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Effect of Intellectual Capital on Financial Performance of Listed Manufacturing Companies in Nigeria

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Abstract

This study evaluates the effect of intellectual capital on financial performance of listed manufacturing companies in Nigeria from 2013-2023. The study employs descriptive research design using time series data of ten (10) years (2013-2023). The population was made of one hundred and two (102) listed manufacturing companies in Nigeria that cut across eight (8) sub-sectors on the floor of Nigerian Exchange Group (NXG) as at December 2023 of which thirty-one (31) entities were sampled for the study. Data for analysis were collected from the published financial statements and other fact books, while panel multiple regression was used for the analysis. Intellectual capital components were measured by human capital efficiency, structural capital efficiency and relational capital efficiency. The study found that human capital has a negative but significant effect on performance measured by ROA, structural capital has a positive significant effect on performance, while relational capital has a positive but insignificant effect on financial performance of listed manufacturing firms in Nigeria. The study recommends manufacturing firms should implement policies that enhance and upgrade their structural assets, while judicious use and efficient investment in both human capital and relational capital for optimal performance of listed manufacturing firms in Nigeria be applied.

Keywords: Intellectual Capital, Human Capital, Structural Capital, Relational Capital, Return on Asset, Financial Performance

1. Introduction

Creation of economic value in todays economic is largely based on knowledge and other non-material and physical or intangible resources. Truck and Barley (2019) point out that knowledge is a main resource of modern economy and "knowledge workers" are the most important labour force. Basic component of intellectual capital is knowledge. Intellectual capital is defined by Roos & Roos (2017) as a set of invisible property of the company and the most important resources for acquiring competitive advantage of the company, whereas, it is known fact that fact that knowledge is crucial for acquisition of sustainable competitive advantage. In knowledge-based economy, it is important to stress the role of service sector since it has a share of more than 70% in

GDP in OECD countries and employs 65% of working population of these countries (OECD - Organization for Economic Co-operation and Development, 2000).

Intellectual capital is an emerging concept in accounting that is associated with the level of knowledge acquired by an organization through development of human capital, investment in marketing to improve customers' relationship with the companies and improving upon organizational culture and database (Anik, Chariri & Isgiyarta, 2021). Thus, the total knowledge acquired by a company through human resources, relational capacity and structural competency is regarded as intellectual capital (Ahangar, 2020). In this case, intellectual capital is seen as a critical resource possessed by a company internally which could affect other accounting attributes reported on financial statements. For the purpose of growing the level of intellectual capital in an entity, adequate investments are required to be made by managers on the variables such as human capital and relational capital. For the improvement in human capital, managers are required to provide funds for training and development of employees for the purpose of raising their technical know-how and making them to be acquainted with the required skills needed in organization.

The management of business organizations are expected to invest funds on marketing activities of their firm and also on distribution activities in order to establish a harmonious relationship with customers and other companies. Business-related facilities must be acquired in line with the level of technology that is necessary to the various tasks in the organization. The various investments on the components of intellectual capital are meant to improve the benefits of human and relational capital. This is because the improvement in human capital is capable of affecting the productivity of an organization positively, the improvement in relational capital is capable of marketing the products or services to the various customers or markets and the growth in structural capital could elevate the operating capacity of a company where tasks are discharged diligently with higher proficiency. On this note, higher level of intellectual capital could influence financial performance positively. According to Muchran (2020), a company with higher intellectual capacity is one that could achieve higher financial performance in an accounting period.

In recent decades, there has been a significant global increase in knowledge and technological advancements. This transformation has had a profound impact on business practices, both in developed and developing economies. According to Hermewan (2020), there is a shift from manufacturing-based economies to knowledge-based economies characterized by technological intensity and rapid change. Because of this shift, intellectual capital (IC) has become a primary focus in many modern firms, particularly in service industries like banking. Intellectual capital, as opposed to physical capital, has emerged as a critical determinant not only of the value of banks but also as a key tool for gaining a competitive advantage while optimizing production levels. Creation of economic value in contemporary conditions is based on knowledge and other non-material resources. Drucker (1993) points out that knowledge is a main resource of modern economy and "knowledge workers" are the most important labour force. Basic component of intellectual capital (hereinafter IC) is knowledge.

In knowledge-based economy, it important to stress the role of service sector since it has a share of more than 70% in GDP in OECD countries and employs 65% of working population of these countries (OECD-Organization for Economic Co-operation and Development, 2000). Main products of service sector are services that are largely results of the work with the help of knowledge and thus the role of intellectual capital, as value driver, is of crucial importance in this sector. IC significance is different in manufacturing and service sector. The possibility of differentiating the services and the attempt of the company to distinguish itself from the group of many others that are similar, it is not possible to realize without the use of IC components – knowledge, skills and abilities of employees, adequate business culture, developed image and good cooperation with business partners and users. On the other hand, in manufacturing companies the incomes from service activities can have a high share in the structure of total income realized. For example, companies such as IBM, SKF and Xerox, create more than 30% of income on the basis of services provided whereas the share of service activities in the profit often exceeds 50% (Gebauer & Hallie,2010). Service companies become increasingly productive in industrialized countries – to the extent that one could say we live in service-based ecomony (Kianto &Tionel 2010).

This study seeks to examine effect of intellectual capital components of Human, structural and Relational capital on the Performance of listed manufacturing firms in Nigeria. The specific objectives are to: evaluate the effect human capital on the performance of listed manufacturing firms in Nigeria, analyse the effect of relational capital on the performance of listed manufacturing firms in Nigeria and to determine the influence of structural capital on the financial performance of listed manufacturing firms in Nigeria.

The hypotheses for the specific objectives are as follows:

H01: Human capital has no significant effect on performance of listed manufacturing firms in Nigeria.

H02: Relational capital has no significant effect on performance of listed manufacturing firms in Nigeria

H02: Structural capital has no significant influence on the financial performance of listed companies in Nigeria.

2. Literature Review

2.1 Concept of Intellectual Capital

The phrase intellectual capital was first proposed by Galbraith in 1969 and popularized by Stewart in fortune magazine where he tried to introduce it as the number of employees‟ knowledge and ability which could strengthen the company's competitiveness. Initially, the difference between book value and market value of companies was considered as intellectual capital. Researchers from different background have tried to define specific concepts of intellectual capital in their own words (Karmath, 2017).

Intellectual capital (IC) is an intangible asset essential in today's knowledge-driven economy, significantly influencing corporate performance. It could also be explained as

knowledge-based resources that contribute to an organization's value creation, innovation and sustainability Researchers like Rastogi (2000) and Lev and Radhakrishan (2003) argue that traditional measures fail to capture IC's true value, as it is both invisible and intangible. IC, comprising Human Capital Efficiency, Structural Capital Efficiency, and Capital Employed Efficiency, fosters innovation, competitive advantage, and value creation (Efenyumi, Okoye & Nwoye, 2022; Dewi & Saudah, 2012). Flamholtz (1999) notes the shift from industrial to post-industrial economies, where IC, rather than manufacturing capabilities, is central to profitability. Effective harnessing of IC provides firms with a competitive edge (Ordonez de Pablos, 2003; Bontis, 2004).

Intellectual Capital as Knowledge Assets

During the last two centuries, the shift from a traditional economy (land, labour, and finance) to a knowledge-intensive economy has resulted in service-based industries taking a larger share of the value creation process, particularly in developed societies. Intellectual Capital (IC) is widely recognized as an innate attribute acquired by a company that propels it forward on the path of value creation, value addition, and value sustainability. Many definitions have been proposed to this end by various scholars and researchers. The concept generally emanated from describing the 'dynamic effects of individuals: the 'Intellect' (Egungwu, & Ursula, 2017). The first of such definition of IC is credited to Thomas Stewart, a pioneer of the concept, who defined Intellectual Capital (IC) as "the sum of everything everyone in your company knows that gives your company a competitive edge in the marketplace" in an article titled "Brain Power-How Intellectual Capital is becoming America's Most Valuable Asset".

IC is a type of knowledge, intellect, and brain activity that uses knowledge as a source of value creation (Apiti, et al, 2017). According to Hamdan (2018), employee knowledge capabilities, creativity and innovation, organizational structure, or relational issues can be recognized as IC due to the convention of employee implicit knowledge into explicit knowledge of the organization. According to John and Iyidiobi,(2018), IC is defined as a set of intangible assets such as resources, competences, and capabilities that improve not only firm performance but also lead to the creation of organizational value. There is no universal definition for intellectual capital, according to Tawyn and Tollington (2012), Explained intellectual capital as course and effect relationship of value creation which is non material but intangible resource of a firm. Intellectual capital is a foundational concept in modern organizational management, emphasizing the importance of intangible assets such as knowledge, skills, and competencies that contribute to an organization's competitive advantage (Marr, 2018). This notion has gained significant traction in the contemporary knowledge economy, highlighting knowledge as a critical organizational asset. Intellectual capital is typically classified into three primary components: human capital, structural capital, and relational capital (Marr, 2018).

Human Capital

Human capital refers to the collective knowledge, skills, and expertise possessed by an organization's employees. It encompasses educational backgrounds, experience, and the ability to create and apply knowledge within the workplace. Essentially, human capital emphasizes that employees are not mere expenses but valuable assets that

substantially contribute to innovation and problem-solving within the organization (Bontis, 2017).

Human Capital (HC**):** Refers to the economic value of a worker's experience and skills. Human capital includes assets like education, training, intelligence, skills, health, and other things employers value such as loyalty and punctuality. It measures the value added by the Human Resources of an organization (Ojo & Nzewi, 2016). Human capital refers to the fact that people invest in themselves through education, training, or other activities, which increases their future income by increasing their lifetime earnings.

This is the intangible assets owned by the firm in the form of intellectual ability, creativity, and innovation that are owned by its employees. In the industry based on knowledge, human capital is a major factor because this resource is the dominant cost in the process of production (Nuryaman, 2015).

Relational capital

Rational Capital signifies the value derived from an organization's external relationships, encompassing interactions with customers, partners, and suppliers. A robust relational capital can lead to increased customer loyalty and the creation of new collaboration opportunities, both of which are crucial in today's globally interconnected business landscape. Relation capital includes all resources that are limited to the external relationships of the firm with customers, suppliers or other stakeholders. Therefore, relational capital is the knowledge that is included in the relationship with any stakeholder that affects the firm's life. Goh (2005) assumes that relation capital is a combination of different kinds of relationship like market relationship, power relationship and cooperation. Chen et al (2006) assert that relational capital incorporates strong levels of understanding, trust, relationship and collaboration among strategic alliance partners, and therefore includes stocks of connections, interaction, linkages, closeness, goodwill and loyalty, between a firm and its upstream suppliers, downstream clients, strategic partners or external stakeholders. Gathrie and Pelty (2000) describe it as external capital, which includes brands, customers and customers satisfaction, company names, distribution channels, business collaborations and licensing agreement. A loyal and sufficiently large customers‟ base is vital to achieving economic success. It is also seen as company's relationship with its customers and with its network of suppliers, strategic partners and shareholders. The value of these assets is determined by the company's reputation or image (Meritum, 2002). These elements of intellectual capital summarily can be seen as the possession of knowledge and experience, professional knowledge and skill, good relationship and technological capability which when applied will give organization competitive advantage.

Structural

Structural capital includes the explicit knowledge embedded in an organization's systems, processes, and databases. It comprises patents, trademarks, databases, and organizational culture, among other elements. For instance, a well-structured knowledge management system can be considered part of an organization's structural capital, enhancing operational efficiency and facilitating continuous learning (*Ezeoha,* 2018).

This is the supportive non-physical infrastructure that enables human capital to function. Intellectual property such as patents, copyright, and trademarks; processes, methodologies, models; documents and other knowledge artifacts, computer networks and software; administrative systems, and so on are all examples of structural capital. It includes knowledge, corporate culture, intellectual procedure, process, philosophy, systems, database systems, and contracts, and it explains the procedures and systems that employees develop and use to be productive, effective, and innovative. Organizational capital consists of the organization's philosophy and systems for leveraging its capability. Process capital refers to the methods, procedures, and programs used to implement and improve the delivery of goods and services (Onyekwelu, et al., 2017). Goh (2005) explained structural capital as things done by an employee for the benefit of the company and remains within the company when employees go home.

Financial Performance

Performance is the act of measuring how well a firm or business organization is doing in the application and utilization of its resources in achieving its goals. Therefore, financial performance is the measurement of business entities activities, operations and policies in monetary term. It can also be explained as the modality of measuring how effective businesses use it resources from the beginning of the business in generating revenue. It can be further be described as a business entity financial health or conditions at a particular period of time, this usually measure either quarterly, biannually 27 or annually as the case may be.

It may also be described as the basis of comparison among firms in the same line of businesses or other businesses that are in different sector of the economy activities in aggregate. It can also be referred to as independent criteria of examining its overall performance in relation to its set goal an objective. The study of firm financial performance is a diverse area in management sciences which drown of many researchers. Malik, (2011) opined that capital appreciation is one of the vital objectives of financial managements, the reason for this is that, one of the major goals of financial management is to maximize shareholders wealth in terms of return on their investment (dividends) which is a prove of a better performance of firms to the owners and also drown attentions of potential investors to such business organization, in conformity with the above.

Solitude and Anderson (2015) suggested that financial performance is an indicator as how sufficient and effective firms are in utilization of their resources for the purpose of achieving their objectives and increase returns on investors capital. According to Stoner (2013), financial position of a firm is a focal interest of stakeholders such as managers, shareholders, governments, lenders and tax authorities etc. their concerns is about what a financial position of a firm is at a given period of time to enable them make business or investment decisions. There are different modalities of measuring financial performance, these are return on assets (ROA), return on equity (ROE), return on capital employed(ROCE) and return on investment(ROI).In this wok we shall adopt ROA as a tool for performance, It serves as a prove on how well business organizations used his asset to generate profit at a given 28 period of time, these assets are, cash at hand, cash

in the bank, amount receivable, properties, inventories, furniture and equipment. It is measure by dividing the total annual earnings by the worth of the assets for the period, in this work ROA will be referred to other measures as it generally considers the best internal management ratio because it measures profit against all assets organizations use in generating their earnings.

2.2 Empirical Review

Intellectual Capital and Performance

The effect of intellectual capital on the performance of quoted Nigerian consumers' industry companies from 2010 to 2014 was examined by Kurfi and Frada (2017) using Pulic VAIC techniques. The study employed regression analysis techniques to assess the hypotheses and the result showed a positive significant influence of IC on performance while both SCE and HCE influenced the performance of Consumer sector firms in Nigeria. Okenwa, et al (2017) investigated the effect of IC on the financial performance of 15 quoted Nigerian banks from the year 2010 to 2015 using survey research design and VAIC techniques. The study employed multiple regression analysis techniques and findings showed a significant positive association between IC and financial performance of Nigerian banks.

The reviewed works by Kurfi, et al (2017); and Okenwa, et al (2017) present valuable insights into the relationship between intellectual capital (IC) and the performance of companies in the Nigerian consumer industry and banking sector, respectively. Kurfi et al. (2017) demonstrate a positive and significant influence of IC on the performance of Nigerian consumer sector firms, highlighting the importance of IC in enhancing performance. On the other hand, Okenwa et al. (2017) establish a significant positive association between IC and financial performance of Nigerian banks, underlining the relevance of IC in the banking industry. However, the proposed study is necessary to extend this understanding specifically to the listed manufacturing companies in Nigeria for the years 2013-2023. The study's objectives align with the critical aspects of financial performance, including either of the followings Return on Assets (ROA), Return on Equity (ROE), and Earnings Per Share (EPS). Employing descriptive and inferential methods on a significant sample size of 31 manufacturing companies for 10 years and measuring intellectual capital using Human capital, Structural Capital and Relationship Capital, this research will offer comprehensive insights into the role of IC in shaping the performance of Nigerian manufacturing companies, further contributing to the existing body of knowledge in this domain.

Alharbi (2023) examines the relationship between firm performance (FP) and intellectual capital (IC) on small business performance as seen by Amman's finance companies. Ordinary least squares (OLS) statistics were employed to analyze the data that were obtained through various sources. Between 2017 and 2021, information was gathered from 30 Saudi Arabian businesses. According to the data analysed, IC efficiency showed a positive and significant influence of on the performance of Nigerian consumer sector firms, highlighting the importance of IC in enhancing performance. However, there is a favorable correlation with ROE and ROA. The study also showed a positive but

insignificant correlation with human and structural capital but a positive and significant relationship with physical capital employed.

Akpana and Agbaka (2015) carried out research work on the effect of intellectual capital on performance of listed communication companies in Nigeria. Data employed are mainly secondary and were obtained from the publications of regulatory agencies like the Central Bank of Nigeria in a ten years period 2011 -2018. Ordinary Least Square (OLS) estimation obtained from an SPSS 17.0 package is adapted to analyze relationship between the variables while The Augmented Dickey Fuller (ADF) is used to test the stationary of the time series data employed. A pair wise Granger Causality is further used to determine co-integration between the study variables. Findings indicate that all the performance indicators tested such as Returns on Assets (ROA), Returns on Capital Employed (ROCE)The outcome revealed that human capital efficiency has positive but insignificant impact on the financial performance (ROA) of listed conglomerates firms in Nigeria; structural capital efficiency has a negative significant effect on the financial performance (ROA) of listed conglomerates firms in Nigeria; capital employed efficiency has negative and insignificant impact on financial performance (ROA) of listed conglomerates firms in Nigeria while relational capital has positive and significant influence of return on assets with a p-value greater than a 5% level of confidence hence, The study recommends that Conglomerates firms should implement regulations that improve and advance their staff members' proficiency in the field of training and development; an improvement in both usage and investment in human capital for improved performance of listed conglomerate firms in Nigeria.

Isola, et al (2019) ascertained the link between female board participation, intellectual capital and performances. The study adopted longitudinal panel analysis to analyze data obtained from the annual reports of selected listed commercial banks in Nigeria. The results revealed that female board participation has insignificant influence on bank performances, whereas intellectual capital efficiencies positively contribute to bank performances. However, significant influences were exhibited upon the interactions of female board participation and components of intellectual capital efficiency on bank performances. The study concentrates on the traditional accounting measure which does not shows the addition to the shareholder or management to make forecast thus, this study shall look at the market performance measures that reflect both the past and future element such as cost of capital from the firm value that is likely to affect the perfection of the investors towards financial companies in Nigeria.

Sani and Aminu (2023), examined the impact of intellectual capital on financial performance of listed firms in Nigeria. Quantitative research design was employed in analysing data which were generated from the annual reports and accounts of the sampled listed oil and gas companies from 2016-2020. Intellectual Capital as independent variables were measured by its components (HCE, SCE and CEE) while financial performance being the dependent variable was measured by NPM and ROE. Regression technique was used as tool for their data analysis and the findings establish that the independent variables (HCE, SCE and RCE) have significant positive impact on the oil and gas companies' Financial Performance proxies by NPM and ROE. The regression results show R-square of 86.1% and 59.4% for NPM and ROE models respectively. The paper recommends that listed oil and gas companies in Nigeria should

improve their efforts to boost the value of their intellectual capital for its crucial impact on NPM and ROE.

Onyekwelu (2016) studied the effect of Intellectual Capital on valuation of firms in Nigeria. The study was a panel study using time series and cross-sectional data. The study covered ten years on twenty-one firms cutting across seven economic sectors in Nigeria. Analysis was done using multiple regression tool. The study indicates that HCE had positive and significant effect on firm performance in Nigeria. SCE showed negative and insignificant relationship while CEE has positive but insignificant effect on variables used in measuring corporate values. The outcome also revealed that human capital efficiency has positive but significant impact on the financial performance measured by (ROA) of listed conglomerates firms in Nigeria; structural capital efficiency has a negative significant effect on the financial performance (ROA) of listed conglomerates firms in Nigeria; capital employed efficiency has negative and insignificant impact on financial performance (ROA) of listed conglomerates firms in Nigeria while relational capital has positive and significant influence of return on assets with a p-value greater than a 5% level of confidence; hence, the study recommends that Conglomerates firms should implement regulations that improve and advance their staff members' proficiency in the field of training and development; an improvement in both usage and investment in human capital for improved performance of listed conglomerate firms in Nigeria.

Onyekwelu (2016), study provides relevant insights into the relationship between IC and corporate value within the Nigerian context. It highlights the impact of Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE), and Capital Employed Efficiency (CEE) on the valuation of firms. However, the knowledge gap lies in the specific examination of how IC influences the performance of listed deposit money banks in Nigeria, a critical sector in the country's economy. The proposed study seeks to bridge this gap by investigating the direct effects of IC, measured through Structural Capital and Relationship Capital, on key performance indicators such as Return on Assets (ROA), Return on Equity (ROE), and Earnings Per Share (EPS) over a span of ten years (2012-2022) for ten commercial banks. The study adopts both descriptive and inferential methods of analysis to provide a comprehensive understanding of the relationship between IC and the performance of manufacturing companies in Nigeria, contributing valuable insights to the existing literature and guiding strategic decision-making in this sector.

Nuryaman (2015), studied the impact of IC on the value of firms with 93 manufacturing companies in Indonesia during the year 2012 using VAIC methodology. Findings showed that IC positively impacted the value of the firm. Furthermore, Hasim, Osman, and Alhabshi (2015), investigated the connection between IC and organization performance of Malaysian firms from the years 2008 to 2014. A well-structured questionnaire was made to elicit facts from the respondents with non- probability convenience sampling. Multiple analysis techniques were employed for the study and findings showed IC has a landslide influence on the organization performance of Malaysian companies. Karchagani (2015) looked at the influence of IC and innovation on the performance of 294 Iranian Agricultural Insurance sectors during 2013 using correlation, multivariate regression analysis technique, and Structural Equation Model.

Findings revealed IC and its components are mutually associated with both innovation and performance.

2.3 Theoretical Framework

Knowledge-Based Theory

This work is anchored on Knowledge-Based View Theory (KBV), the theory was first propounded by Peter Drucker an Austrian-American management Consultant and was popularized by Ikujiro Nonaka and Hirotaka Takeuchi (1991) and (1995) respectively, Grant (1996) in Stam (2006) revealed that KBV focused on knowledge as the most essential resource of a firm. According to the proponents of this theory knowledge-based resources are the main determinants of sustained competitive advantage and financial performance, this is because they are immobile, hard to imitate, heterogeneous and socially complex (Fenwick, 2011) explicitly defined Knowledge as a collection of human-related and non-human-related (Stam, 2006). The former was alternatively called tacit knowledge, while the latter is referred to as explicit knowledge. Human knowledge according to the proponents of this theory refers to everything that had to do with employees, and over which they have control. Non-human knowledge, on the other hand, belongs to the organization, not the employees; thus, they do not have control over it.

However, there is a mutual relationship between tacit and explicit knowledge, this is because the non-human resource has to be available before the human resource can create value for the firm. The theory finally concluded that in order for companies to get a competitive advantage and positive results, they have to accumulate specific knowledge assets. Even though, the proponents of the knowledge-based view see it as a theory in a formal sense, scholars like Grant (1996) argued that it is an extension of RBV, for firstly regarding knowledge as a resource, and organizations as heterogeneous entities relying on specific knowledge assets. The proponents of this theory further added that knowledge was merely part of these assets KBV considers the whole intangible assets as the major determinants and knowledge as part of intangible assets. What matters today are the entire intangible resources of a company rather than physical assets. Since the main objective of this study is to examine the impact of Intellectual Capital (human-related and non-human-related knowledge) on the financial performance of the listed Nigerian manufacturing companies; knowledge-based view best explained this work and therefore, adopted as a guide. This is justified by huge investment in the drivers of both human-related and non-human-related knowledge identified with the listed Nigerian manufacturing companies.

Resource Base Theory (RBT)

This was introduced by Wemerfelt (1984) and refined by Banney (1991) central to the proposition of RBV is that a firm represents a collection of unique resources and capabilities that provide basis of sustained competitive advantage so long as they are valuable, rare, difficult to imitate and non-substitutable (VRIN) (Barney, 1991). The theory presumes that firms are a bundle of heterogeneous, capabilities that are imperfectly immobile across firms. According to this view, firm performance can be

attributed to unique resource rather than industry structure, a proposition supported by strategy literature (Gathrie, Datha & Wright, 2004). Hall (1992) and Grant (1996) classified resources into tangible assets, intangible assets and human resources with human being characterized as the most productive asset. Corporate reputation, corporate culture and employees Know-how were characterized as more influential than tangible assets as they are likely to meet Baneys (1991) four conditions outline. Competitive advantage can be attributed to unique resources particularly intangible ones when they are combined or integrated (Banney, 1999). Knowledge asset are not consumed when they are applied to solving organizational problems, on the contrary a knowledge assets value generally maintained and enlarged by its application, while conventional assets must be depreciated or replaced. (Spender,2002). RBV explains the internal conditions under which competitive advantage for firms is achieved and how the advantage can be sustained over time based on their bundles of resources and capabilities. Central preposition of the RBV is that firms that possess and control resources that have the attribute of valuable and rare would obtain competitive advantage and improved performance. In order for the firms to achieve sustained performance and competitive advantage over time resources must also be valuable, rare, inimitable and non-substitutable (VRIS) These attributes are the fundamental drivers of performance and competitive advantage (Barney, 1991).

3. Methodology

The study employs descriptive research design using time series data of ten (10) years (2013-2023) collected from the published financial statements and other fact books. The population of this study comprised thirty-one (31) manufacturing companies listed on the Nigerian Exchange Group (NGX) as at December 31, 2023. The study excluded companies that were either not listed before the study's defined period or were no longer listed as of 2023. The ordinary least squares method of regression was used with the aid of E-views 7 to determine and analyze the data collected.

The companies were selected from eight (8) sectors of the listed companies in which manufacturing companies cut across. To arrive at the sample, the researcher adopts the following criteria. For the purpose of this study, a stratified and random sampling technique was used considering the sectorial grouping of companies in the Nigerian stock market. The sample size of the study is thirty-one (31) manufacturing companies drawn from the total population and it was arrived at by using Taro Yamane (1967) sample size formula, which is represented thus:

Formulae:
$n = N / (1 + Ne^2)$ or $n = N/1+N(e)^2$
Where n = Number of samples
N = Total population
e = Error tolerance (15%)

Hence: $n = \frac{102}{1 + 100 (0.15)^2}$

$n = \frac{102}{\quad}$

$$n = \frac{1 + 100\,(0.0225)}{1 + 2.25} = \frac{102}{3.25}$$

$$n = \frac{102}{3.25} = 31.3846 \approx 31$$

Additionally, the study will perform robustness tests to satisfy all the assumptions of Ordinary Least Squares (OLS). These include a multicollinearity test using the Variance Inflation Factor (VIF). The Hausman specification test was also be employed to determine the choice between fixed-effect and random-effect regressions. Based on the postulated hypotheses that human capital, structural capital and relational capital have no significant effect on financial performance, the following model is formulated:

$$ROA_{it} = \beta_0 + \beta_1 HC_{it} + \beta_2 SC_{it} + \beta_3 RC_{it} + \varepsilon_{it} \ldots$$

Where:

ROA_{it} = Return on Assets for company
β_0 = Coefficient of the constant variable
HCE_{it} = Human Capital
SCE_{it} = Structural Capital
RCE_{it} = Relational Capital
β_1, - β_3, = Regression coefficients of independent variables
ε_{it} = error term.

Table 1 Measurement of Variables

S/No	Acronym	Variables	Variable Type	Measurement	Author(s)
1.	ROA	Return on Assets	Dependent	$\frac{Profit\ Before\ Tax}{Total\ Assets}$	Nejjari & Aamoum, (2021)
2.	HCE	Human Capital	Independent	$\frac{Training\ and\ Devp.\ Exp.}{Total\ Revenue}$	Madumere and Ubani (2022)
3.	SC	Structural Capital	Independent	$\frac{Number\ of\ Patents/Trademark}{Total\ assets}$	Madumere and Ubani (2022); Onuh, & Yahya (2024)
4.	RC	Relational Capital	Independent	$\frac{Marketing\ expenditure}{Total\ sales\ revenue}$	Aybars & Öner (2022); Ulum, Kharismawati & Syam (2017);

4 . Result and Discussion

Table 2 Descriptive statistics

	ROA	HCE	SCE	RCE
Mean	0.590899	0.457258	0.107000	0.394516
Median	0.277850	0.490000	0.080000	0.410000
Maximum	6.448500	0.950000	0.740000	0.990000
Minimum	0.000500	0.000000	-0.080000	0.000000
Std. Dev.	0.835936	0.241378	0.090998	0.260952
Skewness	3.036748	-0.403493	2.824288	0.095881
Kurtosis	14.70142	2.527530	15.11071	2.070724
Jarque-Bera	2245.052	11.29505	2306.602	11.62920
Probability	0.000000	0.003526	0.000000	0.002984
Sum	183.1786	141.7500	33.17000	122.3000
Sum Sq. Dev.	215.9256	18.00337	2.558710	21.04168
Observations	310	310	310	310

Source: Eview Output, 2024

From the descriptive statistics above, the average value of Return on Assets stood at approximately **-0.590899**. The standard deviation indicated **0.835936** for Return on Assets (ROA) while 0.241378, 0.090998 and 0.260952 represent Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE) and Relational Capital Efficiency (RCE) respectively. ROA, HCE, SCE, and RCE revealed a maximum value of **6.448500, 0.950000, 0.740000, 0.990000** respectively with a minimum value **of 0.0005, 0.000, -0.080**, and **0.00** for ROA, HCE, SCE, and RCE respectively.

The skewness of the result of ROA, HCE, SCE, and RCE with their respective coefficients all greater than the threshold of 0 means that all the variables are positively and weakly skewed signifying that all the variables across the panel is scantily above the mean value. Also, the kurtosis results reflect that the series is leptokurtic with regards to ROA and SCE with coefficients of **14.701** and 15.11 while the value HCE and RCE are platykurtic with coefficient of **2.527** and **2.070** less the normal value of **3**. Finally, the result revealed **310** observations.

Table 3. Correlation Matrix

	ROA	HCE	SCE	RCE
ROA	1.000000			
HCE	-0.144217	1.000000		
SCE	0.112062	0.042146	1.000000	
RCE	-0.006798	0.365042	0.014555	1.000000

Source:EviewOutput,2024

The result of the above table is a correlation matrix that explains the association between the dependent and the independent variable. The result shows a positive relationship/correlation between Structural capital Efficiency (SCE) and Return on Assets (ROA) with a coefficient of **0.112062** whereas Human Capital Efficiency (HCE) and Relational Capital Efficiency (RCE) shows a negative correlation on Return on Assets with the coefficient of **-0.144217** and **-0.006798** respectively.

Table 4. Multicollinearity Test

Variance Inflation Factors
Date: 06/06/25 Time: 14:12
Sample: 1 310
Included observations: 310

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.014438	6.588114	NA
HCE	0.043606	5.315810	1.155552
SCE	0.265989	2.391351	1.001780
RCE	0.037251	3.799321	1.153744

Source: Eview Output, 2024

The result of multicollinearity above test for whether the independent variables are highly correlated. From the table, since the respective VIFs are less than 10 (1.155, 1.321, 1.001 & 1.153), this means that there is absence of autocorrelation.

Table 5. Hausman speificationTest

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	5.266896	3	0.1533

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
HCE	-0.241236	-0.309392	0.009468	0.4836
SCE	-0.428801	-0.208146	0.011742	0.0417
RCE	-0.050148	-0.020356	0.002560	0.5560

Source: Eview Output, 2024

The Hausman test guides to choose between the fixed effect and cross section random effect from the Ordinary Least Square Regression. If the probability is below the threshold of 5%, use the fixed effect model, otherwise use the cross section random

effect model. Therefore, since the probability of 0.1533 from the Hausman test is greater than 5%, the cross section random effect model estimation is adopted in this study.

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	3.035590	Prob. F(3,306)	0.0294
Obs*R-squared	8.959181	Prob. Chi-Square(3)	0.0298
Scaled explained SS	57.41229	Prob. Chi-Square(3)	0.0000

Source: Eview Output, 2024

The above table shows the heteroskedasticity test using the Breush-Pagan-Godfrey estimation technique. The Observed R-Squared of **8.959181**with the probability value of **0.0298** which is less than the significance level of 5% indicates the presence of heteroscedasticity which indicates that the null hypothesis of homoscedasticity is rejected.

Dependent Variable: ROA
Method: Panel Least Squares
Date: 06/06/25 Time: 14:04
Sample: 2014 2023
Periods included: 10
Cross-sections included: 31
Total panel (balanced) observations: 310

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.674454	0.120159	5.613021	0.0000
HCE	-0.583746	0.208821	-2.795438	0.0055
SCE	1.087611	0.515741	2.108832	0.0358
RCE	0.169810	0.193006	0.879819	0.3796

R-squared	0.037216	Mean dependent var	0.590899
Adjusted R-squared	0.027777	S.D. dependent var	0.835936
S.E. of regression	0.824244	Akaike info criterion	2.464119
Sum squared resid	207.8897	Schwarz criterion	2.512333
Log likelihood	-377.9384	Hannan-Quinn criter.	2.483393
F-statistic	3.942776	Durbin-Watson stat	0.939117
Prob(F-statistic)	0.008787		

Discussion of Findings

The regression results revealed that Human Capital Efficiency (HCE) has a coefficient of -0.583746 with a p-value of 0.0055. The result shows that Human Capital Efficiency (HCE} has a negative but significant effect on Return on Assets (ROA) of listed manufacturing companies since the p-value of 0.0055 is less than 5%. This implies that an increase investment in human capital will result to a corresponding increase in return on assets. Therefore, the null hypothesis which states that "human capital efficiency has no significant effect on ROA of manufacturing companies in Nigeria" is rejected.

Structural Capital Efficiency has a positive coefficient of 1.087611 with a corresponding p-value of 0.0358. The result implies that a unit increase in Structural Capital will result

to 1.0876 increase in ROA of listed manufacturing companies in Nigeria. Therefore, since the p-value of 0.0358 is less than the threshold of 5%, it then implies that Structural Capital has a positive and significant effect on ROA of listed manufacturing companies in Nigeria. Hence, the null hypothesis which states that "Structural Capital has no significant effect on ROA of manufacturing companies in Nigeria" is rejected and the alternate hypothesis accepted.

Also, Relational Capital Efficiency showed a coefficient of 0.169810, and a p-value of 0.3796. This simply means that an increase relational capital will result to a corresponding decrease in ROA of listed manufacturing companies in Nigeria. The result shows that relational capital has a statistically positive but insignificant effect on ROA of listed manufacturing companies with the p-value of 0.3796 which is greater than 5%. Therefore, the null hypothesis which states that relational capital efficiency has no significant effect on ROA companies in Nigeria is accepted and the alternative rejected.

The R-Squared of approximately 0.26 indicates that only 26% variation in accounting conservatism is explained by the variables captured in this study, while the remaining 74% are explained by the variables not included in the model. The F-statistic examines the overall significance of the regression model inclusive of all variables. Therefore, by examining the overall fit and significance of the model, it could be observed that the model has a better fit since the p-value (0.000) of F-statistic is less than 0.05 as depicted in the cross section random regression analysis.

5. Conclusion and Recommendations

The objective of the study was to establish the effect of intellectual capital on financial performance of listed manufacturing firms in Nigeria. Therefore, from the findings the study concludes that human capital efficiency has negative but significant effect on return on asset, predicting that increase investment in human capital should cautiously applied as it decreases return on asset of listed manufacturing firms in Nigeria.

Structural capital efficiency has a positive and significant effect on return on asset, suggesting that increase investment in structural capital will brings about increase in performance measured by ROA, manufacturing firms should invest more in structural capital as this will enhance the performance of listed manufacturing firms in Nigeria.

Relational capital efficiency has positive but insignificant effect on return on asset, predicting that an optimal investment is needed to avoid reduction in return on asset of listed manufacturing firms in Nigeria. Based on the findings, the paper recommends that manufacturing firms should implement policies that enhance and upgrade their structural assets such as' patents, copyright, and trademarks; processes, methodologies, models; documents and other knowledge artifacts, computer networks and software; judicious use and efficient investment in both human capital and relational capital for optimal performance of listed manufacturing firms in Nigeria should be applied.

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