**International Journal of Business, Economics and Management**
*2025 Vol. 12, No. 1, pp. 1-16*
*ISSN(e): 2312-0916*
*ISSN(p): 2312-5772*
*DOI: 10.18488/62.v12i1.4084*


# Intellectual capital and sustainable growth of listed non-financial firms in Nigeria

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**Article History**
Received: 15 October 2024
Revised: 14 January 2025
Accepted: 29 January 2025
Published: 11 February 2025

**Keywords**
Corporate sustainability
Human capital
Intellectual capital
Rappaport's growth model
Relational capital
Structural capital
Sustainable growth rate.

**JEL Classification:**
E22; D92; M14.

## *ABSTRACT*

Businesses that prioritize sustainability often gain a competitive edge in the marketplace. However, research suggests that non-financial firms in Nigeria are struggling to incorporate various elements of intellectual capital into their operations, threatening their corporate sustainability. While there is considerable literature on intellectual capital and sustainability in the financial sector, there is limited research on this topic in Nigeria's non-financial firms, which are vital to the economy. This study, therefore, investigates the impact of intellectual capital on the corporate sustainability of non-financial firms listed in Nigeria. The study employed an ex-post facto research design, focusing on 32 companies listed in the industrial and consumer goods sectors on the Nigerian Exchange as of December 31, 2020. Using a purposive sampling technique, a sample of 20 firms was selected for analysis over a 15-year period (2007–2021). The data were sourced from the published annual financial statements of the selected firms, with the reliability of the data ensured by statutory audits and certifications from regulatory agencies. Data analysis was conducted using both descriptive and inferential statistics, with a focus on the System Generalized Method of Moments (SGMM) at a 10% significance level. The findings indicate that intellectual capital significantly influences earnings sustainability ($W(6, 287) = 95.26$, $p < 0.10$). The study concludes that intellectual capital plays a crucial role in enhancing the corporate sustainability of non-financial firms in Nigeria. Consequently, it is recommended that these firms integrate intellectual capital into their operations to strengthen their sustainability efforts.

**Contribution/Originality:** The research uniquely addresses a gap in existing literature by focusing on non-financial firms in Nigeria, employing the Rappaport sustainable growth rate model, and leveraging a 15-year dataset to provide new insights into the integration of intellectual capital in fostering corporate sustainability.

## 1. INTRODUCTION

The topic of corporate sustainability has gained increasing relevance in financial management, especially in recent years. While the traditional aim of businesses has been the maximization of shareholder wealth, Adam Smith's "invisible hand" concept, which promotes perpetual growth and development, confronts limitations in a world with

finite resources. Although profitability is essential for the sustainable development of enterprises, it cannot be pursued indiscriminately. Contemporary financial management now emphasizes the intersection of business operations with sustainable financial performance, evaluating a company's capacity for long-term development.

In the corporate world, sustainability denotes a company's ability to endure and flourish in a rapidly changing, competitive, and demanding environment. The notion of sustainability involves meeting current needs without jeopardizing the ability of future generations to meet theirs. Purvis, Mao, and Robinson (2019) conceptualize sustainability as resting on three interconnected pillars: economic, environmental, and social dimensions, often referred to as profit, planet, and people. Kirikkaleli, Sofuoğlu, Abbasi, and Addai (2023) highlight the alignment of these pillars with the Sustainable Development Goals (SDGs), emphasizing objectives such as fostering industrial sustainability through innovation (SDG 9) and promoting climate resilience by improving natural resource quality (SDG 1) (Ahmed, Shah, & Khan, 2022).

Globally, the need for sustainable growth has become more pressing, prompting a shift from conventional economic models toward sustainability-focused strategies (Hariram, Mekha, Suganthan, & Sudhakar, 2023; Qiang, Saurav, & Viney, 2021). Corporate sustainability, increasingly linked to environmental, social, and governance (ESG) considerations, is now pivotal for organizations seeking long-term value creation and resilience (Shu, 2023). However, in competitive markets, maximizing growth does not always equate to maximizing value. Research suggests that value peaks when firms achieve sustainable growth rates and diminishes when growth surpasses this optimal threshold (Ataunal, Gurbuz, & Aybars, 2016; Ramezani, Soenen, & Jung, 2001). As a result, businesses are progressively embedding sustainable growth into their strategic planning frameworks.

Amid rapid technological advancements in knowledge-driven economies, organizations are compelled to adapt their operational structures to maintain a competitive edge by leveraging intellectual capital (Abd, Jassim, & Hasoon, 2023). This adaptation involves fostering continuous learning, enhancing creative potential, refining existing knowledge, and utilizing resources to navigate evolving market demands (Wealther & George, 2020). Intellectual capital comprising ideas, expertise, competencies, and innovation plays a critical role in driving profitability, customer acquisition, and product or service development, which collectively bolster corporate sustainability. Since John Kenneth Galbraith first introduced the concept of intellectual capital in 1969, its importance for organizational longevity and success has been extensively recognized (Ekanem, 2017).

## 2. LITERATURE REVIEW

Research consistently highlights the critical role of intangible assets in driving a firm's success (Hamzah & Ismail, 2008). Ekanem (2017) argues that intellectual capital, when effectively integrated into organizational operations, fosters innovation and aligns with market demands to enhance corporate sustainability.

The importance of intellectual capital and its components in achieving sustainable corporate growth is particularly evident in emerging markets (Xu & Wang, 2018). Modern organizations increasingly depend on intellectual capital as a cornerstone of their growth strategies, leveraging knowledge and innovation to maintain a competitive edge and improve performance metrics (Sardo & Serrasqueiro, 2018).

As business environments evolve, firms must refine their strategies to maximize the value of intellectual capital. Hamideza, Rahim, and Aminiandehkordi (2015) emphasize this dynamic, while Isabel and Bailoa (2017) underscore the necessity of managing and optimizing intellectual capital effectively. Recent studies, such as those by Shabana (2023) and Asiaei, O'Connor, Barani, and Joshi (2023) demonstrate how green intellectual capital, through initiatives like green innovation, directly supports business sustainability. Furthermore, Gantino, Ruswanti, and Widodo (2023) reveal that intellectual capital enhances firm value, while Vetchagool (2023) illustrates its positive influence on financial performance indicators such as return on assets (ROA) and return on equity (ROE) with firm size acting as a moderating factor.

Scholars like Ahmed, Guozhu, Mubarik, Khan, and Khan (2020) and Matricano, Perugini, and Vona (2020) assert that key intellectual capital constructs including physical, human, structural, process, and relational capital are vital for financial performance and organizational development. Watkins and Kim (2018) highlight that these constructs are shaped by organizational culture and leadership, which together drive innovation.

Structural capital, which involves the effective management of explicit knowledge and its integration into information systems, plays a pivotal role in enhancing value (Abualoush, Bataineh, & Alrowwad, 2018; Asiaei, Jusoh, & Bontis, 2018). Relational capital, as defined by Kianto and Waajakoski (2010) captures the value of an organization's internal and external relationships, while renewal capital, introduced by Kianto (2008) reflects an organization's capacity to learn, innovate, and acquire new skills.

In knowledge-driven economies, intellectual capital is increasingly recognized as fundamental to creating, maintaining, and enhancing value (Onyekwelu, Okoh, & Iyidiobi, 2017). According to the resource-based view (RBV), firms that possess valuable and inimitable resources, such as intellectual capital, are better positioned to achieve a sustainable competitive advantage (Ujwary-Gil, 2017). Effective management of intellectual capital not only enhances organizational performance but also fosters innovation, boosts productivity, and improves profitability (Brennan, 2001; Dzenopoljac, Yaacoub, Elkanj, & Bontis, 2017; Hamdan, 2018; Maji & Goswami, 2017; Smriti & Das, 2018).

Moreover, the disclosure of intellectual capital information is critical to ensuring transparency and efficient resource allocation. It helps mitigate risks of misleading shareholders and promotes optimal capital utilization (Akkas & Asutay, 2023; Nawaz & Ohlrogge, 2022).

The methodologies and measures used to assess sustainable growth vary significantly across the literature. While studies such as Azhar and Paula (2017) and Ewereoke (2018) employed metrics like ROA and ROE, others, like Berzkalne and Zelgalve (2014) utilized Tobin's Q. Some researchers relied on primary data from surveys and questionnaires (Asogwa & Ewans, 2020; Ekanem, 2017; Omar, Saad, & Zaman, 2017) while others analysed secondary data (Akintoye, Adegbie, & Dada, 2022; Vetchagool, 2023). A few studies, Lu, Wang, and Zhang (2021) and Mukherjee and Sen (2019) adopted the Rappaport sustainable growth rate model.

Despite the wealth of research, discrepancies in findings across studies necessitate further investigation into the hypothesis that intellectual capital significantly impacts the sustainable growth of non-financial firms in Nigeria. This study aims to fill that gap by exploring the interplay between intellectual capital and sustainability within this critical sector.

### *2.1. Theoretical Framework*

The knowledge-based theory, an extension of the resource-based view (RBV) introduced by Wernerfelt (1984) highlights the significance of a firm's knowledge assets as its most essential strategic resource. This theory posits that intellectual capital, encompassing the organization's stock of knowledge, is pivotal for sustaining competitive advantage through the assimilation of external innovations (Curado & Bontis, 2006). Intellectual capital encompasses a wide range of elements, including applied expertise, organizational processes, customer relationship management, and specialized skills, all of which collectively provide firms with a distinctive market advantage (Edvinsson & Malone, 1997).

The knowledge-based theory underscores that a firm's most valuable asset is its knowledge, which drives sustainable competitive advantage and superior performance. Knowledge-based resources are challenging to imitate and are embedded in various aspects of an organization, such as corporate culture, identity, policies, and systems. This perspective, rooted in strategic management literature, builds on the RBV and has been supported by numerous studies Hiltrop (1999); Navaneethakrishnan (2019) and Theriou, Aggelidis, and Theriou (2009). A firm's knowledge assets become more valuable through use, creating path dependencies and barriers to imitation, thus establishing a basis for competitive advantage (Collis, 1991; Winter, 1987).

Critics of knowledge-based theory question whether it constitutes a formal theory (Foss, 1996; Phelan & Lewin, 2000). However, proponents argue that the theory effectively addresses the importance of knowledge as a unique and inimitable resource that provides a competitive edge (Demsetz, 1991; Grant, 1996). Knowledge is collectively referred to as intellectual capital, which belongs exclusively to the firm that generates it. Studies have consistently found that intellectual capital is a key determinant of a firm's success (Abd et al., 2023; Akintoye et al., 2022; Asiaei et al., 2023). The knowledge-based theory is relevant to this study as it underscores the importance of intellectual capital for sustainable competitive advantage, which is the focus of this research.

## 3. METHODOLOGY

### *3.1. Population, Sample Size, and Sampling Technique*

The population of this study comprises 32 non-financial companies listed on the Nigerian Exchange Group as of December 31, 2021. The focus on non-financial firms stems from their homogeneous reporting styles and capital classifications. A purposive sampling technique was employed to select 20 firms, representing 62.5% of the population, based on data availability and the study's time frame. Only companies listed before 2007 and consistently publishing financial statements were included in the sample.

### *3.2. Data Source*

Secondary data were sourced from the audited annual reports of the selected 20 companies over 15 years (2007-2021). The audited annual reports and accounts of Nigerian listed companies are considered trustworthy, as they are examined by certified professionals and prepared in accordance with the provisions of the Companies and Allied Matters Act (CAMA) 2020 (as amended) and International Financial Reporting Standards (IFRS). Additionally, these reports are reviewed and approved by the Financial Reporting Council before being released to the public.

### *3.3. Analytical Techniques*

The study employed both the descriptive and inferential analytical techniques. Descriptive analysis was utilized to assess the characteristics of the dataset, focusing on metrics such as mean, minimum, maximum, and standard deviation. Correlation analysis was conducted to evaluate the relationships between variables and detect any multicollinearity. The results of the correlation analysis were further validated using Variance Inflation Factor (VIF) analysis. These procedures formed the pre-estimation phase, ensuring a thorough evaluation of the data's characteristics and distribution.

To test the hypotheses, the study applied multiple regression analysis, specifically a robust two-step System Generalized Method of Moments (SGMM). This method was chosen over Ordinary Least Squares (OLS) due to its ability to address the endogeneity of explanatory variables and account for the feedback effects of lagged dependent variables. The SGMM approach is particularly suited for long panel data analysis, as recommended by Blundell and Bond (1998) and Jin, Lee, and Yu (2021) and is effective in addressing issues of autocorrelation and heteroskedasticity.

The equations examined the relationship between intellectual capital and sustainable growth, incorporating control variables such as firm size, firm age, and debt-to-equity ratio. These controls enhanced the robustness of the findings and mitigated the risk of omitted variable bias. The results, presented in the subsequent section, were evaluated at a 5% significance level.

### *3.4. Measurement of Variables*

Sustainable Growth Rate: as developed by Rappaport (1978) and adopted from the study of Xu, Liu, and Shang (2020) is measured as:

$$\frac{(PAT/S_o)(1+DER)(1-DPO)}{NA_o/S_0 - (PAT/S_o)(1+DER)(1-DPO)}$$

Where:

PAT means Profit After Tax.

DER means the debt-versus-equity ratio;

DPO means the dividend payout ratio;

$NA_0$ means the opening net assets.

$S_0$ means preceding year sales.

Intellectual Capital components measures are adopted from Amin and Aslam (2017); Chen, Cheng, and Hwang (2005); Liang, Huang, and Lin (2011) and Tripathy, Gil-Alana, and Sahoo (2015) as:

Human Capital Efficiency (HUCE) is measured as: Value added divided by Employee benefits (Salaries and Wages);

INCE Innovative Capital Efficiency Value added divided by Intangible assets;

Relational Capital Efficiency (RLCE): Measured as Value added divided by Advertising (Marketing and Selling) Expenses;

SRCE Structural Capital Efficiency (VA-HC)/VA

CEPE Capital Employed Efficiency Value Added divided by Capital employed

Liquidity and Firm age are measured as adopted from Shahzad, Baig, Rehman, Saeed, and Asim (2022) and Kibiya, Aminu, and Abubakar (2019).

Liquidity (LIQD): $\frac{Current\ Assets - Inventory}{Current\ Liabilities}$

Age (Age): How old is the company in year "t" from the date of incorporation till year "t"

### *3.5. Model Specification*

This study examined the effect of intellectual capital on the sustainability growth of companies listed on the Nigerian Stock Exchange. In this study, three categories of variables were employed; independent, dependent, and control variable. Intellectual capital which is the independent variable, is measured by human capital, innovative capital, relational capital and structural capital. Corporate sustainability growth, which is the dependent variable, is measured as earnings sustainability, while firm age and liquidity are used as control variables.

As found in previous related studies, the models established for this study were adapted from Xu and Wang (2018).

Xu and Wang (2018) conducted a study on intellectual capital, financial performance and companies' sustainable growth using evidence from the Korean manufacturing industry and developed a model to establish the relationship between intellectual capital and companies' sustainable growth as follows:

$$SGR_{i,t} = \beta_0 + \beta_1 CEE_{i,t} + \beta_2 HCE_{i,t} + \beta_3 SCE_{i,t} + \beta_4 RDE_{i,t} + \beta_5 RCE_{i,t} + \beta_6 SIZE_{i,t} + \beta_7 LEV_{i,t} + \varepsilon_{i,t}$$

Xu and Wang (2018) proxy intellectual capital by physical capital (CEE), human capital (HCE), structural capital (SCE), Innovative capital (ICE) and relational capital (RCE) while controlling for firm size (SIZE) and leverage (LEV). In addition, their study adopted the Higgins's sustainable growth model developed by Higgins (1977) and modified in the study of Fonseka, Ramos, and Tian (2012) for the sustainable growth rate.

Also, Mukherjee and Sen (2019) conducted an empirical study on the application of Higgin's sustainable growth model in intellectual capital and corporate sustainable growth of Indian companies established the relationship using a regression model as follows:

$$CSG_{it} = \beta_0 + \beta_1 CEE_{it} + \beta_2 HCE_{it} + \beta_3 RCE_{it} + \beta_4 InCE_{it} + \beta_5 PCE_{it} + \beta_6 LEV_{it} + \beta_7 FS_{it} + \beta_8 AGE_{it} + \varepsilon_{it}$$

In the study of Mukherjee and Sen (2019) intellectual capital was measured as: physical capital (CEE), human capital (HCE), relational capital (RCE) Innovative capital (InCE) and process capital (PCE), while controlling for leverage (LEV), firm size (FS) and firm age (AGE)

In addition, the adapted model was also obtained from the study of Xu et al. (2020) who adopted Colley's corporate sustainable growth model and Rappaport's corporate sustainable growth model to represent corporate sustainable growth, in their study on the impact of intellectual capital efficiency on corporate sustainable growth-evidence from smart agriculture in China. The model formulated by Xu et al. (2020) is stated as follows:

$$SGR_{i,t} = \beta_0 + \beta_1 FC_{i,t} + \beta_2 EHCE_{i,t} + \beta_3 NHCE_{i,t} + \beta_4 SCE_{i,t} + \beta_5 CEE_{i,t} + \beta_6 C_{i,t} + \varepsilon_{i,t}$$

Xu et al. (2020) represent intellectual capital with Capital employed efficiency (CEE), non-executive human capital efficiency (NHCE), executive human capital efficiency (EHCE), structural capital efficiency (SCE) and financial capital (FC), while the control variables (C) were size of the company (TA) and the growth rate of the consumer price index (GCPI).

Hence, the study formulated the following multiple regression models by considering the determining power of the lag of the endogenous variable as specified in the method of data analysis:

$$SGR_{it} = \beta_0 + \beta_1 SGR_{it-1} + \beta_2 HUCE_{it} + \beta_3 INCE_{it} + \beta_4 RLCE_{it} + \beta_5 SRCE_{it} + \beta_6 CEPE_{it} + \varepsilon_{it} \quad \text{(Model I)}$$

$$SGR_{it} = \beta_0 + \beta_1 SGR_{it-1} + \beta_2 HUCE_{it} + \beta_3 INCE_{it} + \beta_4 RLCE_{it} + \beta_5 SRCE_{it} + \beta_6 CEPE_{it} + \beta_7 LIQD_{it} + \beta_7 AGE_{it} + \varepsilon_{it} \quad \text{(Model II)}$$

Where;

SGR – Sustainable growth rate, HUCE - human capital efficiency, INCE - Innovative capital efficiency, RLCE - Relational capital efficiency, SRCE – Structural capital efficiency, CEPE – Capital employed efficiency, LIQD – Liquidity, AGE – Firm age

## 4. RESULTS AND DISCUSSION OF FINDINGS

### *4.1. Descriptive Analysis*

The characteristics of the series in the distribution are estimated using descriptive statistics, including the mean, standard deviation, and minimum and maximum values as shown in Table 1.

**Table 1.** Descriptive statistics.

| Variables | Mean | Std. dev | Min. | Max. |
|---|---|---|---|---|
| SGR | -1.265 | 11.885 | -202.57 | 16.55 |
| HUCE | 2.769 | 1.614 | 0 | 17.43 |
| INCE | 48.142 | 355.845 | 0 | 4074.01 |
| RLCE | 17.419 | 123.861 | -3.1 | 2019.75 |
| SRCE | 0.570 | 0.166 | 0.13 | 1 |
| CEPE | 0.251 | 0.135 | 0.02 | 1 |
| LIQD | 0.871 | 0.956 | 0 | 13.58 |
| AGE | 35.551 | 8.971 | 12 | 57 |

**Note:** SGR – sustainable growth rate, HUCE - human capital efficiency, INCE - Innovative capital efficiency, RLCE - relational capital efficiency, SRCE – structural capital efficiency, CEPE – capital employed efficiency, LIQD – liquidity, AGE – firm age.

Table 1 reveals that the companies studied faced a decrease in earnings during the research period. This is evident from the minimum sustainable growth rate (SGR) values, which were as low as -202.57, indicating a downturn in operations rather than growth. For companies to maintain operations, steady growth is essential. Descriptive analysis highlighted the difficulties these companies encountered, underscoring the issues addressed in this study. The average SGR value was -1.265, further suggesting that these firms were shrinking instead of expanding.

In terms of intellectual capital, the minimum values for human capital efficiency, structural capital efficiency, relational capital efficiency, capital employed efficiency, and innovative capital efficiency demonstrated that the companies occasionally added no value throughout the study period. This is shown by the minimum values, which were approximately zero at certain points.

The standard deviation results, which gauge how much the series deviates from the mean, showed that most series were significantly dispersed, as indicated by the large gaps between mean values and standard deviation values. This dispersion indicates instability in growth and capital.

To analyze the relationships among the series, Pearson correlation coefficients were used to examine the associations. Furthermore, the Variance Inflation Factor (VIF) was employed to assess the absence of multicollinearity issues among the variables. The findings are detailed in Table 2.

**Table 2.** Correlation analysis.

| Variables | SGR | HUCE | INCE | RLCE | SRCE | CEPE | LIQD | AGE | VIF | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | VIF | 1/VIF |
| SGR | 1.000 | | | | | | | | | |
| HUCE | 0.021 | 1.000 | | | | | | | 2.16 | 0.464 |
| INCE | 0.010 | -0.064 | 1.000 | | | | | | 1.02 | 0.976 |
| RLCE | 0.001 | -0.073 | -0.015 | 1.000 | | | | | 1.02 | 0.977 |
| SRCE | 0.018 | 0.729 | -0.092 | -0.135 | 1.000 | | | | 2.28 | 0.439 |
| CEPE | -0.031 | 0.275 | -0.083 | -0.052 | 0.330 | 1.000 | | | 1.13 | 0.881 |
| LIQD | 0.045 | -0.058 | 0.089 | 0.025 | -0.101 | -0.082 | 1.000 | | 1.03 | 0.971 |
| AGE | 0.113 | 0.036 | 0.082 | -0.053 | 0.008 | 0.019 | 0.105 | 1.000 | 1.02 | 0.978 |
| | | | | | | | | | Mean = 1.38 | |

**Note:** SGR – sustainable growth rate, HUCE - human capital efficiency, INCE - innovative capital efficiency, RLCE - relational capital efficiency, SRCE – structural capital efficiency, CEPE – capital employed efficiency, LIQD – liquidity, AGE – firm age

The correlation analysis revealed that most coefficients were below 0.5, indicating a weak correlation between the variables. The sustainable growth rate (SGR) showed a positive but weak relationship with other variables, except for capital employed efficiency (CEPE), which had a negative correlation.

Despite these correlations, the relationship between the variables does not suggest a cause-and-effect scenario; changes in one variable do not necessarily impact the others. To check for multicollinearity among the explanatory variables, a correlation matrix was used. The results ranged from 0.001 to 0.729 in absolute values, which are below the 0.8 threshold set by Baltagi (2021) indicating no multicollinearity issues.

As reflected in the results of the Pearson Product Moment correlation Coefficients, the non-existence of multicollinearity problem among the series in the distribution is confirmed by the variance inflation factor (VIF) analysis, which produced a mean value of 1.38. This is well below the benchmark of 10 recommended by James, Witten, Hastie, and Tibshirani (2017) leading to the conclusion that there is no multicollinearity problem among the explanatory variables in the models.

### *4.4. Regression Analysis*

The result of the regression analysis (system generalized moment method) on the effect of intellectual capital on corporate sustainability is presented in Table 3.

**Table 3.** Results of the regression analyses.

| | | Model I | Model II |
|---|---|---|---|
| SGR(L1) | β | 0.018 | -0.032 |
| | ε | 0.124 | 0.031 |
| | T-test (ρ) | 0.15 (0.884) | -1.04 (0.300) |
| HUCE | β | -0.004 | 0.030 |
| | ε | 0.161 | 0.171 |
| | T-test (ρ) | -0.02 (0.980) | 0.17 (0.863) |
| INCE | β | 0.0002 | 0.0001 |
| | ε | 0.0002 | 0.0002 |
| | T-test (ρ) | 1.17 (0.242) | 0.54 (0.592) |
| RLCE | β | 0.0007* | 0.001 |

| | | Model I | Model II |
|---|---|---|---|
| | ε<br>T-test (ρ) | 0.0004<br>1.87 (0.061) | 0.001<br>1.63 (0.103) |
| SRCE | β<br>ε<br>T-test (ρ) | 1.404<br>2.372<br>0.59 (0.554) | 0.482<br>1.999<br>0.24 (0.809) |
| CEPE | β<br>ε<br>T-test (ρ) | -2.287<br>1.400<br>-1.63 (0.102) | 0.798<br>2.485<br>0.32 (0.748) |
| LIQD | β<br>ε<br>T-test (ρ) | | -0.004<br>0.132<br>-0.03 (0.977) |
| AGE | β<br>ε<br>T-test (ρ) | | 0.076<br>0.074<br>1.03 (0.303) |
| CONSTANT | β<br>ε<br>T-test (ρ) | -1.126<br>0.968<br>-1.16 (0.245) | -4.192<br>3.591<br>-1.17 (0.243) |
| Wald test | | $chi^2(6)$ = 95.26 (0.000) | $chi^2(8)$ = 240.89 (0.000) |
| AR (1)<br>AR (2) | | Z = -1.02 (0.305)<br>Z = 0.37 (0.709) | Z = -0.99 (0.321)<br>Z = -0.06 (0.956) |
| test of override. Restrictions | | Sargan: $chi^2(257)$ = 251.82 (0.579)<br>Hansen: $chi^2(257)$ = 10.31 (1.000) | Sargan: $chi^2(263)$ = 251.42 (0.686)<br>Hansen: $chi^2(263)$ = 5.70 (1.000) |
| Exogeneity tests: GMM instruments for levels | | Hansen: $chi^2(218)$ = 9.30 (1.000)<br>Difference (null H = exogenous): $chi^2(39)$ = 1.01 (1.000) | Hansen: $chi^2(228)$ = 7.71 (1.000)<br>Difference (null H = exogenous): $chi^2(35)$ = -2.01 (1.000) |
| Exogeneity tests: Individual instruments | | Hansen test excluding group: $chi^2(252)$ = 10.69 (1.000)<br>Difference (null H = exogenous): $chi^2(5)$ = -0.38 (1.000) | Hansen test excluding group: $chi^2(256)$ = 7.82 (1.000)<br>Difference (null H = exogenous): $chi^2(7)$ = -2.12 (1.000) |

**Note:** SGR – Sustainable growth rate, HUCE - Human capital efficiency, INCE - Innovative capital efficiency, RLCE - Relational capital efficiency, SRCE – Structural capital efficiency, CEPE – Capital employed efficiency, LIQD – Liquidity, AGE – Firm age, β – Coefficient, ε – Standard error, ρ – Probability of the t-test., * denotes the significance result @ 10%

$$SGR_{it} = \beta_0 + \beta_1 SGR_{it-1} + \beta_2 HUCE_{it} + \beta_3 INCE_{it} + \beta_4 RLCE_{it} + \beta_5 SRCE_{it} + \beta_6 CEPE_{it} + \varepsilon_{it}$$

$$SGR_{it} = -1.126 + 0.018 SGR_{it-1} - 0.004 HUCE_{it} + 0.0002 INCE_{it} + 0.0007 RLCE_{it} + 1.404 SRCE_{it} + -2.287 CEPE_{it}$$

In examining the impact of intellectual capital on the earnings growth of non-financial firms in Nigeria using Rappaport's sustainable growth model, the study utilized a 2-step robust System Generalized Method of Moments (SGMM) dynamic panel data estimation. The diagnostic tests conducted on this model confirmed the absence of both first-order and second-order serial correlation, with Arellano-Bond test probabilities for AR(1) and AR(2) being 0.305 and 0.709, respectively, both higher than the 10% significance threshold.

The Hansen and Sargan tests developed by Sargan (1958) were employed to assess the validity of the model. The test results, with p-values of 0.579 and 1.000, exceeded the 0.10 significance level, confirming the model's validity. Therefore, the null hypothesis of the Hansen and Sargan tests, which states that the overidentifying restrictions are valid, was not rejected, indicating that all instruments used in the model were appropriate and exhaustive for the estimation.

Additionally, the stationarity condition of each instrument was verified, and the difference-in-Hansen tests of exogeneity for GMM instruments for levels yielded an insignificant probability value of 1.000. This suggests that the models are dynamically complete and that the instruments are valid for the estimation, ensuring the necessary stationarity for the validity of level instruments. Furthermore, the test's probability value for exogeneity of individual

instruments (1.000) indicated no need to add additional instruments to the models, confirming that the model was correctly specified. Thus, the null hypothesis of the Hansen test excluding groups of instruments was not rejected, supporting the completeness of the instrumentation in the model.

The regression analysis results showed varying effects of the different variables on the sustainable growth rate (SGR). The coefficients revealed that SGR (-1) (β = 0.018, ρ = 0.884), innovative capital efficiency (INCE) (β = 0.0002, ρ = 0.242), relational capital efficiency (RLCE) (β = 0.001, ρ = 0.061), and structural capital efficiency (SRCE) (β = 1.404, ρ = 0.554) positively impacted SGR, but only RLCE had a significant effect. In contrast, SGR (-1), INCE, and SRCE showed insignificant effects. On the other hand, human capital efficiency (HUCE) (β = -0.004, ρ = 0.980) and capital employed efficiency (CEPE) (β = -2.287, ρ = 0.102) negatively impacted SGR, although these effects were not statistically significant. The coefficient values suggest that a 1% increase in SGR (-1), INCE, RLCE, and SRCE would result in a respective increase in SGR by 1.8%, 0.02%, 0.1%, and 140.4%. Conversely, a 1% increase in HUCE and CEPE would lead to a decrease in SGR by 0.4% and 228.7%, respectively.

The Wald test's probability value of 0.000 indicates that the combined influence of SGR (-1), HUCE, INCE, RLCE, SRCE, and CEPE significantly affects the SGR. This led to the rejection of the null hypothesis of Model 1, concluding that intellectual capital has a substantial impact on the earnings sustainability, as measured by Rappaport's model, of non-financial firms listed in Nigeria.

Model Two:

$$SGR_{it} = \beta_0 + \beta_1 SGR_{it-1} + \beta_2 HUCE_{it} + \beta_3 INCE_{it} + \beta_4 RLCE_{it} + \beta_5 SRCE_{it} + \beta_6 CEPE_{it} + \beta_7 LIQD_{it} + \beta_7 AGE_{it} + \varepsilon_{it}$$

$$SGR_{it} = -4.192 - 0.032 SGR_{it-1} + 0.03 HUCE_{it} + 0.0001 INCE_{it} + 0.001 RLCE_{it} + 0.482 SRCE_{it} + 0.798 CEPE_{it} - 0.004 LIQD_{it} + 0.076 AGE_{it}$$

The model incorporated liquidity (LIQD) and firm age (AGE) to account for their influence on earnings sustainability, as assessed by Rappaport's model. Utilizing a 2-step robust SGMM dynamic panel data estimation technique, the analysis indicated that the model was free from first-order and second-order serial correlations, based on Arellano-Bond test probabilities of 0.321 and 0.956, respectively, which are above the 10% significance threshold.

Additionally, the Hansen and Sargan tests confirmed the model's validity with probability values of 0.686 and 1.000, exceeding the 0.10 significance level. The difference-in-Hansen tests of exogeneity for GMM instruments showed a probability of 1.000, confirming the model's dynamic completeness and the validity of its instruments. This result, combined with the exogeneity tests showing a probability of 1.000, indicated that no additional instruments were necessary, affirming the sufficiency of the current instruments.

The impact of intellectual capital and control variables (LIQD and AGE) on earnings sustainability was analyzed using t-statistics. The results showed that HUCE (β = 0.030, ρ = 0.863), INCE (β = 0.0001, ρ = 0.592), RLCE (β = 0.001, ρ = 0.103), SRCE (β = 0.482, ρ = 0.809), CEPE (β = 0.798, ρ = 0.748), and AGE (β = 0.076, ρ = 0.303) had a positive but statistically insignificant effect on SGR. Conversely, SGR (-1) (β = -0.032, ρ = 0.300) and LIQD (β = -0.004, ρ = 0.977) had insignificant negative effects. Specifically, increases in HUCE, INCE, RLCE, SRCE, and CEPE would result in SGR increases of 3%, 0.01%, 0.1%, 48.2%, and 79.8% respectively, while an older firm would see a 7.6% increase in SGR. On the other hand, increases in SGR (-1) and LIQD would lead to declines in SGR by 3.2% and 0.38%, respectively. The Wald test, which yielded a probability value of 0.000, indicated that the combined effect of all measures of intellectual capital and control variables significantly influenced the Sustainable Growth Rate (SGR). This result supports the rejection of the null hypothesis and confirms that both firm age and liquidity play a significant controlling role in the relationship between intellectual capital and earnings sustainability.

## 5. DISCUSSION OF FINDINGS

Equations One examines the effect of intellectual capital and earnings sustainability using Rappaport's corporate sustainability growth rate model; while the controlling effects of firm liquidity and age are examined in Equation 2.

The results are consistent with previous research, such as Akintoye et al. (2022) who identified a positive impact of the Value-Added Intellectual Coefficient (VAIC) on return on assets, Asogwa and Ewans (2020) who found a significant positive relationship between intellectual capital and firm sustainability, and Ekanem (2017) who reported a positive link between intellectual capital and organizational sustainability.

International studies further support these findings. For instance, Nhon, Thi, and Thi (2020) observed that intellectual capital dimensions directly affect firm performance in Vietnam, while Lu et al. (2021) highlighted its importance for sustainable growth in firms from China and Pakistan. Other research, including Ozkan, Cakan, and Kayacan (2017) and Hossain, Rahman, and Mia (2022) also found positive effects of intellectual capital on financial performance and firm value.

However, some studies, such as those by Kibiya et al. (2019); Nuryaman (2015) and Shafi'u, Udin, and Bahamman (2017) reported negative effects, potentially due to differences in research contexts or methodologies. In contrast, the results of this study align with the theoretical frameworks of resource-based and stakeholder theories, which argue that the effective utilization of intellectual capital enhances corporate sustainability.

Overall, the findings highlight the significant role of intellectual capital in driving earnings sustainability, with firm liquidity and age acting as important moderating factors.

**Table 4.** Summary of empirical findings.

| Constructs | Findings of the study | Supported findings | Contrast findings | Remarks |
|---|---|---|---|---|
| Human capital | Insignificant positive effect | Mukherjee and Sen (2019). – (Higgin's sustainable growth rate model), secondary data: insignificant positive on corporate sustainable growth of Indian firms. Tran, Nguyen, and Pham (2022) in Vietnam; insignificant positive effect (ROE). | Nhon et al. (2020) - (field survey study); significant positive effect (ROA) Vietnam information communication technology (ICT) sector. Lu et al. (2021) – *expost facto* study; significant positive effect on both Pakistani and Chinese firms (SGR, Higgin's model). Nuryaman (2015) -secondary data; insignificant negative effect on Indonesia firms (ROE, ROA and NPM) Hossain et al. (2022) – (secondary data) - significant positive effect on ROE of listed banks in Bangladesh Ewereoke (2018) – secondary data, significant positive effect on ROA of Nigerian firms. Tran et al. (2022) in Vietnam; significant positive effect (ROA). | The variations in the result obtained in this study as compared to previous studies could be due to different dimensions of the studies to earnings; difference in method of data collection and analytical techniques adopted; different economic environments, time gap of the study, and different sector assessed. |
| Relational capital | Insignificant positive effect | Lu et al. (2021) – *expost facto* study; insignificant positive effect on both Pakistani and Chinese firms (SGR, Higgin's model). Tran et al. (2022) in Vietnam; insignificant positive effect (ROE). | Nhon et al. (2020) - (field survey study); significant positive effect (ROA) In Nigeria context, Asogwa and Ewans (2020) - (field survey study – questionnaire was employed); significant negative and significant positive (firm sustainability) Mukherjee and Sen (2019) – (Higgin's sustainable growth rate model), secondary data: significant positive on corporate sustainable growth of Indian firms. Tran et al. (2022) in Vietnam; significant positive effect (ROA). | |
| Innovative capital | Insignificant positive effect | | In Nigeria context, Asogwa and Ewans (2020) - (Field survey study – questionnaire was employed); Mixed results from different samples significant negative and significant positive (firm sustainability) Ewereoke (2018) – secondary data, significant positive effect on ROA of Nigerian firms. Mukherjee and Sen (2019) – (Higgin's sustainable growth rate model), secondary data: significant positive on corporate sustainable growth of Indian firms | |
| Structural capital | Insignificant positive effect | Lu et al. (2021) – *expost facto* study; Insignificant positive effect on | Lu et al. (2021) – *expost facto* study; significant positive effect on Pakistani firms (SGR, Higgin's model). Hossain et al. (2022) – (Secondary data) - insignificant negative effect on ROE of listed banks in Bangladesh | |

| Constructs | Findings of the study | Supported findings | Contrast findings | Remarks |
|---|---|---|---|---|
| | | Chinese firms (SGR, Higgin's model).<br>Nuryaman (2015) - secondary data; insignificant positive effect on Indonesia firms (ROA and NPM) | Ewereoke (2018) – secondary data, significant positive effect on ROA of Nigerian firms.<br>Nuryaman (2015) -secondary data; significant positive effect on Indonesia firms (ROE)<br>Tran et al. (2022) in Vietnam; significant positive effect (ROA, ROE). | |
| Capital employed | Insignificant positive effect | Hossain et al. (2022) – (secondary data) - insignificant positive effect on ROE of listed banks in Bangladesh.<br>Nuryaman (2015) - secondary data; insignificant positive effect on Indonesia firms (ROE) | Nuryaman (2015) -secondary data; insignificant negative effect on Indonesia firms (ROA and NPM)<br>Ewereoke (2018) – secondary data, significant positive effect on ROA of Nigerian firms.<br>Mukherjee and Sen (2019) – (Higgin's sustainable growth rate model), secondary data: Significant positive influence on corporate sustainable growth of Indian firms.<br>Tran et al. (2022) in Vietnam; significant positive effect (ROA, ROE). | |
| Firm age | Insignificant positive effect | Nil | Ewereoke (2018) – secondary data, significant negative effect on ROA of Nigerian firms.<br>Mukherjee and Sen (2019) – (Higgin's sustainable growth rate model), secondary data: Negatively but insignificantly moderates the effect of intellectual capital on corporate sustainable growth of Indian firms. | |

Table 4 summarizes the findings of previous studies related to the current research, presenting a comprehensive overview of existing knowledge. It categorizes the findings into constructs of the explanatory variable (intellectual capital), supported findings, contrasting findings, and remarks, providing a framework for understanding the relationships between intellectual capital measures and firm's sustainable growth as discovered in various studies across the globe.

## 6. IMPLICATIONS OF FINDINGS

The findings of this study reveal a critical gap in the adoption of intellectual capital measures among firms, particularly in developing countries. It highlights that many firms have not effectively utilized intellectual capital metrics to evaluate the significance of their resource components. Additionally, the study uncovered that some firms are facing financial distress, as evidenced by negative equity values, which indicates severe losses that have depleted shareholders' investments. This underscores the urgency for improved management strategies focused on revitalizing operations through effective intellectual capital management. Shareholders and board members are called to act promptly to prevent potential liquidation of their firms.

The results indicate that certain firms are indeed in financial trouble, with negative equity values confirming the presence of the issues identified. This should serve as a warning for potential investors to exercise caution.

This study should prompt management to better oversee and manage the resources entrusted to them, ensuring the sustainability of the business and safeguarding stakeholder interests. The observed insignificant positive effects of intellectual capital components suggest the need for firms to develop policies that assess and maximize the value of their investments to restore confidence in management and investment security.

## 7. SUMMARY AND CONCLUSION

This study concludes that intellectual capital significantly impacts the corporate sustainability of non-financial firms listed in Nigeria. Moreover, liquidity and firm age play crucial roles in moderating this impact. Based on these findings, the following recommendations are made:

1. Management Practices: Managers should leverage intellectual capital as a key metric for evaluating firm performance and managerial efficiency. Salaries and wages should be assessed not merely as routine expenses but as investments that can drive sustainable growth. Enhancing employee engagement through a supportive work environment, good benefits, performance appraisals, and continuous training is essential for improving workforce efficiency and productivity.
2. Reporting Standards: Accountants should ensure transparent disclosure of intellectual capital information, particularly relational and innovative costs, in financial statements to better evaluate their value and contribution to sustainable growth.
3. Government Role: The government should enforce compliance with employment laws to boost human capital value, reduce labor turnover, and enhance employee efficiency. Additionally, providing a stable market environment, including effective distribution channels and regulations, will help firms manage market volatility and improve their performance.
4. Crisis Management: In cases of significant losses, firms should consider internal reorganization to protect equity holders' interests. Managers need to focus on intellectual capital to ensure sustainable growth.
5. Benefits of Firm Age: Leverage the advantages of firm age, such as brand recognition and market share. Adequate working capital is crucial for productivity and sustainability, and management should optimize these factors to enhance the impact of intellectual capital on corporate sustainability.

**Funding:** This study received no specific financial support.
**Institutional Review Board Statement:** The Ethical Committee of the Babcock University, Nigeria has granted approval for this study on 3 July 2023 (Ref. No. NHREC/24/01/2020).
**Transparency:** The authors declare that the manuscript is honest, truthful and transparent, that no important aspects of the study have been omitted and that all deviations from the planned study have been made clear. This study followed all rules of writing ethics.
**Data Availability Statement:** The corresponding author can provide the supporting data of this study upon a reasonable request.
**Competing Interests:** The authors declare that they have no competing interests.
**Authors' Contributions:** All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

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