NEXUS BETWEEN INTELLECTUAL CAPITAL EFFICIENCY AND FINANCIAL PERFORMANCE IN SERVICE FIRMS: EVIDENCE FROM NIGERIA EXCHANGE GROUP

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Abstract
This study utilizes multi-theory structure that include resource-based theory and stakeholder theory to investigatetheassociation between componenets of intellectual capital efficiency and financial performance. It also employs Prais-Winsten regression with panel corrected standard errors to calculateits model. The study discoverthat althoughhuman capital and structural capital efficiencies are significant and positivein the determination financial performance firm value, relational capital and capital employed efficienciesimpact seemsinsignificant. The significance of these findings is validatedby an important support to the intellectual capital versus financial performance literature strand.Primarily, the study's results lend further evidence in support of the two theories ability aid theposition of accounting numbers to define and explain financial performance.

Keywords: Financial performance, intellectual capital, service firms, PCSE, HCE, SCE, RCE, CEE, NGX

1.0 Introduction

Intellectual capital is seen to be an important factor of production which plays a crucial role in producing outstandinglyefficient non-natural capital, such as patents, copyrights, trademarks and software systems (Hamzah, 2025) This man-made capital when integrated with natural resources results in productive efficiency. The consequence of this complex integration facilitatesfirms to offer services needed to make societies livable. In addition, offering these services by firms enables them to maximize sales which in turn enhances their ability to generate revenue and earn profits. Nigeria's localintellectual capital was considerablyemergentin the service sector, andhence, offeredan insignificant contribution to creating and retainingof value. In other words, IC development in the sector is fundamentally inhibited by limited research and development investment culture and inadequate knowledge management. This resulted in the government introducing a legal framework to manage and commercialize intellectual property rights across the

economy through National Intellectual Property Policy and Strategy (NIPPS). This landmark efforts sought to enable innovators earn returns on their ideas. Similarly the Nigerian government launched the 3 Million Technical Talent (3MTT) to train people in digital skills to build human capital for the digital economy. Additionally Federal Ministry of Arts, Culture, Tourism and Creative Economy came up with an idea known as IP shield, which seeks to create funds and innovation hubs that uses IP assets to unlock finance for creative entrepreneurs. All these efforts are geared towards developing domestic intellectual capital within the service sector in order to reinforceits ability not only to create value but to retain it. ((Blessing, 2025).

Primarily, this paper intends toevaluate whether these governmental endeavors are producing the results for which they are created. Specifically this paper intend to achieve this by assessingthe relationship between the four components of intellectual capital efficiency (ICE), based on the modified value-added intellectual coefficient (M-VAIC) model (Ulum et al., 2014), and the financial performance of service firms through ROA.

Nigeria's service industry is the largest sector of the economy, contributing over half of the GDP. It is forecasted that the contribution from this sector will be around 33.27 trillion and 35.03 trillion in 2027 and 2028 respectively. (Blessing, 2024). It coversareas like financial services (banking, insurance, Fintech, telecommunications, transportation and logistics, hospitality and tourism, education, healthcare, entertainment, professional services (legal, accounting, consulting), public administration, and a fast-growing digital economy. Alongside traditional services, technology-driven firms and creative enterprises are reshaping how Nigerians transact, communicate, learn, and consume content. From mobile banking to ride-hailing, from e-commerce to streaming platforms, services increasingly define everyday economic life. Services contribute the largest share of Nigeria's GDP and are the backbone of employment in urban centers. Financial services mobilize savings and allocate capital; telecommunications enable digital inclusion; transport services facilitate trade; education and healthcare build human capital. Without a functioning service sector, productivity in agriculture and manufacturing would stall (Blessing, 2025)

Furthermore, the way services are produced is a complex process. Unlike manufacturing, value creation depends less on physical assets and more on knowledge, data, relationships, and systems. Banks rely on risk assessment models and information technology infrastructure; telecom companies operate vast digital networks; logistics firms coordinate real-time tracking systems; universities depend on academic expertise and research capability. Service delivery requires synchronised human expertise, digital platforms, regulatory compliance, customer trust, and adaptive processes. Much of this value is embedded in systems, algorithms, brand reputation, and organisational culture rather than in machines alone. (Blessing,2025)

This is where Intellectual Capital (IC) becomes central. Human capital (skills and expertise), structural capital (systems, databases, processes), and relational capital (customer trust, networks, brand equity) directly influence service quality, innovation capacity, and operational efficiency. Strong IC improves financial performance through higher revenue growth, cost efficiency, customer retention, and risk management. Improved financial performance enhances profitability and cash flows, which in turn increase firm valuation. In knowledge-intensive service industries, firm value is therefore less about physical assets and more about how effectively intellectual capital is developed, managed, and converted into sustainable financial returns.(Ahmad, 2025)

Research Hypotheses

H_{01} HCE does not affects the financial performance of firms in the Nigerian service sector.
H_{02} SCE does not affects the financial performance of firms in the Nigerian service sector.
H_{03} RCE does not affects the financial performance of firms in the Nigerian service sector.
H_{01} CEE does not affects the financial performance of firms in the Nigerian service sector.

2.0 Literature Review

Intellectual Capital Efficiency

Humanity has consistently found innovative ways to advance technology and streamline resource management through the collective power of talent, creativity, and professional expertise (often termed human resources). By bridging the gap between natural resources and physical capital, these human efforts serve as the primary engine for business financial performance. In other words, these man-made efforts made it possible for natural earthly resources to be exploited in a way that affords people access to efficient services. Value-Added Intellectual Capital (VAIC) is a framework used to assess how effectively human contributions drive productivity and growth. Numerous researchers have utilized VAIC across diverse global industries to evaluate intellectual capital performance (Jordãoet al., 2025;Yahaya et al., 2025; Prasad & Mondal, 2025,). According to Pulic (2000), these performance outcomes stem from two key intangible inputs: human capital efficiency (HCE) and structural capital efficiency (SCE) and one tangibleinput in the form of capital employed efficiency (CEE). Ultimately this categorization by Pulic (2000), proposed the three earlier named measures of efficiency (HCE, SCE and CEE). Therefore it can be understood that to measure the value of VAIC these three efficiency measures must be incorporated. Consequently, the higher the value of VAIC the better the management's applicationof a firm's assets to generate financial performance.

However, decades later, Ulum et al. (2016) sought to revisethe original VAIC by adding another input he termed as relational capital efficiency (RCE). This factor was added to the two intangible IC components proposed by Pulic (2000), consequently a new model was born. M-VAIC. Usually considered as more comprehensive, the M-VAIC measure the four components of ICE as used in this paper.

HCE and firm value

As with the first popular Pulic's model, HCE still featured as an integral component of IC.In other words, itsposition as an essential component in the process of firms' valuation of IC is retained. Ahmad (2025) examine the relationship between intellectual capital and firms' performance applying the VAIC model to measure ICE and its components, and their finding reveals that HCE significantly affects firm financial performance. Relying on the Ohlson (1995) model, Liu et al. (Navas-Alcívar., 2025; Ruwanti& Harymawan) show that HCE facilitates a great deal of incremental information in terms of firms' value and value creation.

In a similar vein, results reported by Al Frijat & Elamer (2025) show that HCE turn out to be the most efficient ICE component concerning the enhancement of financial performance. Consistent with the finding reported by Al Frijat & Elamer (2025), the works of (Yahaya, 2026; Rajâa & Mekkaoui.,2025; Ahmad et al., 2025) also documented a significant positive relationship between HCE and financial performance. The results of the studies reviewed in this section provided evidence implying that HCE is a very important compoundthat contributes to creating and boosting firm market value. Consequently, the first hypothesis was raised owing to the above findings.

SCE and firm value

According to the M-VAIC model, the SCE constituent, which is still retained from the original Pulic's model, indicatedthat there exist resources which are embedded in an organization. The SCE, therefore is seen as an intangible asset which is domiciled in the organization even when the first component is not around.Several studies have investigatedthe relationship between ICE and measures of firm financial performance and mixed findings were report. For instance, Yahaya, et al., (2025) examines the impact of intellectual capital on firms' financial performance and the results revealed that SCE has significant negative influence in the relationship. Similarly, the study of Prasad andMondal (2025) revealed that SCE does not affect firms' market value. However,Cuevas-Vargas and Cortés-Palacios(2025) found that SCE contributes immensely to financial performance as their study revealed a significant positive relation. Also, Yin and Xu (2025) investigated the dynamic effect of intellectual capital on firm value using a sample of labour intensive and capital-intensive companies in China, and reported that SCE was significantly positively associated with firm market value. It can be clearly seen that reviewed studies were from geographic locations and distinct jurisdictions, SCE appeared to be an importantfactorof intellectual capital, consequently, its efficiency has a duplicativeinfluence on firms' financial performance.

RCE and Firm Value

RCE is the latest conceptincluded in the modified valued-added model by Ulum et al. (2016, 2017). This addition is thought to complement the two invisible intellectual capital constituents included in the original VAIC model (see Pulić, 1998, 2000). This componentof the model reasoned that building and sustaining economically beneficial connection with stakeholders is as important as the other components. This is even more pronounced in sectors were customer engagement is paramount. Relational capital is seen as a unique resourcerooted in cultivating engagements with stakeholders who could potentially influence the firms' success. To this end,Uwhejevwe-Togbolo et al. (2025)opined that stakeholder relationships are the indispensablerequirementsforcreating, sustainingand replenishinghuman efforts, structures and processes. RCE is the latest conceptincluded in the modified valued-added model by Ulum et al. (2017). This addition is thought to complement the two invisible intellectual capital constituents included in the original VAIC model (see Pulić, 2000). The use of this construct was evident in the work of Iredele et al., (2025) where they underscorethe use of customer relation to improvefinancial performance. Similarly, Ahmad (2025) investigated the relationship between ICE and firm financial performance of banks listed in the Indonesian Stock Exchange. M-VAIC is used to measure ICE elements and the findings reveal that RCE has a positive effect on firm market value and accounting-based financial performance. Furthermore, Al Frijat & Elamer(2025) explain that RCE and CEE have a positive impact on firms' market value. Similarly, Pant et al., (2024) find that components of ICE including RCE significantly positively influence firm market value. Those findings strongly suggests that firms that work on establishing a pleasantrelationship with their partners are more likely to have stronger financial performance than firms' that do not (Aybars & Öner, 2022)

CEE and firm value

This component of intellectual capital is present in both models discussed earlier. It featured as the component number three of the ICE in Pulić (2000), and number four in the modified version by (Ulum et al., 2016). CEE is aprincipaltangible part of ICE measurement upon which the intangiblesrely in order to impact firm financial performance. Several studies have use this

construct to test this relationship were, as in previous cases, mixed findings were recorded. For instance, Yahaya et al. (2025) document that CEE is positively related to manufacturing firms' market value proxied by Tobin's Q. This implies that manufacturing firms employ more of physical and financial capital compared to other intellectual capital components. On the contrary, Purba et al., (2025) find that CEE exhibit a negative relationship with market-to-book value. However, Berhe et al. (2025) report positive and negative association in the same study when they examine the impact of intellectual capital on firm financial performance, proxied by ROA, ROE and growth of revenue. Thus, their results reveal that M-VAIC capital components, including CEE relate positively with financial performance but negatively with market value. On this note, Aybars, A & Öner (2025) and Yahaya, et al. (2025) contend that physical and financial capital exhibit strength in determining firm performance.

Theoretical Framework

In investigatingthe impact of ICE on the financial performance of service sector of the NGX listed companies two theories were thought to beapplicable. These are stakeholder theory (SHT) and resources-based theory (RBT). Consequently, the hypotheses related to HCE, SCE and CEE are reinforced by the proposalof the RBT theory, while the hypothesisassociated RCE is reinforcedby the proposal of SHT.

The Resource-based theory (RBT) describes how, in the quest of financial accomplishment, an organization canbestfurther exploit its capacity to attainand retainvital resources (24).Equally, Duh (2008) provides further proof thatRBT is useful in explainingthe long-standing inconsistencies in firm financial performance that are not attributedto an industrial sector or anymacroeconomic condition. Likewise, Supian and Fuad, (2025) contendsthat the rationale behind RBTindicates that organizations withexceptional and limitedresources (intellectual capital) that are hardtoreplicate by competitors has primed itself to win the competition (Abdallah et al., 2025). Accordingly, this theory appropriately underpins the hypotheses relating to the three constituents of ICE (HCE, SCE and CEE).

Farooq et al., (2025) contendthat SHT is useful becauseit implies thedevotion and trustof stakeholdersin explaining the attainment of organisational goals. Successfulmanagement of stakeholders' expectations and making efforts to meet their informational needs translates into organizational success (Комарудінет al., 2025). It is onlyrational to expect loyalty and support from stakeholders that are well taken care of. This expectation infersthat if organisation sustainsafriendly relationship with stakeholders, it is almost assured of increasein its value. This theory is employed to support the third hypothesis, relating to RCE.

3.0 Methodology

This paper adopted the ex-post facto research design. Ex-post facto is used to study how an independent variable exert influence on the dependent variable (34). Using Time-series data, this paper used secondary data obtained from the Nigeria Exchange Group (NGX) and spanning from 2012 to 2024. Descriptive statistics is employed, as statistical technique, to provide the summary of variables used in this paper. The key statistical inference used is linear regression analysis, which is to assess the impact of ICE on financial performance in NGX listed firms. The results are presented in line with those obtained from the pooled OLS. Before presenting the regression results, the nature of the data suggests the relevance of some pre-regression test.

Population and sample

The population of this study consists of all servicesector firms as at December 2024. However, firms were excluded that fall short of benchmarks listed below.

i. Companies that are not listed on the NGX from January 2012 to 31st December 2024.
ii. Firmsthat were placed on technical suspension or delisted due to merger or acquisition for the period considered in this study.
iii. Firms that do not have adequate data regarding the variables of interest for the study.

After usingthe aforementioned yardsticks, twelve companies materialized as the substantive sample.

On hindsight, it is worthwhile pointing out the rationale for which the covering the covered period of this study was chosen.The period i.e 2012–2024 was selected because it reflects a meaningful phase in Nigeria's economic and regulatory en. Beginning in 2012, Nigeria fully adopted International Financial Reporting Standards (IFRS), marking a significant shift toward improved transparency, comparability, and disclosure quality in financial reporting. This transition strengthened the institutional environment for examining firm-level financial performance and value creation. The period also follows the post-banking crisis reforms initiated by the Central Bank of Nigeria, allowing the study to focus on a relatively stabilized regulatory regime rather than a crisis-distorted environment.

Beyond regulatory reforms, the timeframe captures uninterrupted democratic governance across successive administrations. This continuity enhances institutional consistency and reduces structural disruptions that could bias longitudinal analysis. Importantly, the period also coincides with Nigeria's digital transformation drive, reflecting a broader shift toward knowledge-driven service models where intellectual capital plays a central role.

Finally, 2012–2024 encompasses multiple macroeconomic cycles (including recessionary shocks, recovery phases, and post-pandemic adjustments) thereby providing a robust setting to assess how intellectual capital contributes not only to financial performance but also to firm resilience and long-term value creation. Taken together, this period offers a stable yet dynamic environment that is both institutionally relevant and economically rich for examining the relationship between intellectual capital, financial performance, and firm value in Nigeria.

Variables

Dependent Variable

In this paper, ROA is considered as the measure of financial performance. The main reason for choosing the Return on Assets (ROA) as the DV in this paper, is that in intellectual capital (IC) research it provides animportantadvantagebecause it enables researchers to put a numbers on the value of firms' hidden' assets. In most cases, the studies measuring financial performance uses the ROA to evaluatemanagerial efficiency in handlingfirms' physical assets, the IC research employs ROA to provehow efficiently a firm's intellectual capital components are used to earn profit.

ROA= Net income before tax to total assets (1)

This formula has been repeatedly and effectively employed in several studies on intellectual capital and firm financial performance (Muttakin et al., 2015).

Independent Variables

As indicated earlier, the IVs in this paper are HCE, SCE, RCE and CEE respectively. The summaryof these constituentscreates the M-VAIC coefficient.But, in order to compute the value each constituentof the ICE, it is imperative to calculatethe value-added element which is assumedby the following formula.

VA= OP+ EC+ I+ T+ D+ A (2)

Where;

OP =operating profit

EC =employee costs

I =interest expenses

T= taxes

D= depreciation

A=amortization

HCE= VA/ HC (3)

SC= VA/ HC (4)

SCE =SC/ VA (5)

RC=Advertisement expenses+ selling and distributionexpenses+ marketing cost(6)

HoweverRCE is computedwhere relational capital is divided by the value-added as in (Ulum et al., 2014): Therefore;

RCE= RC /VA (7)

In any organization, the function of intellectual capital cannot be standalone, there must be integration with physical and financial capital.Hence, CEE is calculated by dividing VA with CE as demonstrated in equation (8) below, this was seen in (Irina & Zelgalvea, 2013)

CE= physical capital +financial assets= total assets- intangible assets (8)

CEE= VA /CE (9)

Where;

HC human capital (wages and salaries)

HCE human capital efficiency

VA value added of the firm

SC structural capital

SCE structural capital efficiency

RC relational capital

RCE relational capital efficiency

VA value added of a firm

CE capital employed

CEE capital employed efficiency.

Control Variables

Financial Leverage (LEV)

Financial leverage symbolizes the benefitwhich debt financing provides firms. Financial leverage is essentially the advantage a company gains when it uses borrowed money to fund its operations. Deciding whether to take on debt is a big move for managers because it directly impacts the company's risk, its overall value and the wealth of its shareholders (Arhinful, & Radmehr, 2023).).Beyond that, using operating leverage can help a firm boost its profits, which often leads to a higher stock price and a more valuable business. Because these factors are so interconnected, many researchers have started looking into how IC also plays a role in this process.

Total debt / total assets (10)

Firm Size (FSIZE)

In research, firm size is more than just a number, it is a comprehensive way of measuring a company's financial stand. Generally larger companies have more tools and cash at their disposal, giving them the power to jump on big investment opportunities than smaller firms. Because size can change how a business performs, this paper accounts for its key factor (Al Frijat & Elamer, 2025).

Log of total assets (11)

Empirical Model

The panel dataset for this study is analyzed using Prais-Winsten OLS regression with panel corrected standard errors (PCSE) whereROA is the dependent variable.Conversely, the independent variables consist of the constituentsof in the M-VAIC model considered in this paper, namely, HCE, SCE, RCE and CEE respectively.Moreover, leverage and firm size are incorporatedas control variables. Thetitle of this and content of this paper falls within the general value-relevance literature (38). This shows thatit includes the specification of regression models by modifying the original Ohlson model.Consequently, this paper modelled its time-series cross-sectional (TS-CS) dataset for this study based on the value-relevance model developed by Ohlson (1995) identified as follows:

Achieving objectives of any study involves testing the formulated hypotheses and this is made possible by formulating a regression model capable of capturing the objectives of the study. Therefore, this paper considered the model of Belguith (2016) as used Bala et al, (2021)

The model is as follows:

$$V_t = \beta_0 + \beta_1 BE + \beta_2 AE_t + \beta_3 TE_t + \varepsilon_t$$

Where;

Vt Value of firm at time t.

BEt BE at time t, measured as the beginning BE in a particular year.

AEt Abnormal earning at time t. Following Ohlson (1995), this variable is measured as net income minus 12% charge for the use of equity capital. Note that 12% is the long-term rate of ROE.

TE t Transitory earning at time t.

εt Stochastic error term.

In this study transitory earning is replaced with the M-VAIC components (Bala et al, 2021) the model for this study is specified as Follows

$$ROAi_t = i_t a_0 + a_1 + BE^i_t + a_2 AEi_t + a_3 HCEi_t + a_4 SCEi_t + a_5 RCEi_t + a_6 CEEi_t + a_7 FSIZEi_t + a_8 LEVi_t + \mathcal{E}i_t$$

Where;

ROA = represents the financial performance at time t

HCE t = represents the human capital efficiency at time t

SCE t = represents the structural capital efficiency at time t

CEE t = represents the s capital employed efficiency at time t

RCE t = represents the relational capital efficiency at time t

FSIZE t = represents the firm size at time t

LEV t = represents the leverage at time t

Ɛt = Stochastic error term at time t
β0 = Intercept of the regression line.

4.0 Empirical Results And Discussion

Descriptive Statistics

The statistical summary in table 1 below consisted of the mean which shows the average values of the variables, standard deviation which explains the variables spread and the minimum and maximum value that indicates the lowest and highest value of the variables for the study period.

Table 1:

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	169	-.0176237	.1457743	-.82	.204
HCE	169	2.256237	2.271265	-8.761	9.8955
SCE	169	0.4443817	0. 041411	.375	.5313
RCE	169	0.4611988	.0524387	.375	.5313
CEE	169	.4578751	.0378461	.375	.5313
FSIZE	169	1.33E+10	1.46E+10	1.76E+09	8.34E+10
LEV	169	0.2991964	.3546927	.0001	2.0813

Source: STATA Output, 2026.

Correlation Matrix

Table 2 shows the outcome of the Pearson correlation coefficients between the study variables. It is primarily conducted to assess the strength or otherwise of the dependent and independent variables of this study.

Table 2:

Correlation Matrix

	ROA	HCE	SCE	RCE	CEE	FSIZE	LEV
ROA	1.0000						
HCE	0.4684	1.0000					
SCE	-0.0867	-0.0818	1.0000				
RCE	-0.1631	-0.0844	0.3319	1.0000			
CEE	-0.0940	-0.0599	0.3448	0.3625	1.0000		
FSIZE	-0.1486	-0.0430	0.1725	0.2214	-0.0917	1.0000	
LEV	-0.3544	-0.0546	-0.0744	0.1501	0.0024	0.0064	1.0000

Source: STATA Output, 2026.

Table 2 represents the outcome of the Pearson correlation coefficients between the study variables. The position of Dzenopoljac et al.(2024) is that as long the correlation number does not go beyond 0.7 it is of no statistical concern. Seeing that none of the coefficients has gone beyond that suggested threshold, therefore this paper does not suspect any challenge of multicollinearity in the model.Consequently, table 2 enables understanding the complexities of the sampledfirms to see how efficiently their business activities is using its intangibles versus its bank account. The most notable is that at 0.4684 the connection between ROA and HCE is the strongest. This suggest that workers' skills is a massive driver of firms' activities. It's an indicator that when employees are empowered the whole business benefits.

On the other side, there are some numbers that tells a different story. The negative correlations between ROA and Size (FSIZE) and Debt (LEV)at -0.1486 and -0.3544respectively gives a warning signal. It's that classic struggle where getting too big or leaning too hard on borrowed money starts to drag down the actual profitability. Additionally, SCE and RCE exhibits a decent connection to each other (0.3319),but they aren't really connectedto the ROA in a positive way. This probably indicates that the sampled possess great systems and have relationships in place, but they are not efficiently utilizing these systems to increase profitability.

Variance Inflation Factor

Table 3:
VIF

Variable	VIF	1/VIF
RCE	1.34	0.747443
CEE	1.30	0.769663
SCE	1.26	0.795861
FSIZE	1.12	0.891346
LEV	1.05	0.956666
HCE	1.01	0.986128
Mean VIF	1.18	

Source: STATA Output, 2026.

Additionally, the paper conducted the prescribed test of multicollinearity via the variance inflation factor (VIF). As noted by Hair et al. (2024b), as long as the value of less than 10 is generated then multicollinearity is not a problem. From the VIF values presented in the table above it can be seen clearly that all values are within the acceptable threshold. (Table 3).

Fixed Effects Model And Diagnostic Tests

The section of this paperstarts the analysis by offering an exploratory fixed effects (FEs) estimation which is done in order to observe the relationship between the variables based on theempirical model considered for this paper. In addition, the analysis is to be regarded as the foundation for running the applicable post-estimation diagnostic tests so as to run suitable model to estimate the relationship.

Table 4:
Estimates of FE model
Regression Coefficients (Fixed Effects Model)

Variable	Coefficient	Std. Error	t-Statistic	P>|t|	Lower 95% CI	Upper 95% CI
HCE	0.0280866	0.0040904	6.87	0.000	0.0200092	0.036164
SCE	0.0920303	0.2497278	-0.37	0.713	-0.585176	0.401111
RCE	-0.048834	0.2034983	-0.24	0.811	-0.450685	0.3530173
CEE	-0.242894	0.2778625	-0.87	0.383	-0.791594	0.3058045
FSIZE	-1.25e-12	6.72e-13	-1.87	0.064	-2.58e-12	7.26e-14
LEV	-0.135137	0.0265931	-5.08	0.000	-0.187651	-0.082623
_cons	0.1507184	0.1345382	1.12	0.264	-0.1149564	0.4163932

Model Summary
Number of observations: 169

F(6,162) = 14.61

Prob > F = 0.0000
R-squared = 0.3511
Adjusted R-squared = 0.3271
Root MSE = 0.11958

Source: STATA Output, 2026.

On this, the model itself holds together quite well with an R2 of 0.3511, this implies that about 35% of the variation in performance is explained by these factors. Looking at the individual variables, three clear scenarios emerged from the data, while the others seem to be not so distinct. The first clear scenariois the case of HCE, with a coefficient of 0.028 and a highly significant t-statistic of 6.87 (p=0.000), it's the most reliable driver here. It is clear indication that every unit of investment in human talent is paying off in a tangible and measurable way (Arhinful et al., 2025).The second scenario is about LEVwhich is at 0.135(t=−5.08, p=0.000). This implies that the decisions in the firms' capital structure is inhibiting financial performance. It further suggests that while debt can fund growth, too much of it could potentially suffocate the very assets it was meant to support. Lastly, SCE, RCEand CEE(0.713, 0.811, and 0.383 respectively), suggests that in this specific model, they are not actually contributing much to the outcome. It further implies that having great systems or relationships does not matter much if they are not being activated by the right people or if they are being overshadowed by debt.

.**Diagnostic Checks**

After the above FE estimation, the model is further subjected to prescribed post-estimation diagnostic checks considered suitable. Particularly, the FE model was subjected toModified Wald Test for Groupwise Heteroskedasticity, wooldridge test for autocorrelation. The results of these tests are presented in tables, 4, 5 and 6 respectively.

Table 5:

Modified Wald Test for Groupwise Heteroskedasticity

Chi-square	df	p-value
2503.39	13	0.0000

Table 6:

Wooldridge Test for Autocorrelation

F-statistic	Df	p-value
2.782	(1, 12)	0.1212

Table 7:

Hausman Specification Test

Chi-square	Df	p-value
21.93	5	0.0005

Diagnostic tests indicated heteroskedasticity (p = 0.0000), meaning error variances differ across panels. Although serial correlation was not statistically significant, the presence of

heteroskedasticity violates classical OLS assumptions and renders conventional fixed effects standard errors unreliable.

Endogeneity test

In order to observe whether there exist simultaneous relationships between the variables. The condition of the test is such that to know if ROA has a significant result on the future values of the variables. If the result is discovered to be significant, then it can be deduced that feedback relationships exist (Nadeem et al., 2017). The results of the test are shown below.

Table 8:

Test Description	Statistics	Value	p-value	Result
Joint TEST of Leads (t+1)	X^2	2.45	0.118	Fail to reject

Source: STATA Output, 2025.

This test restricted to firm Size and leverage because they are often prone to feedback effects. For instance a high ROA might lead a firm to borrow more (Leverage) or grow (Size). Testing these specifically addresses the most likely sources of bias.Lu et al. (2024) clearly notes that the test can be conducted using a subset of the leading terms.

Observing the results in Table 5, the coefficients that quantify the influence of ROA on the variables is established to be statistically insignificant for all the estimated models. Therefore this study concludes that there is no feedback relationship from dependent variable and the other variables considered appropriate for this test. Consequently, the variables are not endogenously related and as such it was considered not necessary to employ estimators that explain for the endogeneity problem.

PCSE Estimation Results

Panel Corrected Standard Errors (PCSE), as proposed by Beck and Katz (1995), correct for panel-level heteroskedasticity and contemporaneous correlation across panels. PCSE improves inference by providing robust and more efficient standard errors compared to conventional or clustered estimators in moderate T, small N panels. Given 13 firms over 12 years (N=13, T=12), the dataset fits the structure where PCSE performs well. Thus, the choice of PCSE strengthens the reliability of statistical inference without altering coefficient estimates

Table 9:
PCSE results

Variable	Coefficient	Std. Err.	t-value	p-value	95% CI
HCE	0.0188727	0.0079793	2.37	0.036**	[0.0014874, 0.036258]
SCE	-1.36525	0.5177353	-2.64	0.022**	[-2.493298, -0.2372014]
RCE	-0.0733438	0.2794752	-0.26	0.797	[-0.682268, 0.5355803]
CEE	-0.6079457	0.6216874	-0.98	0.347	[-1.962486, 0.7465948]

Firm Size	-1.34e-12	9.86e-13	-1.36	0.200	[-3.49e-12, 8.12e-13]
Leverage	-0.0501074	0.0221949	-2.26	0.043**	[-0.0984659, -0.0017489]

Source: STATA Output, 2026. Notes: ***, **, * significance at 1%, 5% and 10%

HCE shows a significant and positive influence on firm value at 5% level of significance. In this case, HCE with a coefficient of 0.036** proved to be a reliable driver of performance. It is clear indication that every unit of investment in human talent is paying off in a tangible and measurable way. It's the heartbeat of the model just as in what was obtained with FE estimation earlier. Finally, HCE is found to have a significant effect on the firm value. This means that we can reject the null hypothesis that SCE has a positive and significant impact on firm value at 5% level of significance. This in line with (Ukpong et al., 2024; Onuigbo et al., 2025).

Similarly, SCE has a positive and significant effect on financial performance at 5% level of significance. This is implies that any increase in expenditure on the sampled firms' structural capital increases its financial performance. The study's established result provided a sufficient ground we reject the null version of H 2, which states that SCE does not have significant effect on the financial performance. In line with findings of (Appah, 2023; Rabiu et al., 2025b).

As for leverage, the result implies that higher financial leverage decisions materially influence firm outcomes within the sampled firms same as (Luh, 2025). Additionally, table 9 shows that RCE is discovered to exert an insignificant impact on the financial performance same as in (Sutjipto & Setyohadi., 2024; Syahputra &Handayani., 2023).This indicates that the null hypothesis must not be rejected. It is the same with CEE (Asare et al., 2024) and FSIZE variables as well (Kweh et al., 2024).

Discussion of Results

The result's evaluation of this study was reported via the Prais-Winsten regression with PCSE. It is important to mention that all the four hypotheses proposed in this paper are developed and tested at firm level.

This study examined the effects of intellectual capital components on firm performance among listed Nigerian service sector firms. The empirical results reveal that human capital, structural capital, and leverage significantly influence firm performance, whereas relational capital and firm size do not exhibit statistically significant effects. These findings provide important insights into the financial performance within Nigeria's service sector.

The significant effect of human capital highlightsthe role of employee knowledge, their skills and competencies in driving performance. Nigeria's service sector is characteristically knowledge-intensive, unlike its manufacturing sector counterpart. The service sector rely less on tangible assets and more on intellectual input. The positive and significant coefficient of human capital suggests that firms that invest in staff training achieve higherperformance. This finding reinforces the argument that human capital constitutes a strategic asset in emerging economies where institutional weaknesses increase the premium on managerial and technical competence.

Secondly, structural capital is also found to significantly influence firm performance. This capital reflects organizational processes, databases, information systems and internal controls among

others, that enable firms to institutionalize knowledge beyond individual employees. The significance of this variable suggests that performance in Nigeria's service sector is driven by the presence of efficient organizational systems. This is evident in the increasing digitalization of financial services, telecommunications, and logistics operations in Nigeria.. In the sampled firms it was established that structural capital reduces operational inefficiencies, enhances service delivery, and also improves scalability.

In this study, leverage was also found to be statistically significant, indicating that capital structure decisions materially influence firm performance within the Nigerian service sector. This finding reflects the structural characteristics of Nigeria's financial environment, where borrowing costs are relatively high and access to long-term financing remains constrained. Evidently, in the sampled firms debt financing has enabled service firms to invest in digital infrastructure, branch expansion, and technological upgrades.

In contrast, relational capital does not exhibit a statistically significant effect on firm performance. Relational capital captures customer relationships, brand reputation and stakeholder engagement. This insignificance in the sampled firms implies that dominant firms are controlling significant market shares where competitive advantage likelystemmed from human and structural capitals efficiency rather than from relational networks alone. It is also possible that relational value is indirectly embedded within human and structural capital, thereby diminishing its standalone statistical impact. The finding does not suggest that relationships are unimportant, but rather that in the Nigerian context, internal capabilities appear to play a more decisive role in explaining financial performance.

Firm size is also found to be insignificant, indicating that scale does not automatically translate into superior performance within Nigeria's service sector. This result challenges the traditional assumption that larger firms benefit from economies of scale. In Nigeria, large firms may face bureaucratic rigidities, higher administrative costs, and slower decision-making processes. Conversely, smaller firms may demonstrate greater agility and adaptability in responding to regulatory changes and market fluctuations. The insignificance of firm size suggests that competitive advantage is driven more by capability development and resource utilization efficiency than by asset base or organizational scale. This aligns with the proposition that intangible assets, rather than physical expansion, constitute the primary drivers of value in service-oriented industries.

Collectively, these findings support the Resource-Based View of the firm, which posits that sustainable competitive advantage arises from valuable, rare, inimitable, and non-substitutable resources and hence used in HCE, SCE and CEE related hypotheses. In the Nigerian service sector, human and structural capital appear to meet these criteria more convincingly than relational capital or firm size. On the other hand the SHT theory did not receive enough support from RCE hypothesis, this is possibly because stakeholder engagement is not being prioritized by the sampled firms.

5.0 Conclusion and Reccommendation

This study provides empirical evidence that firm performance in Nigeria's service sector is primarily driven by internal intangible resources alongside financial structure decisions. Relational capital and firm size do not appear to exert independent significant effects within the sampled firms. The findings underscore the strategic importance of knowledge-based assets in an emerging economy.

As Nigeria continues its transition toward a service-oriented economic structure, competitive advantage will depend less on scale and external positioning, and more on the effective development and institutionalization of intellectual capital combined with sound financial management. These results contribute to the growing literature on intellectual capital in emerging markets and provide actionable insights for managers, policymakers, and regulators.

Recommendations

Based on these findings, several practical and policy-oriented recommendations are proposed. First, management of service sector firms in Nigeria should prioritize sustained investment in human capital development. Structured training programs, professional certifications, leadership development initiatives, and knowledge-sharing systems should be institutionalized. Given the pace of technological change, continuous upskilling is essential for maintaining competitive relevance.

Second, firms should strengthen structural capital by investing in digital infrastructure, enterprise resource planning systems, internal control mechanisms, and standardized operational procedures. Institutionalizing knowledge reduces dependency on individual employees and enhances long-term sustainability.

Third, prudent capital structure management is essential. Firms should carefully balance debt and equity financing to avoid excessive financial risk, particularly in a macroeconomic environment marked by interest rate volatility. Financial discipline and risk management frameworks should be strengthened.

At the policy level, regulators should encourage improved intellectual capital disclosure practices to enhance transparency and investor confidence. Government efforts aimed at macroeconomic stabilization and financial sector deepening would further reduce the cost of capital and support sustainable service sector growth.

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