset in general practice either as a result of ignorance, share neglect or 'unseen hand syndrome', even though it is fundamental to their success. Essentially, intellectual capital is a key factor to the growth of the financial services sector of any country. Achieving shareholders wealth maximization through efficient and effective assets/investment management is anchored on intellectual capital.

"Thus, intellectual capital may be interpreted as the intangible assets which are not listed explicitly on a firm's balance sheets but positively impact the performance and success of it" [6]. As what can be seen as the a very comprehensive definition of intellectual capital, Mondal and Ghosh [7] described it as "intangible assets or intangible business factors of the company, which have a significant impact on its performance and overall business success, although they are not explicitly listed in the balance sheet (if so, then under the term goodwill)." "A number of researchers have found that intellectual capital is a key factor in a firm's performance using different methodological approaches" [8,9,7,10, 11,12].

Theoretically, two reference point theories are appropriately reviewed for this study. They are Capital Formation Theory (CFT) and Resource-Based Theory (RBT).

Capital Formation Theory (CFT); Kuznets [13] clearly stated that "domestic capital does not only include constructions, equipment and inventories within the country, but also other, expenditure, except those necessary to sustain output at the existing level. it would include outlays on education, recreation, and material luxuries that contribute to the greater health and productivity of individuals and all expenditures by the society that serve to raise the morale of the employed population. Thus, the term capital formation covers material as well as human capital".

Resource-Based Theory (RBT) provides an important framework to explain and predict what can be an underlying factor for competitive advantage and firm performance. The theory clearly states that talent, technology, knowledge, like skills and experience of the leader, system and procedural resource brings competitive advantage to an entity Barney [14].

2.2 Empirical Evidence

Mbugua et al. [15] examine "the effect of intellectual capital on profitability of listed kenyan commercial banks. The study focused on four variables; human capital, structural capital, relational capital and innovation capital. Descriptive research design was used to test how independent variables influenced listed banks profitability. The target population was ten commercial banks that were listed in Nairobi Securities Exchange by 2012. The study used secondary data sources from published audited accounts for last 5 years from 2009-2013 in gathering data for analysis. Descriptive statistical tool MS-Excel and SPSS was used to analyze data. The study found that structural capital and innovation capital affects listed commercial banks of Kenya profitability".

Ozkan et al. [6], evaluated "the relationship between the intellectual capital performance and financial performance of 44 banks operating in Turkey between 2005 and 2014. The intellectual capital performance of banks is measured through the value-added intellectual coefficient (VAIC) methodology. The intellectual capital performance of the Turkish banking sector is generally affected by human capital efficiency (HCE). In terms of bank types, development and investment banks have the highest average VAIC. When VAIC is divided into its components, it can be observed that capital employed efficiency (CEE) and human capital efficiency (HCE) positively affect the financial performance of banks. However, CEE has more influence on the financial performance of banks compared to HCE".

Suroso et al. [16] did "a research on the influence of intellectual capital and corporate governance on the financial performance of the company. The data from 11 sharia banking in Indonesia. The analytical method used is seemingly unrelated regression, with two dependent variables, namely return on asset (ROA) and asset growth (AG) and seven independent variables, namely human capital, structural

capital, capital employed, which is a sub variable of intellectual capital, and the board of size, the board of demography, the board of education (BE), the board of evaluation is a sub variable of corporate governance. The results of this study indicate that intellectual capital has a positive and significant effect on ROA, and no effect on AG. While corporate governance has a positive effect on ROA and does not affect the growth of corporate assets".

Onyekwelu et al. [1] appraised "the effect of intellectual capital on financial performance of firms in Nigeria using the banking industry. The research used the Value-Added Intellectual Coefficient (VAIC) to ascertain the extent that intellectual capital indices affect financial performance of three Nigeria. Data were collected from the published annual financial statements of the three banks and analyzed using regression tool. The study indicates that IC has a positive and significant effect on banks' financial performances of the banks but some are not significant. The results further showed that the banks are statistically different in both the intellectual capital and its financial performance indicators. It also shows that the banks with high IC also show high financial performance".

Inyada [17] examines "salient issues on the impact of intellectual capital on the financial performance of quoted banks in Nigeria. Secondary sources of data collection were employed with the help of the Nigerian Stock Exchange Fact Book. The timeframe for the study was five (5) years and five (5) quoted banks out of the listed banks in Nigeria were used based on purposive sampling. It was discovered that intellectual capital positively and significantly impacted on the financial performance of establishments. Also, physical and structural capitals have positive relationship with the financial performance of the organizations studied".

Research Hypotheses

The following tentative statements were examined:

HO_1: There is no significant relationship between structural capital and Profit after tax of financial institutions in Nigeria.

HO_2: There is no significant relationship between relational capital and Profit after tax of financial institutions in Nigeria.

HO_3: There is no significant relationship between human capital expenditure and Profit after tax of financial institutions in Nigeria.

HO_4: There is no significant relationship between green intellectual capital expenditure and Profit after tax of financial institutions in Nigeria.

3. METHODOLOGY

This section presents the methodological approach adopted. Time series and cross section (Panel) data sourced from annual financial statement of eight (9) sampled financial institutions covering the banking sector were used. The period covered spans from 2010 to 2023. This section also provides for econometric tools employed. They are explained below.

3.1 Pooled Effects Regression

This is to evaluate for joint influence of employed variables on the criterion. It assumes homogeneity among employed data that captured the dependent variable and independent variables.

3.2 Fixed Effect Regression

In statistics, a fixed effect model is a statistical model in which the model parameters are fixed or non-random quantities. This is in contrast to random effects models and mixed models in which all or some of the model parameters are considered as random variables.

3.3 Random Effects Regression

In econometrics, random effects models are used in the analysis of hierarchical or panel data when one assumes no fixed effects (it allows for individual effects).

3.4 Likelihood Ratio Test

In statistics, a likelihood ratio test (LR test) is a statistical test used for comparing the goodness of fit of two statistical models (pooled regression model and fixed effect model) a null model against an alternative model. The test is based on the likelihood ratio, which expresses how many times more likely the data are under one model than the other.

3.5 Hausman Specification Test

This test is used to compare random effect model to fixed effect model. When the probability value of the Hausman specification test is greater than 5% level of significance, it means that the random effect model will be adopted for the study but when the Hausman specification probability value is lesser than or equal 5% level of significance, it therefore means that the fixed effect model should be adopted for the study.

3.6 Lagrange Multiplier Test

It is for the purpose of deciding between the random effect and simple regression.

3.7 Panel Unit Root Test

The stationarity of series used in the study was determined with the estimation of unit root. Dickey Fuller (DF) unit root test was estimated based on the following regression equation:

$$\Delta Y_t = \alpha + \beta T + \delta Y_{t-1} + \gamma_i \Delta Y_{t-i} + \varepsilon_t$$

Hypothesis:

H_0: $\beta > 0$ (there is unit root in the series).

H_1: $\beta_0 - \beta_1 < 0$ (the series are stationary)

The hypothesis is tested on the basis of t-statistic of the coefficient

Decision rule: Reject H_0 if the test statistic is less than critical values, otherwise do not reject. (Haris and Sollis, 2004; Elliott et al. 1996).

3.8 Panel Co-integration

The study applied the Panel Co-integration Rank Test, which is utilized in ascertaining and determining the long-run relationship among employed variables. The cointegration test is used to ascertain the presence of a potential long-run equilibrium relationship between two variables (Awe, 2012) and is expressed as:

$$Yt = \mu + T\ Yt\text{-}1 + \varepsilon t$$

$$\Delta tx = k\ X{-}1\ i{=}1\ \Gamma i \Delta tx{-}i + \Pi xt{-}1 + \mu 0 + \Psi Dt + \varepsilon t.$$

Decision rule: Accept H_0: (there is no significant cointegration relationship) if p – the value is greater than 5% significance level, otherwise accept H_1: (there is a significant cointegration relationship) if the test statistic is equal to or lesser than 5% level of significance.

3.9 Panel Dynamic Error Correction Model

This seeks to correct the error in the model. Error Correction Models (ECMs) entail a series of longitudinal models that seek to appraise the adjustment speed at which a criterion variable returns to equilibrium after a change in a predictor variable.

Estimation of ECMs of the form:

$$et\ 1 + vt\square$$

(Banerjee et al. 1993; Hamilton, 1994; Johansen 1995)

ECMs are useful for appraising the long and short-term influences of one time series on another. This study utilized the Vector Error correction model.

3.10 Model Specification

This study formulates its model in a functional and mathematical forms respectively as:

$$FPAT_t = f\ (FHUCE_t, FSCCE_t, FRLCE_t, FGRRE_t) \quad (1)$$

$$FPAT_{it} = \alpha_0 + \alpha_1 FHUCE_{it} + \alpha_2 FSCCE_{it} + \alpha_3 FRLCE_{it} + \alpha_4 FGRRE_{it} \quad (2)$$

Econometrically, the model is presented as follows

$$FPAT_{it} = \alpha_0 + \alpha_1 FHUCE_{it} + \alpha_2 FSCCE_{it} + \alpha_3 FRLCE_{it} + \alpha_4 FGRRE_{it} + \mu_t \quad (3)$$

Where:

FPAT = Financial Sector Profit after Tax
FHUCE = Financial Sector Human Capital Expenditure
FSCCE = Financial Sector Structural Capital Efficiency
FRLCE = Financial Sector Relational Capital
FGRRE = Financial Sector Green Intellectual Expenditure
α_0/β_0 = Constant Term
$\alpha_1/\beta_1 – \alpha_4/\beta_4$ = Coefficients of Predictors

3.11 An Operational Measure of Variables

Profit After Tax: This captures the amount of net income after aggregate tax deductions. Profit

After Tax measures a corporation's profitability by revealing how much profit a company generates with the money shareholders have invested as measured in millions of naira.

3.12 Human Capital Expenditure

This captures all expenditures on the stock of knowledge, copyrights, habits, social and personality attributes, including creativity, embodied in the ability to perform labor so as to produce economic value as measured in millions of naira and as captured in banks selected. A positive relationship with Return on Equity is anticipated.

3.13 Structural Capital

This refers to all expenditures on supportive infrastructure, processes, and databases of the organisation that enable human capital to function. Structural capital is owned by an organization and remains with an organization even when people leave. It is measured in millions of naira and expected positive relationship with Return on Equity.

3.14 Relational Capital

This captures all expenditures towards customers, vendors, and other important constituencies. It is measured in millions of naira with an anticipated positive relationship with Return on Equity.

3.15 Green Intellectual Expenditure

This captures all expenditures on environmental management of the firm in the form of external scholarships, grants and selected elements of corporate social responsibility. It is measured in millions of naira and expected to have positive relationship with Return on Equity.

4. DATA ANALYSIS AND PRESENTATION OF ESTIMATION RESULTS

Data for the study are analyzed accordingly and presented here as estimation results.

4.1 Presentation of Stationarity (Unit Root) Test Result

The unit root test is carried out using Augmented Dickey Fuller (ADF) test to evaluate the stationarity of the variables employed for the research. The result of the unit root test is presented in Table 1.

The table above shows the employed panel variable at first difference. “It can be seen that all probability levels are lower than the 1%, 5%, and 10% significance levels. This shows an absence of unit root and the presence of stationarity tendencies amongst employed variables. It can be inferred from this that the employed variables’ probability distribution does not change over time when shifted. This gives room for variables with predictive tendencies and gives rise to further tests like the co-integration test which would be carried out after determining the type of model to utilize (pooled, random, or fixed)” [18].

4.2 Pooled Effects Regression Output

The result of pooled effects regression of all employed variables is presented in Table 3.

Table 1. Result of Stationarity (Unit Root) Tests

Variables	ADF - Fisher Chi-square	Prob	ADF - Choi Z-stat	Prob	Note	Discovery	Conclusion/ Decision
$FPAT_{it}$	100.616	0.0000	-5.89593	0.0000	I(1)	No Unit root	Stationary at 1st Diff
$FHUCE_{it}$	75.8911	0.0000	-4.16833	0.0000	I(1)	No Unit root	Stationary at 1st Diff
$FSCCE_{it}$	128.384	0.0000	-7.06346	0.0000	I(1)	No Unit root	Stationary at 1st Diff
$FRLCE_{it}$	73.7140	0.0000	-3.91258	0.0000	I(1)	No Unit root	Stationary at 1st Diff
$FGRRE_{it}$	71.7810	0.0000	-3.11747	0.0000	I(1)	No Unit root	Stationary at 1st Diff

Using both 1% and 5% Substantial Level.
Source: E-view 8 Output (Authors’ Computation and Compilation)

"Based on the above output in Table 2, it can be easily deduced that Human capital expenditure and relational capital were against the a priori as they both possessed negative coefficients of -0.156028 and -3.846355 respectively. Although, only structural capital efficiency showed signifying influence on profitability of firms. This goes to show that, unilaterally, financial institutions' expenditure of supportive infrastructure, processes, and databases of the organization promotes the ability to increase their profitability. The fundamental problem of this model lies in the fact that employed predictor variables jointly account for 25.25 Percent of variations in the criterion variables. The second problem with this regression type (pooled effect) is the fact that it fails to evaluate individuality or

Table 2. Result of pooled effect regression

Dependent Variable: FPAT				
Method: Panel Least Squares				
Date: 02/03/24 Time: 00:32				
Sample: 2010 2023				
Periods included: 7				
Cross-sections included: 15				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	9002912.	4342048.	2.073425	0.0407
FHUCE	-0.156028	0.226288	-0.689511	0.4921
FSCCE	2.318501	0.554782	4.179122	0.0001
FRLCE	-3.847755	3.032814	-1.268708	0.2075
FGRRE	3.597355	4.493480	0.800572	0.4253
R-squared	0.252563	Mean dependent var		12021453
Adjusted R-squared	0.218666	S.D. dependent var		27231462
S.E. of regression	25564733	Akaike info criterion		36.99777
Sum squared resid	6.54E+16	Schwarz criterion		37.12415
Log-likelihood	-1937.383	Hannan-Quinn criter.		37.04898
F-statistic	4.500728	Durbin-Watson stat		0.579880
Prob(F-statistic)	0.002194			

Source: Extracts from E-views 10

Table 3. Fixed Effects Regression Output

Dependent Variable: FPAT				
Method: Panel Least Squares				
Date: 02/03/24 Time: 00:55				
Sample: 2010 2024				
Periods included: 7				
Cross-sections included: 15				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	36319009	5248544.	6.919826	0.0000
FHUCE	1.193380	0.153494	7.774764	0.0000
FSCCE	-1.049169	0.443986	-2.363069	0.0204
FRLCE	-7.160194	1.571511	-4.556249	0.0000
FGRRE	-6.671449	2.237966	-2.981032	0.0037
	Effects Specification			
Cross-section fixed (dummy variables)				
R-squared	0.886369	Mean dependent var		12021453
Adjusted R-squared	0.862586	S.D. dependent var		27231462
S.E. of regression	10094552	Akaike info criterion		35.25518
Sum squared resid	8.76E+15	Schwarz criterion		35.73542
Log likelihood	-1831.897	Hannan-Quinn criter.		35.44978
F-statistic	37.26861	Durbin-Watson stat		1.814343
Prob(F-statistic)	0.000000			

Source: Extracts from E-views 10.

Table 4. Random effects regression output

Dependent Variable: FPAT				
Method: Panel EGLS (Cross-section random effects)				
Date: 02/03/24 Time: 00:55				
Sample: 2010 2023				
Periods included: 7				
Cross-sections included: 15				
Swamy and Arora estimator of component variances				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	12910484	6149396.	2.099472	0.0383
FHUCE	0.975722	0.147263	6.625710	0.0000
FSCCE	-0.900663	0.417436	-2.157608	0.0334
FRLCE	-2.625410	1.352060	-1.941785	0.0550
FGRRE	0.365332	1.944670	0.187863	0.8514
Effects Specification				
			S.D.	Rho
Cross-section random			19309520	0.7854
Idiosyncratic random			10094552	0.2146
Weighted Statistics				
R-squared	0.291183	Mean dependent var		2330274.
Adjusted R-squared	0.262831	S.D. dependent var		14832776
S.E. of regression	12735209	Sum squared resid		1.62E+16
F-statistic	10.27005	Durbin-Watson stat		1.052149
Prob(F-statistic)	0.000001			
Unweighted Statistics				
R-squared	-0.732719	Mean dependent var		12021453
Sum squared resid	1.34E+17	Durbin-Watson stat		0.127699

Source: Extracts from E-views 10

heterogeneous tendencies that exist in each of our employed companies. Since all companies cannot be the same, we do not accept this result" [18].

4.3 Presentation of Fixed Effect Regressions

To deal with the issues of heterogeneity bias, the fixed effect is carried out as follows:

"The coefficient significance level shows that all forms of intellectual capital expenditure by banks have significant tendencies to stimulate the profitability of employed banks as they possess a probability level way below the 5% significance level. Structural capital in the form of supportive infrastructure and relational capital in the form of customers, vendors, and other important constituencies can be seen based on their negative coefficient to drain probability and defy prioritized expectations. We further proceed to the Random effect to check for the common mean value of employed variables and their influence on the criterion variable" [18].

4.4 Random Effects Model

The random effect above shows a lower predictive ability of employed predictor variables. This is evident as the R-square of 0.291183 shows that employed predictor variables jointly account for only 29.12 percent of variation in Profit after tax of financial institutions (FPAT). The idiosyncratic random Rho shows 0.2146 which is very low and as such shows disconnect between employed variables and also their inherent residuals. To this effect, structural capital (FSCCE) and Relational Capital (FRLCE) are seen to go against apriori based on their negative coefficients, while only human capital expenditure (FHUCE) and Green Intellectual Capital Expenditure (FGRRE) are in favour of a prior indicating that they are stimulus to profitability. While the latter (FHUCE and FGRRE) promotes profitability, the former (FSCCE and FRLCE) is seen to adversely affect the profitability of financial institutions.

4.5 Diagnostic Test

The need therefore arises to determine which of the model is most efficient i.e. whether the pooled, random or fixed effect.

Table 5. Likelihood ratio test output

Redundant Fixed Effects Tests			
Equation: Untitled			
Test cross-section fixed effects			
Effects Test	**Statistic**	**d.f.**	**Prob.**
Cross-section F	39.669263	(14,86)	0.0000
Cross-section Chi-square	210.972165	14	0.0000

Source: Extracts from E-views 10

4.6 Likelihood Ratio Test

This test compares the pooled regression model with the fixed effects model. The null hypothesis favours the pooled model i.e. Unobserved sectional differences are not significant.

The above likelihood ratio test which shows the predominance between the pooled and fixed effect is seen to show a cross-section F-statistics of 39.669263 at a probability level of 0.0000 which is seen to be below the 0.05 significance level. This leads to the rejection of the null hypothesis (the null hypothesis supports the pooled model). The alternate hypothesis which is accepted favors the fixed effect. The study therefore upholds the fixed effect over the pooled effect. We therefore proceed to evaluate the better model between the fixed and random model.

4.7 Hausman Specification Test (HST)

HST is used to compare the random effect model with the fixed test model. The null hypothesis of the random effects model i.e. zI is uncorrelated with the explanatory variables (Its null hypothesis is that the random effects model is appropriate while the alternative hypothesis is the fixed effects model is appropriate).

The Hausman specification test output via its cross-section random chi-square statistics of 62.161515 at a probability level of 0.0000 leads to the rejection of the null hypothesis (the null hypothesis supports the random effect). The alternate hypothesis thus upholds the effect of the fixed model. Therefore, the validity of the empirical output of the fixed model stands and is binding on employed variables in the short run.

4.8 Lagrange Multiplier Test

To decide between the random effect and a simple OLS regression, we carry out the Lagrange multiplier test;

The above probability levels at all Lagrange types show a probability level less than 0.05, we therefore reject the null hypothesis. And conclude that the random effect is superior (which supports our even more superior fixed effect). This is evidence of significant differences across banks. Based on these findings, the fixed effect still favorably stands out.

4.9 Kao Residual Co-integration Test Output

The results of Johansen's cointegration tests for all the longitudinal variables of this research are presented in Table 8.

From the above table, the Augmented Dickey-Fuller T-statistics value of -5.046418 at a probability level of 0.000 which is less than the 5% significance level shows great evidence in support of the existence of a long-term relationship between employed variables. This shows that there is evidence of similarities in trends between employed variables amidst variations and shocks in the immediate financial environment.

Table 6. Hausman specification test output

Correlated Random Effects - Hausman Test			
Equation: Untitled			
Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	62.161515	4	0.0000

Source: Extracts from E-views 10

Table 7. Lagrange multiplier tests output

Lagrange Multiplier Tests for Random Effects			
Null hypotheses: No effects Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives			
	Test Hypothesis		
	Cross-section	**Time**	**Both**
Breusch-Pagan	75.37672 (0.0000)	0.414080 (0.5199)	75.79080 (0.0000)
Honda	8.681977 (0.0000)	-0.643490 --	5.684068 (0.0000)
King-Wu	8.681977 (0.0000)	-0.643490 --	4.216932 (0.0000)
Standardized Honda	10.15698 (0.0000)	-0.438603 --	3.130722 (0.0009)
Standardized King-Wu	10.15698 (0.0000)	-0.438603 --	1.637342 (0.0508)
Gourierioux, et al.*	--	--	75.37672 (< 0.01)
*Mixed chi-square asymptotic critical values:			
1%	7.289		
5%	4.321		
10%	2.952		

Source: Extracts from E-views 10

Table 8. Kao Residual Cointegration Test Result

Series: Fpat Fhuce Fscce Frlce Fgrre Date: 02/03/24 Time: 01:02 Sample: 2010 2023 Null Hypothesis: No cointegration Trend assumption: No deterministic trend Automatic lag length selection based on SIC with a max lag of 1 Newey-West automatic bandwidth selection and Bartlett kernel				
			t-Statistic	**Prob.**
ADF			-5.046418	0.0000
Residual variance			1.38E+14	
HAC variance			8.93E+13	
Augmented Dickey-Fuller Test Equation Dependent Variable: D(RESID) Method: Least Squares Date: 02/03/24 Time: 01:02 Sample (adjusted): 2011 2023				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID(-1)	-0.957383	0.106700	-8.972693	0.0000
R-squared	0.474657	Mean dependent var		-294461.3
Adjusted R-squared	0.474657	S.D. dependent var		12439533
S.E. of regression	9016239.	Akaike info criterion		34.87800
Sum squared resid	7.24E+15	Schwarz criterion		34.90578
Log-likelihood	-1568.510	Hannan-Quinn criter.		34.88920
Durbin-Watson stat	2.105145			

Source: Extracts from E-views 10

Table 9. Presentation of panel error correction model

Vector Error Correction Estimates					
Date: 02/03/24 Time: 01:03					
Sample (adjusted): 2013 2023					
Standard errors in ( ) & t-statistics in [ ]					
Cointegrating Eq:	CointEq1				
FPAT(-1)	1.000000				
FHUCE(-1)	0.000530				
	(0.00026)				
	[2.01938]				
FSCCE(-1)	-2.283537				
	(1.24324)				
	[-1.83676]				
FRLCE(-1)	-325.8053				
	(19.3554)				
	[-16.8328]				
FGRRE(-1)	497.0501				
	(28.0059)				
	[17.7481]				
C	-69516438				
Error Correction:	**D(FPAT)**	**D(FHUCE)**	**D(FSCCE)**	**D(FRLCE)**	**D(FGRRE)**
CointEq1	-0.202982	-0.004337	0.003830	-0.000530	-0.001399
	(0.08759)	(0.01107)	(0.00254)	(0.00026)	(0.00020)
	[-2.31752]	[-0.39171]	[1.50567]	[-2.01938]	[-6.85389]
D(FPAT(-1))	-0.738032	-0.344759	0.012249	-0.006313	-0.004454
	(0.17085)	(0.08141)	(0.01871)	(0.00193)	(0.00150)
	[-4.31983]	[-4.23465]	[0.65483]	[-3.27178]	[-2.96761]
D(FPAT(-2))	-0.137165	-0.112747	0.014467	-0.000334	-0.001381
	(0.19614)	(0.09347)	(0.02147)	(0.00222)	(0.00172)
	[-0.69931]	[-1.20626]	[0.67365]	[-0.15080]	[-0.80163]
D(FHUCE(-1))	1.018505	0.417092	-0.011318	0.010929	0.007107
	(0.39266)	(0.18712)	(0.04299)	(0.00443)	(0.00345)
	[2.59384]	[2.22906]	[-0.26326]	[2.46449]	[2.06044]
D(FHUCE(-2))	-0.017289	0.049004	-0.027395	0.001196	0.003281
	(0.41866)	(0.19950)	(0.04584)	(0.00473)	(0.00368)
	[-0.04130]	[0.24563]	[-0.59765]	[0.25294]	[0.89229]
D(FSCCE(-1))	-0.376805	-0.513046	-0.183610	-0.004476	-0.008139
	(0.93647)	(0.44626)	(0.10253)	(0.01058)	(0.00823)
	[-0.40237]	[-1.14967]	[-1.79079]	[-0.42323]	[-0.98944]
D(FSCCE(-2))	-0.962440	-0.572604	-0.000890	0.027464	0.016842
	(0.64899)	(0.30926)	(0.07106)	(0.00733)	(0.00570)
	[-1.48299]	[-1.85152]	[-0.01252]	[3.74715]	[2.95435]
D(FRLCE(-1))	4.214196	-4.629934	0.944029	-0.202982	-0.296102
	(7.75551)	(3.69573)	(0.84912)	(0.08759)	(0.06813)
	[0.54338]	[-1.25278]	[1.11177]	[-2.31752]	[-4.34641]
D(FRLCE(-2))	9.217044	-1.014744	1.066824	-0.007748	0.112215
	(7.18244)	(3.42265)	(0.78638)	(0.08111)	(0.06309)
	[1.28327]	[-0.29648]	[1.35663]	[-0.09552]	[1.77860]
D(FGRRE(-1))	-10.16654	-0.937747	-1.136722	0.099429	0.173482
	(4.12502)	(1.96569)	(0.45163)	(0.04659)	(0.03623)
	[-2.46461]	[-0.47706]	[-2.51692]	[2.13433]	[4.78772]
D(FGRRE(-2))	-6.978944	-1.444269	-0.722967	0.113406	-0.061580
	(4.63977)	(2.21099)	(0.50799)	(0.05240)	(0.04076)
	[-1.50416]	[-0.65322]	[-1.42319]	[2.16429]	[-1.51093]

C	1960109.	-1170882.	230578.0	-76127.18	-111065.8
	(2708725)	(1290788)	(296567.)	(30590.6)	(23793.9)
	[0.72363]	[-0.90711]	[0.77749]	[-2.48858]	[-4.66783]
R-squared	0.350621	0.327620	0.205742	0.577967	0.916256
Adj. R-squared	0.201805	0.173533	0.023725	0.481251	0.897064
Sum sq. Resids	9.18E+15	2.08E+15	1.10E+14	1.17E+12	7.08E+11
S.E. equation	13828578	6589728.	1514035.	156171.2	121472.5
F-statistic	2.356069	2.126203	1.130345	5.975926	47.74297
Log likelihood	-1064.977	-1020.503	-932.2593	-795.9645	-780.8886
Akaike AIC	35.89923	34.41678	31.47531	26.93215	26.42962
Schwarz SC	36.31810	34.83565	31.89418	27.35102	26.84849
Mean dependent	-645097.9	-589086.7	75301.96	-92091.00	-116886.8
S.D. dependent	15478290	7248611.	1532321.	216831.4	378612.2
Determinant resid covariance (dof adj.)		1.36E+59			
Determinant resid covariance		4.45E+58			
Log-likelihood		-4476.961			
Akaike information criterion		151.3987			
Schwarz criterion		153.6676			

Source: Extracts from E-views 10

The above Error Correction estimate shows that the equilibrium model can be adjusted back to equilibrium by 20.29% (-0.202982). This is upheld based on the anticipated negative assigned coefficient of the Error Correction estimate (CointEq1), which is seen to be significant. The long-run result of human capital expenditure is significant at 2.01938 with a positive coefficient of 0.000530, which connotes that a 1% increase in human capital expenditure will lead to a 0.053% increase in profit after tax of selected financial institutions. The probability value of structural capital expenditure is -1.83676 which is less than ± 1.98 or 2. This means that there is no significant relationship between structural capital expenditure and profit after tax while its coefficient is -2.283537, which implies that a 1% increase in structural capital will bring about a 228.35% decrease in profit after tax. Relational capital is significant with a probability value of -16.8328 which is greater than ± 1.98 or 2. While its coefficient is negative at -325.8053 which connotes that a 1% increase in relational capital will lead to a 32580.53% decrease in profit after tax. Green intellectual capital is significant at 17.7481 and has a positive coefficient of 497.0501.

4.11 Stacked Pairwise Granger causality test

To evaluate for a causal relationship between the employed variables, the following evaluation is presented as follows.

The stacked pairwise Causality test shows the presence of a bidirectional relationship between human capital expenditure and profit after tax with probability values of 0.0023 and 0.0001. while structural capital expenditure has a unidirectional relationship with profit after tax with probability values of 0.0020 and 0.0697. There exists no directional relationship between

Table 10. Pairwise Granger Causality Test output

Pairwise Granger Causality Tests
Date: 02/03/24 Time: 00:59
Sample: 2010 2023
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
FHUCE does not Granger Cause FPAT	75	6.61020	0.0023
FPAT does not Granger Cause FHUCE		10.4563	0.0001
FSCCE does not Granger Cause FPAT	75	6.79046	0.0020
FPAT does not Granger Cause FSCCE		2.76720	0.0697
FRLCE does not Granger Cause FPAT	75	1.65531	0.1984
FPAT does not Granger Cause FRLCE		0.82674	0.4417
FGRRE does not Granger Cause FPAT	75	1.97296	0.1467
FPAT does not Granger Cause FGRRE		0.78165	0.4616

Source: Extracts from Eviews 10

relational capital and profit after tax with probability values of 0.1984 and 0.4417. Again, green intellectual capital showed no directional relationship with profit after tax with probability values of 0.1467 and 0.4616. These outcomes are clear evidence of budgetary gaps.

5. DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Discussion

The study shows evidence in support of a significant and positive relationship between human capital expenditure (FHUCE) and profit after tax (FPAT) of financial institutions. This connotes that human capital expenditure is key to driving profit after tax upward. This aligns with the study of Ozkan [6] and Suroso [16]. It also supports the bi-causal relationship between human capital expenditure (FHUCE) and profit after tax (FPAT) of financial institutions. Structural capital expenditure (FSCCE) is significant and negatively related to profit after tax. This implies that not enough structures are made available in the organization to help improve the profit after tax of captured financial institutions. It was found that a significant and negative relationship exists between relational capital expenditure (FRLCE) and profit after tax, which contradicts the study of Muthia and Rosyeni [19] and Sayad and Pourmohammadi [20] but aligns with the study of Onyekwelu et al. [1] and Inyada [17]. This could be a result of financial institutions not effectively relating with the major public and other constituents and tapping from their available potential. It is also evidence of budgetary gaps. Green intellectual capital (FGRRE) is significant and positively related to the profit after tax of captured financial institutions. This is in line with the study of Erinos and Rahmawati [21] and Chaudhry (2016). It shows that financial institutions have impacted greatly on the environment they reside in and this has brought a siren environment for business operations and increased market share (number of customers).

5.2 Conclusion

From the study, it is evident that financial institutions have been able to harness the productive use of intellectual capital especially human capital (FHUCE) and Green intellectual capital (FGRRE) leading to their increased profitability. Thus, this study concludes that intellectual capital stimulates financial institutions' profitability performance. However, the potency lies in its effective and efficient utilization. In all, a budget adjustment in favor of intellectual capital is inevitable!

5.3 Recommendations

In light of the study findings and discussion thereto, it is recommended that financial institutions should re-evaluate their provisions on structural capital and relational capital which have not fared well in this study. Consequently, the need to formulate an appropriate investment policy on intellectual capital that would cover the identified components becomes not only important but urgent. Thus, increased budget is a *sine quo non*. Judicious application of the provisions to the various components should not only be pursued vigorously but seen as very fundamental to the profitability of financial institutions.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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