

Research Paper

Intellectual Capital Efficiency and Corporate Sustainability Growth: The Nigerian Evidence

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Abstract— The study examined the relationship which exists between intellectual capital efficiency and corporate sustainability growth. Intellectual capital efficiency was proxy using human capital efficiency, relational capital efficiency and structural capital efficiency while corporate sustainability growth was measured using corporate sustainability growth rate (CSGR). The study adopted Ex post facto design and data for this study was obtained from the annual accounts of the 45 manufacturing firms listed on the floors of Nigerian Exchange Group for the year ended 2015-2022. Also, panel least square model was employed for the data analysis. The findings of the study indicate a positive and significant association between human capital efficiency, relational capital efficiency, structural capital efficiency and sustainability growth of manufacturing firms in Nigeria at 1% -5% significant level. The study therefore concludes that intellectual capital efficiency ensures corporate sustainability growth. Thus, the study recommends that manufacturing firms in Nigeria should develop a means to improve their human capital efficiency as any negative changes in human capital efficiency will impact the sustainable growth of the firm. They should also invest heavily in relational and structural capital as it can improve their competitiveness, reputation and bottom line.

Keywords— Relational Capital Efficiency; Human Capital Efficiency; Structural Capital Efficiency; Intellectual Capital Efficiency; Corporate Sustainability Growth

1. Introduction

The focus of global and investment reporting has shifted from traditional corporate reporting, which primarily considers financial capital to integrated reporting that includes financial, productive, intellectual, human, social, relational and natural capital. The Organization for Economic Cooperation and Development claims that investments are gradually shifting to intangible assets from physical assets [1]. Intellectual capital is a knowledge that could be converted to values and the aggregation of all the skills and knowledge of employees that help the organization towards achieving a competitive advantage. Intellectual capital represents the body of knowledge at a given point in time accumulated through knowledge flow activities [2]. The consideration of intellectual capital as a source of competitive advantage has led to the development of appropriate methods to measure it, since conventional financial reporting is unable to capture all aspects of it [3].

There are mixed and conflicting results on the relationship between intellectual capital and corporate performance. Also,

some studies on the relationship between intellectual capital and financial performance in developed countries agree that intellectual capital has a significant and positive association with the financial performance of organizations, thus giving organizations a competitive advantage over others [4]; [5]; [6]; [7]; [8]; [9].

The studies above were conducted in advanced economies. In view of the significant contribution of economically emerging countries to the overall development of the world economy, it is imperative to conduct an empirical study on developing or emerging economies such as Nigeria where, despite the shift towards intensive intellectual capital economy, Nigeria firms have continued to use traditional accounting that focuses more on the physical assets in the financial reporting and only few studies were spotted like [2], [10], [11], [12] to have investigated the relationship between intellectual capital and firm performance, while [13] emphasized on the relationship between intellectual capital and revenue growth.

From the above analysis, it emerged that most studies conducted in Nigeria limited intellectual capital to corporate performance, predominantly using traditional accounting

performance measures that could not provide a comprehensive view of the corporate financial performance. Hence the need for the present study to examine the relationship between intellectual capital efficiency and corporate sustainability growth using manufacturing firms in Nigeria as a reference point. To achieve this purpose, the study formulated the following hypotheses;

H₀₁: Human capital efficiency has no significant relationship with corporate sustainability growth

H₀₂: There is no significant relationship between relational capital efficiency and corporate sustainability growth

H₀₃: Structural capital efficiency has no significant relationship with corporate sustainability growth

2. Related Work

2.1. Intellectual Capital

The shift from the traditional economy (labor, land and finance) to the knowledge intensive economy over the past two centuries has led the service based industries take the largest share of the value-added process, especially in developed economies. Intellectual capital is widely recognized as the innate trait that a company normally acquires which propels it along the wheel of value creation and value sustainability [10]. According to [14], intellectual capital is the information technology customer relationships, possession of knowledge, applied experience and professional skills that give a company a competitive advantage in the marketplace.

2.1.1 Components Of Intellectual Capital

2.1.1.1 Human Capital

Human capital is understood to mean employee values that create potential and are reflected in the knowledge, skills, abilities, competencies, experience and talents of managers and employees in an organization. Also, [15] submitted that the concept of human capital is based on the fact that learning and knowledge, innovation and creativity, competences and skills that are relentlessly pursued and applied to business's environmental context cannot be substituted. Human capital encompasses the knowledge, experience, professional skills and ability to innovate employees within an organization. Human capital consists of the skills, competences and abilities of individuals and groups [16], [10]

2.1.1.2 Relational Capital

Relational capital (RC) is seen as external connections to the organization's suppliers and customers that enable it to sell and buy goods and services in an effective and efficient manner [17]. Relational capital represents an organization's ability to positively interact with members of the business community to foster the potential for wealth creation through the enhancement of human and structural capital [8]. As stated by [18], RC is a knowledge embedded in a relationship with suppliers, customers, industry bodies, or other stakeholders that affect the life of an organization.

2.1.1.3 Structural Capital

Structural capital is the organization's ability to perform the routines and structures of the organization that support the

efforts of employees to achieve optimal intellectual performance as well as business performance, for example: the organizational culture, operating systems, manufacturing processes, management philosophy and all forms of intellectual performance of the company real estate is owned by the company [19]. According to [20], it is an infrastructure that supports employees to perform optimally, including the organization's ability to reach the market, software, hardware, databases, patents, organizational structure, trademarks and all capabilities of organizations supporting employee productivity.

2.1.2 Corporate Sustainability Growth (CSG)

Corporate sustainability growth is a growth that could be profitably maintained for future benefits [9]. Corporate sustainability growth as a concept was popularized by Higgins' remarkable study in 1977, where he proposed that sustainable growth rate model should be used to explain its practical limits to growing firms. Corporate sustainable growth rate explains if there is consistency between the sales growth with the realities of the firm and the financial market [21]. As reported by [22], corporate sustainability is all about financial performance information and non-financial information that includes social and environmental activities that enable companies to grow sustainably and friendly.

The study of [23] submitted that to ensure sustainability, organizations must concede the following:

- i. Responsible for their social, environmental and economic impact.
- ii. Being transparent in decisions and activities affecting its responsibilities.
- iii. Interests of the stakeholders to be responded to.
- iv. The rule of law is mandatory for all.

A firm with growth rate which deviates from sustainable growth will eventually fall into the dilemma of unsustainable growth [24]. For the purpose of this study, corporate sustainability growth was measured as return on equity multiplied by retention ratio. This is expressed as ROE(1-DPR).

2.2 Theoretical Framework

2.2.1 Resource Based Theory

Resource-based theory posits that a company's image and reputation aims to maintain competitive advantage through efficient and effective use and control of both intangible and tangible resources [25]. The notion of value creation is considered as a measure for determining corporate performance. The resource based theory was instituted into resource portfolio [26]. Thus, the study conceptualized the resources based theory of enterprise resource in circumstances where the availability and quality number of resources in a portfolio is used to determine corporate performance. Thus, the resource based theory is considered as the foundation for explaining intellectual capital which ensures corporate sustainability growth in Nigeria.

2.3 Empirical Review

According to the study of [12] on the relationship between the performance of multinational companies and intellectual

capital in Nigeria, a longitudinal design was used and the data were obtained from 24 sampled multinational companies were used for the ten-year period; 2010-2019. Data were analyzed with panel regression using STATA 16 software. The result showed that capital employed efficiency has significant and positive impact on performance of firms in Nigeria. Also, structural capital efficiency and human capital efficiency have no impact on performance of firms in Nigeria.

Based on the study of [11] on effect of natural and intellectual capital on performance of firms in Nigeria, a period of 10 years; i.e 2012 to 2021 was covered. Also, the data for the study was obtained from the financial reports of the firms under coverage. Ex post facto design was adopted and the data analysis was done using multiple regression. The results of the study showed that there is a significant and positive relationship between intellectual capital and financial performance in Nigeria. Also, natural capital has an insignificant and positive impact on financial performance. Thus, the study concludes that firms intellectual capital ensures corporate performance.

Also, [27] examined the relationship between financial performance and intellectual capital among the listed deposit money banks for the period ended of 2013-2017. The study used secondary data which was collected from the financial reports of the banks under review. The study selected 12 banks out of the population of listed 14 deposit money banks in Nigeria. Using a multiple regression model, the four hypotheses were evaluated at the significance level of 5%. The results of the study show that profitability of banks in Nigeria is a dependent of its intellectual capital.

Based on work by [28] on the relationship between intellectual capital and financial performance of oil and gas firms in Nigeria, a period of 10 years starting from 2007 to 2016 was covered in the study. Data was collected from the annual reports of the firms under review and was analyzed using regression model. Thus, the results indicate that intellectual capital only marginally affected financial performance.

Also, [29] examined the impact of intellectual capital on the financial performance of banks in Nigeria. Specifically, the study looked at the following: to examine the effect of human capital on the return on assets; evaluate the effect of structural capital on the return on assets; and to determine the impact of capital employed on the return on assets employed by banks in Nigeria. The study, which applied the ex post facto research design, used data from four deposit banks in Nigeria for the periods 2011 to 2015. Descriptive statistics were used for the pre-test analysis and a regression analysis for the hypothesis test. The study found that human capital efficiency has insignificant and positive effect on ROA; structural capital efficiency has insignificant and positive impact on return on assets; and capital employed has a negative and insignificant impact on the return on assets in the Nigerian banking sector.

Based on study by [10] on the extent to which intellectual capital affect the performance of banks in Nigeria using Value Added Intellectual Coefficient, the data was obtained from the annual reports of the 3 banks and analyzed using a regression model. The study shows that IC has significant and positive impact on banks' financial performance. The results also showed that banks differ statistically in terms of both financial performance indicators and intellectual capital. It also shows that the banks with optimal IC have high financial performance. The study recommends that banks in Nigeria should invest vigorously in developing their human capital, as this is a key factor in business performance.

A study by [30] analyzed the impact of intellectual capital on company valuation covering the period of 2004 to 2013. Using market to book ratio and earnings per share and Pulic VAIC, the results show that human capital efficiency has significant and positive impact on market/book value. Structural capital has a negative and insignificant impact on earnings per share.

3. Methodology

The study adopted *ex post facto* design based on the fact that the data for the study was secondary which already existed and cannot be controlled. The population of the study consists of 66 manufacturing companies listed on Nigerian Exchange Group (NGX) for the period of December 31, 2022, covering the period 2015-2022. A sample of forty-five (45) publicly traded manufacturing companies that regularly published their financial statements was used. Based on this, a total of 45 firms made up our sample size with 360 observations.

The data for the study was collected from the annual reports of the firms under review. Panel least square regression model was employed in the data analysis with the aid of E-View 12 in order to examine the relationship between intellectual capital efficiency (HRE, RCE & SCE) and corporate sustainability growth (CSG). The panel least square employed in the study is a parameter estimate in the regression analysis using cross sectional data. Thus, the results were used to determine the validity or otherwise of the tentative statements (hypotheses) for the study. Correlational matrix was also carried out for the test of auto-correlation of the regressors and multi-collinearity feature.

3.1 Measurement and Operationalization of Variables

Table 1: Variable Measurements

Variable	Measurement
Dependent	
Corporate Sustainability Growth	ROE(1-DPR)
Independent	
Human Capital Efficiency	Value Added/Human Capital
Relational Capital Efficiency	Relational Capital/Value Added
Structural Capital Efficiency	Structural Capital/Value Added

Empirical Survey (2023)

3.2 Model Specification and Justification

The researcher designed a model in line with the previous studies to examine the relationship between intellectual capital efficiency and corporate sustainability growth. The functional model is expressed as thus:

$$CSG = F(HCE, RCE, SCE)$$

The explicit form of the regression for the study is shown as thus:

$$\text{Model: } CSG_{it} = \beta_0 + \beta_1 HCE_{it} + \beta_2 RCE_{it} + \beta_3 SCE_{it} + \mu$$

Where:

CSG = Corporate Sustainability Growth

HCE = Human Capital Efficiency

RCE = Relational Capital Efficiency

SCE = Structural Capital Efficiency

μ = error term

Decision Rule: to accept H_0 if P-value greater than 5% significant level; otherwise reject H_0

4. Results and Discussion

Table 2: Descriptive Statistics

	CSG	HCE	RCE	SCE
Mean	3.22	3.26	2.67	2.05
Median	0.07	2.78	2.10	1.90
Maximum	6.99	4.01	3.10	3.13
Minimum	-0.35	0.09	0.19	0.09
Std. Dev.	3.88	0.68	0.67	0.58
Skewness	-10.44	0.43	0.61	0.24
Kurtosis	12.96	2.26	2.07	2.44
Jarque-Bera	18.79	19.32	35.36	8.12
Probability	0.46	0.39	0.25	0.60
Sum	79.61	1173.90	960.70	739.28
Sum Sq. Dev.	5394.10	165.60	160.98	119.19
Observations	360	360	360	360

Source: E-View 12 Computational Results (2023)

Table 2 above shows that corporate sustainability growth (CSG) value for the sampled firms' was 3.22. This implies that corporate sustainability is determined by firms' intellectual capital efficiency. The maximum point for the study was 6.99 while the minimum point was -0.35. The variations in minimum and maximum CSG value for the sampled firms justify the study that corporate sustainability growth is a determinant of intellectual capital efficiency. The distribution as shown above is leptokurtic since the kurtosis (12.96) is greater than 3. This implies that the outliers are more. The Jarque-Bera probability of 0.46 is greater than 0.05 which connotes that the distribution of CSG is not deviated from the normal distribution.

The average value of human capital efficiency (HCE) for the sampled firms was 3.26. This means that firms with HCE

value of 3.26 have human capital efficiency at a risk level of 0.68%. The minimum and maximum point for the study was 0.09 and 4.01 respectively. The variation in minimum and maximum HCE values between the sampled firms justifies the need for this study, as the study assumes that firms with such variability have sustainable growth. The distribution as shown above is platykurtic since the kurtosis (2.26) is less than 3. This implies that the outliers are few. The Jarque-Bera probability of 0.39 is greater than 0.05 which connotes that the distribution of HCE is not different from the normal distribution.

The average relational capital efficiency (RCE) value for the sampled firms was 2.67. This means that firms with RCE values of 2.67 and above have relational capital efficiency. The maximum and minimum values for the study were 3.10 and 0.19 respectively. The variation in the minimum and maximum RCE values between the sampled firms justifies the need for this study, as the study assumes that firms with such variability are more sustainable. The distribution as shown above is platykurtic since the kurtosis (2.07) is less than 3. This implies that the outliers are few. The Jarque-Bera probability of 0.25 is greater than 0.05 which connotes that the distribution of RCE is not deviated from the normal distribution.

The mean value of structural capital efficiency (SCE) for the sampled firms was 2.05. This implies that firms with SCE of 2.05 and above have structural capital efficiency at a degree risk of 0.58%. The minimum and maximum point for the study was 0.09 and 3.13 respectively. The variation in minimum and maximum SCE values between the sampled firms justifies the need for this study, as the study assumes that firms with such variability have sustainability growth. The distribution as shown above is leptokurtic since the kurtosis (2.44) is greater than 3. This implies that the outliers are few. The Jarque-Bera probability of 0.60 is greater than 0.05 which connotes that the distribution of SCE is not different from the normal distribution.

Table 3: Correlation Matrix

Variables	CSG	HCE	RCE	SCE
CSG	1.00			
HCE	0.06	1.00		
RCE	0.01	0.54	1.00	
SCE	0.03	0.05	0.52	1.00

Source: Result Output from E-Views 12 (2023)

Table 3 exposts the relationship between the dependent and independent variables used in the study. The results of the study show that the independent variables are positively related to dependent variable (corporate sustainability growth) and with each other. The values on the diagonal are all 1, indicating that each of the variables is perfectly correlated with itself.

A weak positive relationship was found between HCE and CSG which implies that an increase in firms' human capital increases corporate sustainability growth by 6%. Relational capital efficiency recorded a weak positive association with

corporate sustainability growth by 1%. This implies that corporate sustainability growth of firms' is determined by relational capital efficiency. Also, a weak positive relationship was found between structural capital efficiency and corporate sustainability growth. Hence, an increase in firms' structural capital increases corporate sustainability growth by 3%

Also, when testing for multi-collinearity, we found that no two exogenous variables were perfectly correlated. Thus implies non multi-collinearity existence in the model.

4.1. Test of Hypothesis

Table 4: Panel Least Squares Result on Intellectual Capital Efficiency and Corporate Sustainability Growth

Dependent Variable: CSG
Method: Panel Least Squares
Date: 06/05/23 Time: 18:36
Sample: 2015 2022
Periods included: 8
Cross-sections included: 45
Total panel (balanced) observations: 360

Variable	Coefficient	Std. Error	t-Statistic	Prob.
HCE	0.436362	0.079770	5.470252	0.0033
RCE	0.178734	0.051723	3.455600	0.0137
SCE	0.915394	0.141591	6.465058	0.0000
C	1.404033	0.215909	6.502899	0.0000
R-squared	0.411683	Mean dependent var	22.11330	
Adjusted R-squared	0.400733	S.D. dependent var	3.876253	
S.E. of regression	3.884533	Akaike info criterion	5.562932	
Sum squared resid	5371.897	Schwarz criterion	5.606111	
Log likelihood	-977.3277	Hannan-Quinn criter.	5.580100	
F-statistic	7.490402	Durbin-Watson stat	1.953843	
Prob(F-statistic)	0.000000			

Source: Result Output from E-Views 12 (2023).

The R-squared for the model, shown in Table 4 above, was 0.41%, indicating that the variables in the model accounted for 41% of change in dependent variable of corporate sustainability growth (CSG), while about 59% was unaccounted for. The F-statistic value of 7.490 and P-value of 0.0000 indicate that the panel least-squares model is statistically significant at 1% level. Thus implies that the regression model is appropriate for the study.

Autocorrelation Test: The DW statistic is 1.953843, which is approximately 2, which agrees with Durbin Watson's rule of thumb. This means that the data are free of autocorrelation and suitable for the interpretation of the result. The Schwarz Criterion and the Akaike Info Criterion of 5.606111 and 5.562932, respectively; further strengthen the reliability of our result as it confirms the goodness of fit of the model.

In addition, the specific results for each explanatory variable from the panel least squares model as shown in Table 4 are provided below as follows:

4.2 Discussion of Findings

Human capital efficiency has no significant relationship with corporate sustainability growth. This was tested and the result of the panel's least squares as shown in Table 4 indicates that the relationship between human capital efficiency (HCE) and corporate sustainability growth (CSG) is significant and positive with the P-value of 0.0033 which is below the 5% level of significance adopted. Also, the positive coefficient of 0.436 implies that an increase in human capital increases the corporate sustainability growth by 43.6%. The implication of this is that human capital efficiency determines corporate sustainable growth. This is to say that human capital is based on the fact that learning and knowledge, innovation and creativity, competences and skills that are relentlessly pursued and applied to business's environmental context cannot be substituted. Hence, the alternate hypothesis which states that human capital efficiency is significantly related to corporate sustainability growth was accepted while the null hypothesis on the other hand was rejected. This finding is consistent with the findings of [11] who found that human capital efficiency ensures firm performance. Contrary to this, [28] and [12] found no significant relationship between human capital efficiency corporate performance in Nigeria.

There is no significant relationship between relational capital efficiency and corporate sustainability growth. This was tested and the result of the panel least squares as shown in Table 4, indicates that the relationship between relational capital efficiency (RCE) and corporate sustainability growth (CSG) is significant and positive with the P-value of 0.0137 which is below the 5% significant level adopted. In addition, the positive coefficient of 0.178 suggests that relational capital efficiency ensures the corporate sustainability growth by 17.8%. The implication of this is that relational capital efficiency is a determinant of corporate sustainable growth. Thus, relational capital represents an organization's ability to positively interact with members of the business community to foster the potential for wealth creation through the enhancement of human and structural capital [31]. To this effect, the alternate hypothesis which connotes that there is a significant relationship between relational capital efficiency and corporate sustainability growth was accepted while the null hypothesis on the other hand was rejected. This result agrees with the a priori expectations of [10], who reported that relational capital efficiency has significant implications for firm performance.

Structural capital efficiency has no significant relationship with corporate sustainability growth. This was tested and the result of the panel's least squares as shown in Table 4, shows that the relationship between the structural capital efficiency (SCE) and corporate sustainability growth is significant and positive with a P-value of 0.0000 which is below the 5% level of significance adopted. Furthermore, the positive coefficient of 0.915 shows that an increase in structural capital increases the corporate sustainability by 91.5%. This implies that structural capital efficiency is a determinant of corporate sustainability growth. This is to say that structural capital is a processes, supportive infrastructure and databases

of an organization which enables human capital to function. Also, it remains with an organization even after the employees must have left including trademarks, patents, processes as well as the organization information system, image, databases and proprietary software [32]. Hence, the alternate hypothesis which connotes that structural capital efficiency has significant relationship with corporate sustainability growth was accepted while the null hypothesis on the other hand was rejected. The finding is in consonance with the findings of [10], [27] who found that structural capital ensures firm performance. In disagreement, the study of [30], [29] and [12] found no significant relationship between structural capital efficiency corporate performance in Nigeria

5. Conclusion and Future Scope

The study having developed a model fit on intellectual capital efficiency using (HCE, RCE & SCE) notes that among the three categories of intellectual capital efficiency that were examined, structural capital efficiency (SCE) has the highest level of influence on corporate sustainability growth (CSG) by the model followed by human capital efficiency (HCE) and structural capital efficiency (SCE). Hence, intellectual capital efficiency determines corporate sustainability growth in Nigeria. Bases on this, it was concluded that intellectual capital efficiency has significant effect on sustainability growth of manufacturing firms in Nigeria. Thus, intellectual capital efficiency ensures corporate sustainability growth.

5.1 Recommendation

1. Manufacturing firms in Nigeria should develop a means to improve their human capital as it has positive and significant impact on corporate sustainability growth. They should look for ways to ensure the efficiency of human capital at their disposal. This is because any negative changes in human capital efficiency impacts corporate performance.

2. Manufacturing firms should also invest heavily on relational capital as it improves corporate reputation, competitiveness and bottom line.

3. Since significant and positive relationship was found between structural capital efficiency and corporate sustainability growth, manufacturing firms should invest more in structural capital in order to increase profitability

Conflict of Interest

There is no competing interest declared by the authors.

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Authors' Contributions

Kelvin Mordi made a significant contribution through the problem identification. Also, Amara Uzodimma did the review of the related literature. Every other aspect of the work was handled by Dr Omaliko Emeka the corresponding author.

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