Intellectual Capital Determinants and Financial Performance of Listed Manufacturing Companies in Nigeria

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Abstract
This study assessed the effect of intellectual capital determinants and financial performance of listed manufacturing companies in Nigeria from 2013-2023. The study employed 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 eighty-two (82) entities were sampled for the study. Data for analysis were collected from the published financial statements. Panel multiple regression was used for the analysis. Intellectual capital components were measured by human capital efficiency, structural capital efficiency, relational capital efficiency, innovation Capital efficiency and capital employed efficiency. The study found that structural capital, relational capital and capital employed have positive and significant effect on financial performance, measured by ROA. While human and innovation capital have negative and insignificant effect on financial performance of listed manufacturing firms in Nigeria. The study recommended manufacturing firms to implement policies that enhance and upgrade their structural, relational and capital employed, while judicious use and efficient investment in both human capital and innovation capital for optimal performance of listed manufacturing firms in Nigeria be applied.

Keywords: *Intellectual Capital, Human Capital Efficiency, Structural Capital, Relational Capital, Innovation Capital, Capital Employed, Return on Asset, Financial Performance*

1. Introduction

The primary goals and objectives of every business or corporation is profit maximization. Financial capital and other hard wares of business organizations alone are not enough to ensuring the actualization of these goals and objectives as stated above, for businesses to grow and stay ahead of its competitors; there must be a fusion of both tangible and intangible resources.

Yousoff, Jantan and Ibrahim (2003), maintained that the shift from industrial era to the information and knowledge era has presented firms with strategic challenges thereby making knowledge more productive as a competitive resource in a dynamic environment. The medium for leveraging new information, knowledge, and resources can be achieved through the firm's intellectual capital (IC). Tangible assets such as property, plants, and equipment continue to be important factors in the production of goods and service. However, their relative importance has decreased through time as the importance of intangible assets such as intellectual based assets have increased

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. Intellectual capital is defined by (Roos & Roos ,1997) as a set of invisible property of the company and the most important resources for acquiring competitive advantage of the company, whereas, it started from the fact that knowledge is crucial for acquisition of sustainable competitive advantage. In knowledge-based economy, it important to stress the role of manufacturing 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 manufacturing sector 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).

Statement of Problem

Several studies were carried out to establish the effect intellectual capital on performance. For instance, studies conducted in the banking sector include the studies of (Ekwe 2013; Inyada 2018; Oko, Onodi and Tapang 2018; Ofurum and Aliyu (2018). Similarly, studies in other sectors include the work of Onyekwelu and Ubesie (2016), in the pharmaceutical companies, Apiti, Ugwoke, Chiekezie and Rita (2017), in the food and beverage companies, Chigozie, et al., (2018), in the manufacturing sector and Inyada.

Most of the studies were carried out in service providing sector, with very few works conducted in other sectors. The only research work carried in the manufacturing industry was the work of Madugba etal(2021).The scope of their work was for five years and the variables were the only tripartite variables of IC which are HC,RC and SC. Therefore, this study investigated intellectual capital determinants and financial performance of listed manufacturing companies in Nigeria for the period of ten years and also incorporating other determinants of intellectual capital such as capital employed and innovational capital.

The specific objectives are to:

i. Evaluate the effect human capital on the performance of listed manufacturing firms in Nigeria,
ii. Analyse the effect of relational capital on the performance of listed manufacturing firms in Nigeria
iii. Determine the influence of structural capital on the financial performance of listed firms in manufacturing Nigeria
iv. Investigate the influence of capital employed on the financial performance of listed manufacturing firms in Nigeria.
v. Appraise the impact of innovational 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 financial performance of listed manufacturing firms' in Nigeria

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

H03: Structural capital has no significant influence on the financial performance of listed companies in Nigeria.

H04: Innovational Capital does not have any significant influence on the financial performance of listed companies in Nigeria.

H05: Capital employed has no significant influence on the financial performance of listed companies in Nigeria.

2. Literature Review

Financial Performance

Financial 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 also be described as the basis of comparism 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 shareholder's 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 investor's 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.

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- Intellectual Capital is (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.

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

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 customer's satisfaction, company names, distribution channels, business collaborations and licensing agreement. A loyal and sufficiently large customer‟ 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 Capital

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.

Innovational Capital

Innovation means Introducing new services and products to the market that improve upon their previous iterations in terms of performance and utility is an example of product innovation (Nuryakin, 2018). Su and Tang (2016) defined innovation as "the presence of originality or a degree of invention". Product innovation, according to the Oslo Manual (Organization for

Economic Cooperation and Development/OECD, 2005), is the introduction of a good or service that is new or significantly better in terms of its characteristics or planned functions.
(Nwokoro, Ikeora & Ogini,2022), defined Innovation in the financial sector as the act of creating and then popularizing new financial instruments as well as new financial technologies, institutions, and markets (Makur, 2014). It may be viewed as the design, development, and implementation of innovative financial instruments and processes, and the formulation of creative solutions to problems in finance. According to Korir (2014), financial innovations is one of the most important competitive weapons and generally seen as a firm's core value capability. It is considered as an effective way to improve firm's productivity due to the resource constraint issue facing a firm. Ignazio (2017) groups financial innovations into; new products for example adjustable rate mortgages and exchange-traded index funds; new services for example on-line securities trading and Internet banking; new "production" processes for example electronic record keeping for securities and credit scoring and new organizational forms for example a new type of electronic exchange for trading securities and Internet-only banks.
Evidence suggests that businesses that have a product-based competitive advantage over their rivals whether through innovation, quality, packaging, or design perform better than their peers (Batiz-Lazo & Woldesenbet (2019). Dong et al., 2016). In a similar vein, Nuryakin (2018) argues that productivity increases along with product innovation. Biemans et al. (2016) affirm that product innovation is one of the most important instruments for designing strategies to break into new markets, break into the existing profit-enhancing market, and provide enterprises with a competitive edge. Businesses respond to customers' ever-evolving wants and demands by innovating new products (Gast, 2018). New technologies (Filho & Moori, 2017) or improved material components (Nataya, 2018) can be used to innovate products by significantly altering their characteristics and use. The goal of product innovation in the banking industry is to increase customer satisfaction by providing new, high-quality services with more features and benefits (Kong & Masud, 2019). Current examples of electronic product advances in the banking sector include internet banking and mobile banking (Chong et al., 2016).

Capital Employed

Capital employed is not a traditional component of intellectual capital (IC) but without which intangible capitals cannot function. It serves as an anchor in which intangible capital values can be harnessed to enhance performance. Capital employed facilitates investment on employees training, development and recruitment. It can also be used in funding of organizational processes, system and databases development which is structural capital. It supports marketing and customer's relationship and building initiatives. The objective of any business is to create as much value-added as possible out of a given amount of investments. Therefore, in measuring intellectual capital, capital employed incorporated to the existing components of intellectual capital to obtain information on how efficiently this value added has been created, as value grows out of physical assets. Thu, capital employed interpreted as total assets of a firm (Pulic, 2000). Capital employed represents the value of the physical assets used in the business (Inyada, 2018). Similarly, Palazzi, Sgro, Ciambotti and Bontis (2019), opined that capital employed can be seen as the summation of all company's assets used to create value. Furthermore, capital employed can also be seen as the book value of a firm's net assets (Ekwe,2014)

Empirical Review

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, 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. 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.

Theoretical Framework

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).

Resource Base Theory 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 financial performance and competitive

advantage (Barney, 1991). 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 determinants of Intellectual Capital components (Human capital, Relational Capital, Structural capital, Innovational and capital employed) on the financial performance of the listed Nigerian manufacturing companies; Resource based theory best explained this work and therefore, adopted as a guide.

3.Methodology

The study employed descriptive research design using time series data of ten (10) years (2013-2023) collected from the published financial statements. The population of this study comprised one hundred and two (102) 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 sample size of this study comprised eighty-two (82) 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 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, stratified and random sampling techniques was used considering the sectorial grouping of companies in the Nigerian stock market, 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 (5%)

Hence:

$$n = \frac{102}{1 + 102\ (0.05\ )^2}$$

$$n = \frac{102}{1 + 100\ (0.0025)}$$

$$n = \frac{102}{1 + 0.25}$$

$$n = \frac{102}{1.25}$$

$$n = 82$$

Additionally, the study performs 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, relational capital, Innovational capital and capital employ yed have no significant effect on financial performance the following model is formulated:

$ROA_{it} = \beta_0 + \beta_1 HC_{it} + \beta_2 SC_{it} + \beta_3 RC_{it} + \beta_4 INC_{it} + \beta_5 CE_{it} + \varepsilon_{it}$ ...

Where:

ROA_{it} = Return on Assets for company
β_0 = Coefficient of the constant variable
HC_{it} = Human
SC_{it} = Structural Capital
RC_{it} = Relational Capital
INC_{it} = Innovation Capital
CE_{it} = Capital Employed
β_1, - β_5, = Regression coefficients of independent variables
ε_{it} = error term.

Table 1 Measurement of Variables

S/No	Variables	Measurement	Author(s)
1.	Return on Assets (ROA) Dependent	$\frac{Profit\ Before\ Tax}{Total\ Assets}$	Nejjari & Aamoum, (2021)
	Independent Variables		
2.	Human Capital (HC)	$\frac{Training\ and\ Devp.\ Exp.}{Total\ Revenue}$	Madumere and Ubani (2022)
3.	Structural Capital (SC)	$\frac{Number\ of\ Patents/Trademark}{Total\ assets}$	Madumere and Ubani (2022); Onuh, & Yahya (2024)
4.	Relational Capital (RC)	$\frac{Marketing\ expenditure}{Total\ sales\ revenue}$	Aybars & Öner (2022); Ulum, Kharismawati & Syam (2017);
5	Innovation Capital	$\frac{R\&D}{Sales}$	Akamelu & Iyidiobi (2018)
6	Capital Employed	Shareholder 'equity + non-current liabilities	Etim,Useni,Inyang &Nweze (2024)

Source: Author's Compilation, 2025

4.Result and Discussion

Table 2: Descriptive Statistics

	ROA	HCE	SCE	RCE	INC	CE
Mean	0.590899	0.457258	0.107000	0.394516	0.108546	0.606340
Median	0.277850	0.490000	0.080000	0.410000	0.064850	0.291500
Maximum	6.448500	0.950000	0.740000	0.990000	0.862400	6.448500
Minimum	0.000500	0.000000	-0.080000	0.000000	0.001100	0.000500
Std. Dev.	0.835936	0.241378	0.090998	0.260952	0.116536	0.835773
Skewness	3.036748	-0.403493	2.824288	0.095881	2.477334	2.988651
Kurtosis	14.70142	2.527530	15.11071	2.070724	12.55581	14.49150
Jarque-Bera	2245.052	11.29505	2306.602	11.62920	1496.555	2167.192
Probability	0.000000	0.003526	0.000000	0.002984	0.000000	0.000000
Sum	183.1786	141.7500	33.17000	122.3000	33.64930	187.9653
Sum Sq. Dev.	215.9256	18.00337	2.558710	21.04168	4.196447	215.8418
Observations	820	820	820	820	820	820

Source: Eview OutPut, 2025

From the descriptive statistics above, the average value of Return on Assets stood at approximately 0.5958881. The standard deviation indicated 0.835936 for Return on Assets (ROA) while 0.241378, 0.090998, 0.260952,0.116536 and 0.835773 represent human capital (HC) structural capital(SC), relational capital (RC), innovational capital (INC) and capital employed (CE) innovational Capital (INC) and Capital Employed (CE) respectively. ROA, HC, SCE, RCE, INC and CE revealed a maximum value of 0.00005, 0.950000, 0.740000, 0.990000 0.862400, and 6.448500 respectively with a minimum value of 0.0005, 0.000, -0.0800, 0.0000,0.0011 and 0.0005 for ROA, HCC, SCC, RCC, INCE, and CEE, respectively.

The skewness of the result of ROA, HCC, SCE, RCE, INCE and CEE, with their respective coefficients all greater than the threshold of 0 means that all the variables are positively skewed except for human capital which negatively skewed signifying that all the variables across the panel is above the mean value. Also, the kurtosis results reflect that the series is leptokurtic with regards to ROA, SCE, INC and CE with coefficient value above normal distribution of 3, as follows 14.701,15.11071,12.55581, and 14.491502, while the value HCE and RCE are platykurtic with coefficient of 2.527 and 2.070724 less the normal value of 3. Finally, the result revealed 820 observations

Table 3: Correlation Matrix

	ROA	HCE	SCE	RCE	INC	CE
ROA	1.000000					
HCE	-0.144217	1.000000				
SCE	0.112062	0.042146	1.000000			
RCE	-0.006798	0.365042	0.014 555	1.000000		
INC	0.142216	0.239670	0.017807	0.050709	1.000000	
CE	0.992775	-0.148757	0.100569	-0.031958	0.155127	1.000000

Source: Eview OutPut, 2025

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(SC) Innovational Capital*(INC)* and capital employed (CE) on Return on Assets (ROA) with a coefficient of 0.112062,0.142216 and 0.992775. Whereas human capital and relational capital show 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: 09/23/25 Time: 02:32
Sample: 1 820
Included observations: 820

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.000231	7.494498	NA
HCE	0.000676	5.861431	1.274160
SCE	0.003784	2.420153	1.013846
RCE	0.000525	3.809846	1.156940
INC	0.002520	2.070826	1.107169
CE	4.77E-05	1.648142	1.078606

Source: Eview OutPut, 2025

The result of multicollinearity above is to test for whether the independent variables are highly correlated with one another. From the table, since the respective VIFs are less than 10 (1.2741, 1.0138, 1.1569,1.1071 & 1.0786), this means that there is absence of autocorrelation

Table 5: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	2.46968	Prob. F(5,304)	0.0326
Obs*R-squared	12.1009	Prob. Chi-Square(5)	0.0334
Scaled explained SS	370.4377	Prob. Chi-Square(5)	0.0000

Source: Eview OutPut, 2025

The above table shows the heteroscedasticity test using the Breush-Pagan-Godfrey estimation technique. The Observed R-Squared of 12.10049 with the probability value of 0.0334 which is less than the significance level of 5% indicates the presence of heteroscedasticity which indicates that the null hypothesis of homoscedasticity is rejected

Table 6: 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	9.816186	5	0.0806

Source: Eview OutPut, 2025

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 0.0806 from the Hausman test is greater than 5%, the cross section random effect model is adopted in this study

Table 7:
Pairwise Granger Causality Tests
Date: 09/23/25 Time: 02:29
Sample: 2015 2024
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
HCE does not Granger Cause ROA	248	0.8909	0.4116
ROA does not Granger Cause HCE		1.1399	0.3215
SCE does not Granger Cause ROA	248	3.1167	0.0461
ROA does not Granger Cause SCE		7.1605	0.0010
RCE does not Granger Cause ROA	248	1.6195	0.2001
ROA does not Granger Cause RCE		0.1501	0.8607
INC does not Granger Cause ROA	248	0.3368	0.7143
ROA does not Granger Cause INC		0.0754	0.9271
CE does not Granger Cause ROA	248	0.0567	0.9446
ROA does not Granger Cause CE		0.1716	0.8423
SCE does not Granger Cause HCE	248	0.0215	0.9786
HCE does not Granger Cause SCE		1.0594	0.3481
RCE does not Granger Cause HCE	248	0.4860	0.6155
HCE does not Granger Cause RCE		0.2854	0.7516
INC does not Granger Cause HCE	248	0.6832	0.5056
HCE does not Granger Cause INC		2.5241	0.0822

CE does not Granger Cause HCE	248	1.2088	0.3005
HCE does not Granger Cause CE		0.8180	0.4422
RCE does not Granger Cause SCE	248	0.9526	0.3872
SCE does not Granger Cause RCE		1.32535	0.2676
INC does not Granger Cause SCE	248	0.74523	0.4757
SCE does not Granger Cause INC		0.48686	0.6152
CE does not Granger Cause SCE	248	7.08991	0.0010
SCE does not Granger Cause CE		2.52905	0.0818
INC does not Granger Cause RCE	248	0.26673	0.7661
RCE does not Granger Cause INC		0.77118	0.4636
CE does not Granger Cause RCE	248	0.19713	0.8212
RCE does not Granger Cause CE		1.97045	0.1416
CE does not Granger Cause INC	248	0.07401	0.9287
INC does not Granger Cause CE		0.39838	0.6718

Source: Eview OutPut, 2025

The table above shows the results of the pairwise Granger causality tests. The results revealed a positive causal relationship between return on asset (ROA) and structural capital efficiency (SCE) on manufacturing sector and with a P-Value of 0.046 and 0.001 which is less than the significant level of 5%. Similarly, there was no causal relationship found between listed manufacturing companies and other components of intellectual capital (Human capital, Relational Capital, Innovational Capital and Capital employed) as their P-values are greater the 5% significant level as showed in the table above

Table 8: Regression Result

Dependent Variable: ROA
Method: Panel Least Squares
Date: 09/23/25 Time: 02:22
Sample: 2015 2024
Periods included: 10
Cross-sections included: 82
Total panel (balanced) observations: 820

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.041938	0.015195	-2.759927	0.0061
HCE	-0.012525	0.025999	-0.481743	0.6303
SCE	0.111167	0.061517	1.807113	0.0717
RCE	0.085687	0.022916	3.739233	0.0002
INC	-0.090813	0.050198	-1.809118	0.0714

CE	0.994032	0.006908	143.8866	0.0000

R-squared	0.986554	Mean dependent var	0.590899
Adjusted R-squared	0.986333	S.D. dependent var	0.835936
S.E. of regression	0.097727	Akaike info criterion	-1.794105
Sum squared resid	2.903395	Schwarz criterion	-1.721784
Log likelihood	284.0862	Hannan-Quinn criter.	-1.765194
F-statistic	4460.898	Durbin-Watson stat	0.511820
Prob(F-statistic)	0.000000		

Source: Eview OutPut, 2025

Discussion of Findings

The regression results revealed that Human Capital Efficiency (HCE) has a coefficient of -0.012525 with a p-value of 0.6303. The result shows that Human Capital Efficiency (HCE} has a negative and insignificant effect on Return on Assets (ROA) of listed manufacturing companies since the p-value of 0.6303 is more than 5%. This implies that an increase investment in human capital will result to a corresponding decrease 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 accepted.

Structural Capital Efficiency has a positive coefficient of 1.111167 with a corresponding p-value of 0.0417 The result implies that a unit increase in Structural Capital will result to 0.11167 increase in ROA of listed manufacturing companies in Nigeria. Therefore, since the p-value of 0.0417 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 positive coefficient of 0.085687, with a corresponding p-value of 0.0002 far below the 5% significant level. This simply means that an increase relational capital will result to a corresponding increase in ROA of listed manufacturing companies in Nigeria. The result shows that relational capital has a statistically positive and has a significant effect on ROA of listed manufacturing companies with the p-value of 0.0002 which is lower than 5%. Therefore, the null hypothesis which states that relational capital efficiency has no significant effect on ROA companies in Nigeria is rejected and the alternative accepted

Innovational capital efficiency showed a negative (INC) has a coefficient of -0.090813 with a p-value of 0.0714. The result shows that Innovational Capital Efficiency (INC} has a negative and insignificant effect on Return on Assets (ROA) of listed manufacturing companies since the p-value of 0.0714 is more than 5%. This implies that an increase investment in Innovational capital will result to a corresponding decrease in return on assets. Therefore, the null hypothesis which states that "innovational capital efficiency has no significant effect on ROA of manufacturing companies in Nigeria" is accepted.

Capital employed Efficiency has a positive coefficient of 0.994032 with a corresponding p-value of 0.0000. The result implies that a unit increase in Capital employed will result to 0.994032 increase in ROA of listed manufacturing companies in Nigeria. Therefore, since the p-value of 0.0000 is far 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 "Capital employed has no significant effect on ROA of manufacturing companies in Nigeria" is rejected and the alternate hypothesis accepted.

The R-Squared of approximately is 0.98655 indicates that about 99% variation in return on asset (ROA) is explained by the variables captured in this study, while the remaining 1% 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 F-value (4460) as depicted in the cross section random regression analysis.

5. Conclusion and Recommendations

This study investigated the determinants 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 and insignificant 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 and significant effect on return on asset, predicting that an investment in relational capital will bring about increase in return on asset (ROA) of listed manufacturing firms in Nigeria. Also, capital employed has positive and significant effect on the financial performance of listed manufacturing companies. Innovational capital showed a negative and insignificant effect on financial performance.

Based on the findings, this paper recommends that manufacturing firms should implement policies that enhance and upgrade their structural, relational and capital employed such as' patents, copyright, and trademarks; processes, methodologies, models; documents and other knowledge artifacts, computer networks and software; while, judicious use and efficient investment in both human capital and innovation capital for optimal performance of listed manufacturing firms in Nigeria should be applied.

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