INTELLECTUAL CAPITAL AND FINANCIAL OUTCOMES OF LISTED OIL AND GAS FIRMS IN NIGERIA

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https://doi.org/10.57233/ijamer.v1i4.03

Abstract
This research investigates the connection between various components of intellectual capital namely human, structural, and physical capital and the financial performance of Nigerian oil and gas firms listed on the Nigerian Exchange. The study's population consisted of eight oil and gas companies listed as of December 31, 2023. An ex-post facto research approach was employed, with a selection process that narrowed the sample to five companies through filtration sampling. This was done to ensure the inclusion of firms with complete data from their annual reports and financial statements spanning a decade (2014-2023). Data analysis was conducted using a robust random-effects regression model in STATA 13.0. The findings indicate that physical and human capital do not have a statistically significant influence on return on assets (with P-values of 0.958 and 0.682, respectively). Conversely, structural capital shows a positive and significant effect on return on assets among the sampled companies (P-value = 0.001). The study concludes that investing in physical and human capital may not necessarily translate into improved financial outcomes, whereas enhancing structural capital is likely to have a beneficial impact. Based on these results, it is advised that industry operators should carefully evaluate and strategically invest in their intellectual capital components human, structural, and physical before making financial commitments.

Keywords: Financial performance, human capital, intellectual capital,physical capital, structural capital.

1.0 Introduction

Nigerian economy is majorly anchored on the oil and gas sector as it generates the largest part of government revenue. Nigeria continues to be a major exporter of liquefied natural gas (LNG) and a major producer of high-value low-sulfur crude oil in Africa. In order to increase LNG production capacity in the upcoming years the $10 billion Nigeria Liquified Natural (NLNG) Train 7 project is still ongoing. At its Bonny Island facility in Rivers State, NLNG presently runs six LNG production units (also known as trains). By adding a seventh unit, the Train 7 project would increase yearly LNG production from the current 22 million metric tons (MMT) to roughly 30 MMT. Oil theft and production disruptions which affect a crucial source of GDP and government revenue continue to pose serious economic challenges for Nigeria. As of October 2024, the nation's average daily oil production was roughly 1.43 million barrels per day (bpd), slightly higher than in previous months but still below the 1.5 million bpd OPEC quota (International Trade Administration, 2025).

The International Accounting Standards Board (IASB) works to acknowledge intangible assets as significant elements of corporate assets as the world grows more interconnected. The importance of intellectual assets in a company's valuation and financial report has thus

become a hot topic of discussion (Eckstein, 2004). Knowledge, innovation and intellectual property are becoming vital in today's economy and intellectual capital (IC) is increasingly seen as a major source of economic value and competitive advantage. Despite this change, tangible assets like real estate and machinery are still crucial for manufacturing and effective operations (Syarifuddin&Asad, 2024). Organizational success depends on the dynamic interaction of tangible and intangible assets because it generates value (Saraswati, 2025).

Human,structural and physical capital are all components of intellectual capital (IC) and they all positively impact organizational performance and innovation. The abilities and knowledge of employees are included in human capital which is essential for innovation and problem-solving (Bontis *et al.,* 2018). Physical capital consists of tangible assets like infrastructure and machinery. Productivity is increased by this capital, managerial effectiveness and intellectual capital (IC) (Scafarto *et al.,* 2016). Internal systems, databases, patents and other internal structures are all considered structural capital (Xu& Li, 2019). Each of these elements contributes to the field's success and innovation. A company's ability to make money and profits from its assets is measured by its financial performance. Return on assets (ROA), return on equity (ROE), profit margins and earnings per share (EPS) are just a few of the metrics that assess a company's health and effectiveness (Jordão& Almeida, 2017). Stakeholders can make informed decisions by regularly reviewing financial results. It aids in determining the advantages and disadvantages that promote sustainable growth (Xu& Wang, 2019).

The relationship between financial performance as determined by return on assets (ROA) and Intellectual Capital (IC) components such as human, structural and physical is complicated in the Nigerian oil and gas sector. While structural capital enhances organizational procedures and knowledge management, human capital affects operational efficiency, customer satisfaction and innovation (Bayraktaroglu *et al.,* 2019). Nadeem *et al.* (2018) claimed that physical assets like infrastructure have an impact on both cost-effectiveness and service delivery. For academics, the role of intellectual capital (IC) in boosting profits and a company's valuation has become a major challenge (Xu& Liu, 2020). Because structural and human capital cannot be adequately accounted for in traditional accounting, organization's actual value is still underestimated (Brooking, 1996). As a result, the worth of a business is undervalued. Effectively managing and assessing the impact of intellectual capital (IC) on performance is still challenging as businesses rely more and more on it for competitive advantage (Wulf *et al.,* 2019). Another measurement challenge in this context is the integration of physical capital (Ahmed *et al.,*2019).

Previous research on the relationship between intellectual capital and financial performance has yielded mixed outcomes. Some studies indicate a significant positive correlation, while others report insignificant or even negative associations. Additionally, most of the existing empirical investigations have concentrated primarily on the manufacturing industry (Tutliha & Rahayu, 2019; Sharma *et al.,* 2024; Cindiyasari *et al.,* 2022), with limited focus on the oil and gas sector (Bala *et al.,* 2021). Furthermore, although certain dimensions of intellectual capital have been explored in prior studies, the comprehensive impact of IC on financial metrics, especially return on assets (ROA), among Nigerian oil and gas firms remains underexplored. Against this backdrop, the current study seeks to address this research gap and offer more conclusive evidence on how different components of intellectual capital influence financial performance.Based on the specific research objectives, the following research questions were raised for the purpose of the study:

i. In what ways does human capital influence the financial outcomes of publicly traded oil and gas companies in Nigeria?

ii. To what degree does structural capital impact the financial results of listed oil and gas firms in Nigeria?
iii. What is the strength of the association between physical capital and the financial performance of listed oil and gas companies in Nigeria?

This study aims to analyze how intellectual assets influence the financial outcomes of publicly listed oil and gasfirms in Nigeria. The specific objectives are:

i. To analyze how human capital influences the financial outcomes of publicly traded oil and gas companies in Nigeria.
ii. To explore the relationship between structural capital and the financial performance of listed oil and gas firms in Nigeria.
iii. To evaluate the effect of physical capital on the financial results of Nigerian oil and gas companies that are publicly listed.

In line with the outlined objectives, the following null hypotheses were proposed to direct the investigation:

H_{01}: There is no significant impact of human capital on the financial outcomes of publicly traded oil and gas companies in Nigeria.
H_{02}: Structural capital does not have a notable influence on the financial performance of listed oil and gas firms in Nigeria.
H_{03}: Physical capital does not significantly affect the financial results of listed oil and gas companies in Nigeria.

Alternative Hypotheses:
H_{11}: Human capital has a significant effect on the financial performance of listed oil and gas companies in Nigeria.
H_{12}: Structural capital significantly influences the financial outcomes of publicly traded oil and gas firms in Nigeria.
H_{13}: Physical capital plays a crucial role in determining the financial performance of listed oil and gas companies in Nigeria.

2.0 Literature Review

Intellectual capital constitutes majorly business resources that are knowledge based including employees' skills, organization's processes, systems, cultures, software, databases, designs, images and relationships. All these assets are considered to be intangibles, notwithstanding, intellectual capital can also be defined to include physical capital that knowledge helps create. Intellectual capital should not be mistaken for intellectual property, as the latter is just an integral part of the former, while the former is a broader term that covers other items than intellectual property (patents, copyrights, trademarks & business secret). Possession of these resources in right mix and quality is expected to increase firm's performance. Most of the companies fail to report these assets in their financial statements, and this makes such reports to be incomplete and deficient in terms of information content. In recent decades, intellectual capital, a notion with roots in ancient societies, has come to be recognized as a crucial organizational resource. It includes intelligence, knowledge and value-producing cognitive activities, according to Ge and Xu (2020).

Human Capital

Human capital is a part of the hidden and undisclosed assets in the financial reports of an entity. It includes employees' knowledge, skills, and experience acquired through education, training and previous works. Efficiency and effectiveness of other business economic

resources, to some extent, hinge on human capital efficiency. Why? Because it is human beings who combine and drive other resources for the attainment of organizational goals. Machine efficiency, materials usage efficiency, and management policies effective are all determined by employees' efficiency. In essence, businesses must ensure that their recruitment criteria are very high to facilitate employment of high quality staff. Priority should be given to candidates with good educational background, relevant skills and cognate experience. In addition to this, organizations must ensure that necessary trainings are organized for their employees, from time to time, to keep up with the moving trends in the organizations.

Further education, participation in both local and international workshops, seminars and conferences also need to be promoted among the staff. This, however, is expected to equip them with more knowledge and skills for higher position, more responsibilities and improved productivity (Wang *et al.,*2018). According to Huang and Huang (2020),employees' performance will be greatly impacted by tacit knowledge. Value can be created at different organizational levels by converting implicit knowledge into explicit knowledge (Abdullah &Sofian, 2012). According to Asiaei and Jusoh (2015), funding employees' skills, leadership and problem-solving abilities directly improves business financial performance. The knowledge and skills needed by an organization are formed by human capital (Chowdhury *et al.,*2019).

Structural Capital

There are resources that facilitate employees' efficiency as they provide standard bases for them to work with in discharging their duties. This capital includes items such as organizational decision-making procedures, management information system, internal control system, accounting system, organizational norms, values, cultures, business processes, communication channel, trademarks, copyrights, franchise, patents among others. All these are considered to be assets because they assist to create and add value to the organizations. Possession of these assets determines a lot in business success. They help in making right and quality decisions for the organization, ensure high quality information is always made available for management use, ensure efficiency, economy and effectiveness in the organizations, ensure accuracy, validity and completeness in accounting records leading to quality financial reporting, ensure that things are always done based on established rules and regulations, and guarantee income for the organizations.

According to Firer and Williams (2003), structural capital that contributes to value creation includes systems, procedures, intellectual property and organizational structure. Doorasamy (2021) claimed that it has improved efficiency by formalizing databases, processes and workflows. Intellectual property rights like patents and trademarks determine an organizations ability to innovate and stay competitive. According to Huang and Huang (2020), knowledge management systems (KMS) and organizational culture are crucial elements that support the ongoing exchange of ideas and knowledge. By providing greater access to resources and expertise, alliances and partnerships with outside parties improve structural capital (Harrison & Sullivan, 2000). Growth is supported by the efficient use of structural capital which advances operations and innovation (Ousama& Fatima, 2015).

Physical Capital

Physical assets are assets that can be seen, touched and felt by humans. The role of these assets is immeasurable in business, particularly, in manufacturing and construction companies. They form larger part of the total assets of these companies on their financial reports. Apart from property, plants and machines, they include inventory and cash because these two assets can also be seen, touched and felt. However, in the financial service sector,

the majority of the assets that appear on financial statements are intangible and other non-physical assets. There must be regular repairs and maintenance of these assets to keep and improve their operational efficiency. Upgrading and refurbishing must also be done when necessary to keep up with changes in the operating environment. They are the assets that usually remain in business when things go wrong, and are made available to settle creditors in the liquidation process.

The machinery, structures, and tools necessary for production are referred to as physical capital (Yilmaz&Acar, 2018). According to classical economics, technology is produced and implemented using physical assets (Ofurum&Aliyu, 2018). To become more competitive, businesses have recently relied on sophisticated equipment, infrastructure and digital media like software and communication networks (Feimianti&Anantadjaya, 2014). In addition to assisting organizations with technological changes, proper upkeep and modernization of physical assets guarantee the long-term functionality and productivity of operations (Xu& Liu, 2020).

Financial Performance

The primary motive of most businesses is to make and maximize their profits. In business, profitability is assessed at regular intervals, usually at the end of the accounting year. Periodic performance evaluation is important as it helps businesses determine whether they are still on the right path or not. What keeps a business going is its ability to recover its operating costs and leave an adequate margin for the owners for taking risks by providing their money and other resources for organization's use. Assessing business performance allows management to analyze their operating activities over a period, identify their strengths, weaknesses, opportunities and threats, and thereby, make necessary adjustments for a better future performance. The most commonly used financial performance metric is profitability, and this can be assessed using return on asset (ROA), return on capital employed (ROCE), return on equity (ROE) and profit margin (PM).

Financial performance evaluates a company's ability to make money in relation to its costs. A statement of financial position evaluates the company's assets, liabilities and shareholder equity to provide a comprehensive picture of its current state. This, however, is crucial for external users like lenders, suppliers, customers, and investors (Berzkalne&Zelgalve, 2014). It supports decision-making both inside and outside, it helps assess investment potential and the company's capacity to pay debts (Maditinos *et al.,* 2011). According to Maditinos *et al.*(2011), liquidity, solvency and profitability ratio provide information about short-term liquidity, long-term stability and operational efficiency. Comprehending financial performance over time is essential (Maditinos *et al.,* 2011).

Theoretical Review

The resource-based view (RBV) framework underpins this study, emphasizing its connection to intellectual capital. Its core argument is that for a firm to attain sustained competitive advantage, it must acquire and manage resources that are valuable, rare, unique, and non-substitutable (VRIN) (Barney, 1991). Additionally, the organization must be capable of absorbing and leveraging these resources effectively. According to RBV, intellectual capital comprises internal assets, and the theory suggests that having the appropriate combination and quality of human capital and structural capital can enhance a company's competitive edge. This, in turn, is likely to positively influence financial performance.

Empirical Review in Emerging Economies

Sharma *et al.* (2024) analyzed how various elements of intellectual capital influence the capacity of Indian sugar mills to generate income over a decade. Their findings indicated that

return on assets (ROA) was positively affected by relational capital and the efficiency of capital utilization. Additionally, human capital and capital efficiency contributed to enhancements in return on equity (ROE). Notably, each component proved to be more effective in explaining variations in ROE and ROA than overall aggregate measures. In another study, Tutliha and Rahayu (2019) explored the impact of intangible assets on the financial stability and performance of Indonesian manufacturing firms. Their focus was on employee effectiveness along with human, relational, and structural capital. Results demonstrated that capital efficiency, relational capital, and human capital all positively influenced a firm's value, while structural inefficiencies had a negative effect on financial distress. Furthermore, Yilmaz and Acar (2018) applied an adjusted VAIC approach that accounts for differences in organizational size. They concluded that models incorporating multiple factors offer a more precise explanation of both market and financial performance. Their research revealed that, despite varying effects, physical capital and market value are key determinants of performance and relational capital influences market value.

Whereas, Cindiyasari *et al.* (2022) used SEM in Indonesia and discovered that intellectual capital has a major impact on profitability, market valuation and growth. In contrast the impact of productivity or enterprise value is minimal. In the meantime, enterprise value is significantly impacted by market valuation. In summary a substantial amount of data from around the globe demonstrates that the various elements of intellectual capital (IC) have varying contextual effects on firm value and performance. While structural capital has a wide range of effects, human and capital employed efficiencies have a more consistent effect on financial outcomes. Of which, Hoang *et al.* (2020) found a favorable correlation between firm performance and intellectual capital in Vietnamese listed companies.

Empirical Review in Nigeria

Chude *et al.* (2023) examined listed manufacturing companies on the Nigerian Exchange and found that financial performance and intellectual capital are positively correlated. Similarly, a study conducted by Michael and Babajide in 2021 on 18 Nigerian consumer goods companies, over ten-years, found a strong positive correlation between the various components of intellectual capital and financial performance. Whereas, Bala *et al.*(2021) discovered that intellectual capital significantly affects firm value in the Nigerian oil and gas industry.

Identified Gap in the Study

Previous research on the relationship between intellectual capital and financial performance has yielded inconsistent findings. Some studies indicate a significant positive correlation, whereas others report either negligible positive effects or negative relationships. Additionally, most of the existing empirical investigations have concentrated on the manufacturing industry (Tutliha & Rahayu, 2019; Sharma *et al.,* 2024; Cindiyasari *et al.,* 2022), with limited focus on the oil and gas sector (Bala *et al.,*2021). Furthermore, although certain elements of intellectual capital have been explored, the comprehensive impact of IC on financial metrics specifically return on assets (ROA) within Nigerian oil and gas firms remains underexplored. In light of this, the current study seeks to address this gap and provide more conclusive evidence regarding how different components of intellectual capital influence financial performance.

3.0 Methodology

Based on secondary data from the financial statements of nine (9) listed oil and gas companies on the Nigerian Exchange (NGX) as of December 31 2023, this study is ex-post facto. A purposeful sampling procedure was used to select five companies based on the availability, validity and reliability of data between 2014 and 2023, as only these companies

have complete data for the study period. The majority of the secondary data used by the researchers came from annual reports which is appropriate given the type of variables being examined.

Variables Measurement

The research employed return on assets (ROA) to represent financial performance, whereas human capital efficiency (HCE), structural capital efficiency (SCE), and physical capital efficiency (PCE) served as indicators of intellectual capital.The variable measurements are listed in Table 1.

Table 1:
Measurement of the Variables

Variable Name	Type	Variable Measurement
Return on assets (ROA)	Dependent	Measured as profit before tax (PBT), interest, and preference divided by total assets.
Human capital efficiency (HCE)	Independent	The valueadded ratio (VAR) is calculated by dividing total value added, which is equivalent to net operating profit, by total salaries and wages. This ratio measures the ability of human capital to create firm value (Alimuddin *et al.,* 2017).
Structural capital efficiency (SCE)	Independent	This is the difference between value added and human capital divided by total value added. It represents the total value added related to structural capital (Nadeem *et al.,* 2017).
Physical capital efficiency (PCE)	Independent	This is determined as capital expenditure divided by total assets (Nadeem *et al.,* 2017; Alimuddinet *at al*., 2017).

Source: Authors' compilation, 2025.

Model Specification

The regression model below utilized return on assets (ROA) as the dependent variable to evaluate how human, structural, and physical capital influence financial performance:

$ROA_{it} = \beta_0 + \beta_1 HCE_{it} + \beta_2 SCE_{it} + \beta_3 PCE_{it} + \varepsilon_{it}$

Where**:**

ROA_{it}= Return on assets

HCE_{it}= Human capital efficiency

SCE_{it}= Structural capital efficiency

PCE_{it}= Physical capital efficiency

ε = Error term

β_0 = Intercept

i = Period

t =Time

$\beta_1 - \beta_3$ = Coefficients of the explanatory variables.

4.0Data analysis and Results

Descriptive statistics, normality tests, correlation analyses, variance inflation factors, Hausman tests, heteroscedasticity tests and a robust random effects regression model were used to examine the obtained data.

Table 2:
Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min.	Max.
ROA	110	0.741	0.0338	0.548	0.866

HC	110	14.165	43.342	12.044	55.145
SC	110	6.748	0.528	5.111	8.382
PC	110	9.099	0.509	7.15	9.854

Source:STATA 15 Output, 2025.

During the observation period, the Return on Assets (ROA) varied from 0.548 to 0.866, with an approximate average of 0.741, as detailed in Table 2. The ROA's standard deviation was 0.034, suggesting that the growth was steady yet moderate throughout the timeframe. Human Capital (HC) exhibited substantial growth, with values ranging from 12.044 to 55.145 and an average of 14.17, accompanied by a high standard deviation of 43.34. Structural Capital (SC) experienced growth rates between 5.111 and 8.382, with an average of 6.75 and a standard deviation of 0.528. Physical Capital (PC) demonstrated a gradual increase, fluctuating from 7.15 to 9.854, with a mean close to 9.0 and a standard deviation of 0.509.

Table 3:
Results of Shapiro-Wilk test

Variable	OBS	W	V	Z	Prob>Z
ROA	110	0.67001	29.509	7.548	0.00000
HC	110	0.30904	61.789	9.196	0.00000
SC	110	0.94654	4.781	3.489	0.00024
PC	110	0.90639	8.371	4.739	0.00000

Source: STATA 15 Output, 2025.

The variables, ROA, HC, SC and PC have probability values below the threshold of 0.05 as shown in Table 3, indicating that they are not normally distributed around their mean. The need to use a robust effect regression model resulted from the abnormal distribution patterns found across these variables which show a violation of the basic assumption of normality inherent in traditional linear regression.

Table 4:
Pearson correlation matrix

Variable	ROA	HC	SC	PC
ROA	1.000			
HC	0.095	1.00		
SC	0.712	0.1063	1.000	
PC	0.146	0.072	0.798	1.000

Source: STATA 15 Output, 2025.

To assess multicollinearity, the correlation matrix measures the strength of the relationships between the proxies of the independent variables and the dependent variable. Based on the statistics presented in Table 4, there is a weak yet positive correlation between Human Capital (HC) and Return on Assets (ROA), with a correlation coefficient of 0.095, which is significant at the 1% level. Conversely, structural capital (SC) shows a strong, positive, and highly significant relationship with ROA, with a correlation coefficient of 0.712 at the 1% level. The correlation between Physical Capital (PC) and ROA is 0.146, indicating a weak positive relationship that is significant at the 15% level. According to Gujarati (2003), all the correlations among the proxies for the independent variables fall below the 0.80 threshold, suggesting that multicollinearity is not a concern in this analysis and that one of the key assumptions of linear regression has been met.

Table 5:
Variance Inflator Factor (VIF).

Variable	VIF	I/VIF
HC	1.04	0.965180
PC	1.03	0.973672
SC	1.01	0.987505
Mean VIF	1.03	

Source: STATA 15 Output, 2025.

To ensure there was no issue of multicollinearity among the independent variables, collinearity diagnostics such as assessing Variance Inflation Factors (VIF) and Inverse Variance Inflation Factors (I/VIF) were performed. Since both the VIF and I/VIF values remained below their respective critical thresholds of ten (10) and one (1) (Gujarati, 2003), as shown in Table 5, the analysis indicates that multicollinearity is not a concern. Consequently, this suggests that the variables were appropriately chosen and are suitable for inclusion in the regression model, fulfilling an essential condition for valid regression analysis.

Table 6:
Heteroscedasticity test

Type of test	**Chi2**	**P-Value**
Heteroscedasticity Test	72.43	0.0000

Source: STATA 15 Output, 2025.

To make sure there was enough data for the model, a heteroscedasticity test was employed. A straightforward linear regression model would not fit the data because of the heteroscedasticity that was evident in the results. As shown in Table 6, the heteroscedasticity test yields a chi-square value of 72.43 and a p-value of 0.0000. This disproves the fundamental tenet of homoscedasticity (constant variance of errors) making the application of classical linear regression impossible. To solve the problem, a robust regression was used instead.

Table 7:
Result of Hausman specification test

Chi2	6.04
Prob. Chi2	0.1096

Source: STATA 15 Output, 2025.

Because the sampled companies have unobserved heterogeneity, using panel data may result in correlated errors. In particular, oil and gas companies possess entity-specific traits, and dependent and independent variables may be impacted by this. A Hausman test was performed to evaluate the model choice, indicating that the random effects model is more suitable than the fixed effects model. The decision is supported by the Chi-squared statistic of 6.04 presented in Table 7, with a p-value exceeding 0.05.

Table 8:
Robust Random Effect Regression Model

Variable	**Coefficients**	**z-value**	**Prob.**
Cons.	3.9151	2.25	0.024

HC	-0.0002	-0.41	0.682
SC	0.7717	3.33	0.001
PC	-0.0265	-0.05	0.958
R-sq overall	0.6376		
Wald chi2	13.39		
Prob. >chi2	0.0039		

Source: STATA 15 Output, 2025.

Discussion of Findings

As demonstrated in Table 8, human capital efficiency (HCE), structural capital efficiency (SCE), and physical capital efficiency (PCE) collectively explain 64% of the variation in return on assets (ROA). The model appears to be a good fit, with an R-squared value of 0.6376, and the variables are appropriately integrated. Additionally, the model's appropriateness and significance for the research are supported by a p-value of 0.0039 and a Wald chi-square statistic of 13.39. The analysis indicates that human capital efficiency has a negligible and statistically insignificant impact on financial performance, as measured by ROA, with a coefficient of -0.0002 and a p-value of 0.682. This suggests that a one-unit change in human capital efficiency is unlikely to produce a meaningful effect on ROA. Contrary to expectations that improvements in human and physical capital efficiency would positively influence financial outcomes, the results show the opposite. This may be attributed to staff being unable to align their training efforts with actual productivity gains. Similarly, the findings reveal that physical capital efficiency has a coefficient of -0.0265 with a p-value of 0.958, indicating that fluctuations in physical capital efficiency are unlikely to cause significant changes in the firms' financial performance. This could be due to the failure of recent capital investments to enhance operational efficiency.

These findings contradict the results of some previous studies in the related area such as the work of Tutliha and Rahayu (2019); Sharma *et al.* (2024); Cindiyasari *et al.*(2022). The results also oppose the resource-based view hypothesis, which suggests that there should be a positive correlation between intellectual capital and financial outcomes. Meanwhile, from the table above, it is observed that structural capital efficiency has coefficient of 0.7717 with probability value of 0.001. This means that a unit increase or decrease in structural capital efficiency is more likely to increase or decrease return on asset by about 77% respectively. The implication of the result is that additional investment in structural capital will likely make organization to be more efficient leading to increase in financial performance. The result correlates with the proposition of resource based view and findings of Tutliha and Rahayu (2019); Sharma et al. (2024); Cindiyasari et al. (2022) who similarly found positive and significant relationship in their studies.

5.0 Conclusion and Recommendation

This study examined the differential effects of intellectual capitalcomponents on financial performance in Nigerian oil and gas firms. Unlike aggregateIC measures used in prior studies, our disaggregated approach reveals that structuralcapitalefficiency significantly enhances ROA (β=0.772, $p<0.01$), whilehuman capital andphysical capital efficiencies show no significant effects. Thesefindings suggest thatin the capital-intensive Nigerian oil and gas sector, organizationalsystems,processes, and knowledge management infrastructure are more critical for financialperformance than workforce efficiency or physical assetaccumulation.Theoretically, this contributes to RBV by demonstrating that not allresourcecategories equally influence performance in specific industrycontexts.In

conclusion, in order to improve and sustain competitiveness and profitability, Nigerian oil and gas companies must re-strategize and develop their intellectual assets, especially in the areas of human and physical capital management and strong structural capital.

Every research has its inherent limitations, and this particular study is no different. It primarily concentrates on the oil and gas industry, with only five companies chosen as samples. This scope may restrict the broader applicability of the findings, so caution is advised when extrapolating the results to other industries. Additionally, the study examines only three independent variables: human capital efficiency, structural capital efficiency, and physical capital efficiency. Future research could expand on this by incorporating control variables, moderating factors, or mediating variables to enrich the analysis.

Recommendations

Firms should prioritize investments in: (a) Enterprise resource planning (ERP) systems (b) Standard operating procedures documentation (c) Knowledge management systems and (d) Intellectual property protection (patents for drilling techniques proprietary technology) given the strong positive effect of structural capital. The lack of significant effects in human capital efficiency may be due to measurement constraints rather than the lack of significance of HC. Internal audits should be carried out by businesses in order to: (a) assess skill-job matching (b) evaluate training programs and (c) implement performance-linked compensation.As the aforementioned demonstrates, this study also suggests that Nigerian oil and gas companies give top priority to implementing comprehensive employee development programs which include ongoing training skill development and an environment that encourages creative and effective ideas. To boost productivity and financial performance, businesses should also concentrate on enhancing and streamlining organizational procedures, safeguarding intellectual property and modernizing information systems through the adoption of new technologies, process simplification, patenting and trademarking. Lastly, oil and gas companies should carefully evaluate their infrastructure and physical assets to make sure that spending on them is strategic and directly improves operational efficiency and profitability.

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