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# Effect of Intellectual Capital Development on Firm Value of Technology Firms in Nigeria

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**ABSTRACT**: Intellectual property as intangible assets includes patents, trademarks and copyrights, which can also be included in the traditional financial statement. Intellectual capital can be defined as the knowledge that is transformed into intellectual property or the end result of the process itself. The main objective of the study is to examine the effect of intellectual development on firm value of technology firms in Nigeria. Specifically, the study assesses the effect of human capital development, structural capital development, relational capital development and innovation capital development on firm value of technology firms in Nigeria. The study is anchored on the resource-based view (RBV) theory. The researcher adopted *ex-post facto* design in the study. The result of the study revealed that human capital development, structural capital development, relational capital development and innovation capital development has no significant effect on firm value of technology firms in Nigeria. The studies therefore conclude that intellectual capital development has positive and significant effect on firm value of technology firms in Nigeria. Amongst the recommendations is that management of the technology firms in Nigeria make more provisions for human capital development since this will enhance the firm value of technology firms in Nigeria. The management of the technology firms in Nigeria should make policies that will enable more structural capital development to improve technology firms in Nigeria. The management of the selected technology firms in Nigeria should also make more policies that will improve the relational capital development as a catalyst to improve firm value of technology firms in Nigeria. and the management of the selected technology firms in Nigeria should put in place effective and appropriate innovation capital development such that would enhance the firm value of technology firms in Nigeria

Key words: Intellectual capital development, firm value, technology firms

## INTRODUCTION

With the appearance of the knowledge economy era, knowledge has become an important resource which is gradually replacing the tangible capital such as machinery, equipment, raw materials to enhance the competitiveness of enterprises and promote its firm value (Pulic, 1998; Xu & Liu, 2019). The popularity of artificial intelligence makes "innovation" become the source of a country's economic vitality (Lei, 2020). For enterprises, only continuous innovation can maintain its vitality. Compared with other developed countries, Nigerian innovation ability and intellectual capital utilization ability are deficient, which requires Nigerian enterprises to tap the potential of intellectual capital development, to innovate products, services and management systems constantly and to utilize intellectual capital improving firm value of technology firms (Onyekachi, 2020).

On the other hand, the firm value of technology firms has attracted more and more attention from academia and industry (Qiao et al., 2016; Xu et al., 2019; Xu et al., 2019; Xu et al., 2019b; Xu al., 2019d; Zaid et al., 2018). The firm value of technology firms determines the dynamic development trend of technology firms, which not only reflects the potential of the firm value of technology firms but also affects its future financial performance. Some scholars believe that tangible resources are essential to the firm value of technology firms, while the intangible resources with the characteristics of scarcity, non-imitation, and irreplaceability determine whether technology firms can obtain a sustainable competitive advantage (Si et al., 2020; Xu et al., 2019c; Xu et al., 2019a; Xu et al., 2019b; Xu et al., 2019d). This would link intellectual capital development with the firm value of technology firms closely.

The existing literature has demonstrated that intellectual capital development has become key competitiveness of technology firms (Sardo & Serrasqueiro, 2018; Xu & Liu, 2020), contributing to its brand value, financial performance and innovation ability. However, these studies focus on short-term corporate performance or static financial profitability indicators. Nowadays, with the rapid technological upgrading, it is insufficient to evaluate an enterprise performance only by the short-term financial indicators, it is necessary to measure the long-

term operation and development ability of the enterprise (Scott, 2013).

The evaluation of firm value of technology firms not only reflect the historical performance of technology firms but also predict the profit expansion of technology firms in the future. If technology firms want to own an excellent development of technology firms, they must utilize intangible resources (intellectual Capital development) to maintain competitive advantage, and adjust the investment in intellectual capital with dynamic changes of the internal and external operating environment. (Arvan et al., 2016; Rooney & Dumay, 2016). There is little research focus on the relationship between intellectual capital development and firm value of technology firms in Nigeria. Moreover, the majority of literature selects high-tech industries as samples to study intellectual capital development (Purohit & Tandon, 2015; Xu & Li, 2019) and pay little attention to the technology firms, traditional industries and emerging industries. The reality is that those enterprises attach importance to technological and knowledge innovation will be interested in the management of intellectual capital development. Due to different industries have various requirements for resources, the impact of different resources on the industry will be variety (Wei et al., 2019; Xu & Chen, 2020b; Xu et al., 2020a; Xu et al., 2020b; Xu et al., 2020c; Zhu et al., 2020). Therefore, whether intellectual capital invested in enterprises with high technology products has the corresponding output. Are the outputs significantly to improving firm value of technology firms. There is great practical significance to answer these issues different from other industries. Is the intellectual capital of all industries conducive. Hence, the study examines the effect of intellectual development on firm value of technology firms in Nigeria

It has become therefore imperative for technology firms in Nigeria to develop methods of valuing their intellectual capital development and firm value, if it would continue to be relevant in the ever competitive knowledge-based economy. Therefore, this study is intended to determine the effect of those variables (human capital development, structural capital development, relational capital development and innovation capital development) on firm value of technology firms in Nigeria. In line with the objective of this study, the following hypotheses were formulated to guide the study:

**$H0_1$**: Human capital development has no significant effect on firm value of technology firms in Nigeria

**$H0_2$**: Structural capital development has no significant effect on firm value of technology firms in Nigeria

**$H0_3$:** Relational capital development has no significant effect on firm value of technology firms in Nigeria

**$H0_4$:** Innovation capital development has no significant effect on firm value of technology firms in Nigeria

## LITERATURE REVIEW

### Concept of Intellectual Capital Development

Intellectual capital, the possible explanation for its broad definition could be seen by its synonymous use with other words such as intangible assets, invisible assets, knowledge assets, knowledge capital, information assets, human capital and the hidden value of companies (Bontis, 2001) (Tseng & Goo, 2005). According to Sullivan (2000), intellectual property as intangible assets includes patents, trademarks and copyrights, which can also be included in the traditional financial statement. Intellectual capital can be defined as the knowledge that is transformed into intellectual property or the end result of the process itself. Intellectual assets are a part of intellectual capital. They are "the codified knowledge and know-how of the firm's human capital."

Since the 1990s, academia and industry have begun to discuss intellectual capital. For the composition of intellectual capital, it is the sum of all the things that can create value, such as knowledge, experience, corporate culture, internal and external relations (Pulic, 2000; Sardo & Serrasqueiro, 2018; Xu et al., 2019c; Xu et al., 2019a; Xu et al., 2019b; Xu et al., 2019d). For the earnings of intellectual capital, it is the sum of all the expertise that can improve the competitive advantage of the enterprise. For the invisibility of intellectual capital, it is all intangible assets that can increase enterprise value and create profits beyond its book value (Sardo & Serrasqueiro, 2017). For the components of intellectual capital, it includes human capital, structural capital and relational capital (Nimtrakoon, 2015).

The existing literature usually divided the concept of intellectual capital into two-components, three-components, four-components and five-components (Asiaei & Jusoh, 2015; Guerrero-Baena et al., 2015; Ulum et al., 2014; Xu et al., 2017). The two-

components include human capital and structural capital. The three-components include human capital, structural capital and relational capital. The four-components include human capital, process capital, innovation capital and relational capital. The five-components include human capital, structural capital, innovation capital, process capital and customer capital.

Although there are many criteria to divide the components of intellectual capital, there is no significant difference in the understanding of the essence of intellectual capital among these scholars. The specific measurement methods could be employed according to the research purpose and objects.

On the other hand, the sustainable growth of enterprises has attracted more and more attention from academia and industry (Qiao et al., 2016; Xu et al., 2019c; Xu et al., 2019a; Xu et al., 2019b; Xu al., 2019d; Zaid et al., 2018; Lei, 2020; Liu, 2019). The ability of sustainable growth determines the dynamic development trend of enterrprise, which not only reflects the potential of the enterprise's survival and development but also affects its future financial performance. The existing literature has demonstrated that intellectual capital has become key competitiveness of enterprises (Sardo & Serrasqueiro, 2018; Xu & Liu, 2020), contributing to its brand value, financial performance and innovation ability. If enterprises want to own an excellent efficiency of sustainable growth, they must utilize intangible resources (intellectual capital) to maintain competitive advantage, and adjust the investment in intellectual capital with dynamic changes of the internal and external operating environment.

**Human Capital Development**

Human capital (HCD) is critical to organizations survival and connotes the human resources that make up the entirety of the organization (Bontis 1998). It is the centre piece of intellectual capital as it is viewed as the combined skill, innovation, knowledge and ability of employees (Bontis, Keow & Richardson, 2000). HC is one of the underlying strategic resources, which is both supportive and necessary for success in any organization since human resource knowledge and skill is vital in today's fast-paced, changing competitive climate (Subramaniam & Youndt, 2005; Edvinsson & Malone, 1997; Ahmadi et al., 2012; Rahim, Atan & Kamaluddin, 2016).

Human Capital consists of the skills, competencies and abilities of individuals and

group (Stewart, 1997). Human Capital is interpreted as employee values creating potentials depicted in the knowledge, competencies, skills, experiences, abilities and talents of firm's employees and managers. The concept and perspective of human capital stems from the fact that there is no substitute for knowledge and learning, creativity and innovation, competencies and capabilities and that they need to be relentlessly pursued and focused on the firm's environmental context and competitive logic. Human capital captures knowledge, professional skills, experience and innovativeness of employees within an organization, Boujelbene and Affes (2013; Banimadh, et al. 2012; Uadiale and Uwuigbe, 2011; Odogwu and Chidi, 2010).

**Structural Capital Development**

Structural capital (SCD), is sometimes used in place of organizational capital in existing intellectual capital literature. It includes all non-human reserves of knowledge in a firm for better innovativeness and performance (Bontis 1998; Youndt, Subramaniam & Snell 2004). Structural capital provides for efficient processes of communication and operation, which facilitate knowledge related activities and eventually contribute to values and profits (Karagiannis, Waldner, Stoeger & Nemetz, 2008). It is referred to as the knowledge that is left at work when employees' close from work. Structural capital is within the control of an organization as they possess and manage it to the benefit of the organization most especially when combined with other capitals (Edvinsson & Malone 1997). It involves the assets; hardware, organizational culture and practices, intellectual property rights, software, repository, research and development activities, and whatever supports increased efficiency and effectiveness (Steenkamp, & Kashyap, 2010).

Khan (2016), explored the strategic links between structural capital and organizational innovation in Australian SMEs. The study used the Confidentialized Unit Record File (CURF) database from the Australian Bureau of Statistics (ABS), Business Longitudinal Database (BLD) (2013) to investigate 2,154 SMEs. The result revealed that structural capital was a necessary ingredient for achieving organizational innovation but however the study indicated that the relationship declines over time. This study ignored larger enterprises as though it only considered enterprises employing less than 200 employees. Intellectual properties are protected commercial rights such as patents, trade secrets, copyrights and trademarks.

Intangible assets are all of the other talents and theory by which an organization is run.

**Firm Value of Technology Firms in Nigeria**

Firm value of technology firms in Nigeria is a subjective measure of how well a technology firms in Nigeria can use assets from its primary mode of business and generate revenues. This term is used as a general measure of a firm's overall financial health over a given period of time, and can be used to compare similar firms across the same industry or to compare industries or sectors in aggregation (Okeke, 2015).

There are many different ways to measure firm value, but all measures should be taken in aggregation. Line items such as revenue from operations, operating income or cash flow from operations can be used, as well as total unit sales. Furthermore, the analyst or investor may wish to look deeper into financial statements and seek out margin growth rates or any declining debt. Return on Equity, Return on Assets and Net Assets Per Share were used as a performance measurement in the prior expectations of Nahiba (2017), Brockman (2015), Oliveira, Rodrigues and Craig, (2015), Raheman, Salleh, Afza and Chek (2014), Abd.Hamid, Abdul Aziz, Dora and Said (2017) and Rouf (2016) etc

For the purpose of this study, one accounting based measurement (ROE) was used. i.e Return on Equity (ROE) was used to measure financial performance as used by Oliveira, Rodrigues and Craig, (2015), Raheman, Salleh, Afza and Chek (2014). This was captured as Net Profit After Tax divided by Total Equity i.e (ROE) This is expressed mathematically as

ROE = NPAT/Total Equity

**Theoretical Framework**

The study is anchored on the resource-based view (RBV) theory Barney, 1991. Based on the central premise of RBV, organizations would be able to outperform other organizations and gain an edge over competitors if they possess valuable, rare, inimitable, and non-substitutable resources and capabilities (Barney, 1991). The resource-based view (RBV) of the firm argues that sustained competitive advantage derives from the firm’s resources and capabilities – bundles of tangible and intangible assets, including management skill, organizational operations and activities, and the depth of knowledge and information that they control (Barney, 2001). Thus, companies should assure clients that their performance exceeds all known expectations. Many scholars asserted that investment in intellectual capital leads to an

improvement in economic performance (Bollen, Vergauwen and Schnieders, 2005; Bontis, 1998; Sharabati, Jawad & Bontis, 2010). This performance is defined by the profitability of operations, which represents a surplus or a margin that is captured due to the difference between the cost of income or production.

The underlying assumption of this theory is the basis for our study that intellectual capital can influence corporate sustainability of consumer goods companies in Nigerian. As the RBV theory provides that performance improvement is only possible when a firm has a comparative advantage over its competitors, and this competitive advantage is gained through intellectual capital acquisition. The theory supports that having intellectual capital provides an advantage for improved corporate sustainability of consumer goods companies in Nigerian.

**2.3. Empirical Review**

Justin, Kwaghfan and Michael, (2021) investigated the relationship between Intellectual Capital Reporting (ICR) and Financial Performance of listed consumer goods companies in Nigeria in the Covid-19 Pandemic era. The study deployed ex-post facto research design as data were sourced from published accounts and annual reports of fifteen (15) listed consumer goods companies in Nigeria from 2012-2019. OLS regression was used to analyze the data with the aid of STATA version 14.2. Results revealed that ICR components that is HCR, SCR and RCR have significant relationships with financial performance proxied by Tobin's Q. The study therefore concluded that there is a strong relationship between ICR and financial performance of listed consumer goods companies in Nigeria. The study made a policy recommendation among other things that, management should invest more aggressively in human capital development in order to enhance value and competitiveness of their companies in the post Covid-19 pandemic era.

Mutalib and Abdul, (2020) examined the intellectual capital (IC) disclosure's effect on the market value of the companies listed on Nigerian Stock Exchange's main board. The hypothesis for the study is formulated using signaling theory. Using content analysis of sampled 30 most capitalized firms, the study generates IC disclosure scores from annual reports. IC is surrogated with customer capital, protected capital, human capital, innovation capital and process capital, while corporate market value is proxied with market capitalization. This study longitudinally

examined the connection between market capitalization and IC disclosure quality using data between 2016 and 2019 financial years based on ordinary least square method. The result revealed that the listed companies' corporate market value and the overall IC disclosure are significantly and positively correlated. The study recommends that managers should disclose adequate information on IC because of its influence on investors' decisions and activities at capital market.

Salim and Ejikeme, (2019) explored the effect of human, structural and relational capital on operational performance of hospitality firms. The study adopted a survey research design whereby questionnaires were administered to a sample of two hundred and forty (240) respondents. Multiple regression analysis was employed to test the three (3) hypotheses formulated. The study found that human, structural and relational capital has a significant and positive effect on operational performance. The study concludes that intellectual capital is an important and necessary factor to be considered by firms in terms of achieving competitive advantage. The study recommends intensive and well-structured training for staff, the creation of corporate memory as well as the improved relationship with stakeholders.

Awan and Saeed (2015) analyzed the concept of intellectual capital, its importance for higher educational institutions and its impact on their working environment and performance. The author selected two universities, namely: Bahauddin Zakariya University Multan and Islamia University Multan and has taken a sample of 200 employees of these Universities: 150 academic and 50 non-academics. The data was collected through a structured questionnaire by conducting face-to-face interview. Three estimation methods were used to analyze the data. Five point likert scales was used to record the view of respondents about the importance of intellectual capital and its management by these two selected Universities.

Mbugua and Rotich (2014) examined the effects of intellectual capital on profitability of listed Kenyan commercial banks. The study focused on four variables; human capital, structural capital, relational capital and innovation capital. Descriptive research design was used to test how independent variables influenced listed banks profitability. The target population was ten commercial banks that were listed in Nairobi Securities

Exchange by 2012. Data was sources from published audited accounts for last 5 years from 2009-2013. Descriptive statistical tool MS-Excel and SPSS was used to analyze data. The study found that structural capital and innovation capital affects listed commercial banks of Kenya profitability. The study recommends that Kenyan listed banks to continue with strong control over structural and innovation capital, more allocations for intellectual capital investment be made to the two elements of intellectual capital for more growth in profitability.

Djamil, Razafindrambinina and Tandeans (2013) examined the impact of intellectual capital on firm‟s stock return. The increasing importance of intellectual capital that generates more value is beneficial both for managers and investors at large. The banking sector in Indonesia is chosen as the data sample for this research. Intellectual capital is measured by VAICTM, a method was adopted. The regression models explore the relationship between current and future stock returns and intellectual capital and its constituents. The findings show that intellectual capital does not affect the current stock return, but it however contributes to stock return growth. Only one element of intellectual capital affects the stock return. The results may indicate that changes of stock returns are mostly determined by external factors such as inflation, exchange rate and socio-economic conditions.

Ngari, Gichira, Aduda and Waititu (2013) examined the relationship between Intellectual Capital Accounting and Business Performance of Pharmaceutical Companies in Kenya. To do this study, the researchers formulated three hypotheses. With a target population of eighty-nine (89) local pharmaceutical manufacturing companies, a sample size of 31 companies qualified for the study as they were the only ones that has been licensed by Pharmacy and Poisons Board and this signifies a 35% o total population. Data were collected through a 5-Scale Likert structured questionnaire administered to 31 pharmaceutical companies. The Multi-regression analysis tool, Analysis of Variance (ANOVA) and Pearson Bi-variate correlation coefficient were used to test the hypotheses. The result shows that intellectual capital accounting has positive relationship with business performance; however, human capital was the most prominent of intellectual accounting.

Mavridis (2005), appraised VAIC model on financial performance using seventeen

commercial banks and concluded that value added (VA) and physical capital has normal, strong and positive relation. Another study was conducted to measure the intellectual capital performance i.e. (HCE, SCE, and CEE) and its impact on financial performance (ROE, EPS and ASK) of 150 listed companies in Singapore stock exchange by using VAICTM model and conduced that IC performance has significant relation with firm's performance of UK banks over the period 1999-2005 and argued that efficiency of U.K banks is based on human capital which means an efficient bank is more investing to create Human Capital Efficiency (HCE). Ahangar (2011) conducted the study by employing the VAICTM to measure the intellectual capital performance and its impact on financial returns in Iranians companies. He concluded that Human Capital Efficiency (HCE) has significant and positive impact on financial returns of companies whereas the relationship of structural and physical capital was not significant with financial performance of companies.

FV= f (HCD, SCD, RCD)

Where:

FV= Firm Value; HCD= Human capital development; SCD= Structural capital development

## METHODOLOGY

The study adopted *ex-post facto* research design. Secondary data was used and sourced from the financial statements of selected listed technology firms in Nigeria for the period of 2016-2021. The study was conducted on intellectual development on firm value of technology firms in Nigeria. The target population of the study comprise of one hundred and forty four (144) listed technology firms in Nigeria stock exchange. The listed technology firms studied include LG, MTN, SAMSUNG, TECNO, ARTEL Nigeria, GLO Nigeria. The data collected were tested and subjected to diagnostic and specification tests. The diagnostic tests include; correlation coefficient, multicollinearity test, normality and hausman tests. Ordinary least square regression was run with Eview 7 software.

### Model Specification

The model adopted for study is the model of Onuorah and Osuji (2014) who examined intellectual capital development and firm value of technology firms in Nigeria

The Model is stated thus:

RCD= Relational capital development

**The model is modified by introducing innovation capital development**

FV= f (HCD, SCD, RCD, ICD)

The Econometric Equation Form of the Model is:

$FV = \beta 0 + \beta 1\ HCD + \beta 2\ SCD + \beta 3\ RCD + \beta 4\ ICD + \mu$-

**Where:**

FV= Firm Value; HCD= Human capital development; SCD= Structural capital development

RCD= Relational capital development; ICE= Innovation Capital development

$\mu$ = Stochastic Disturbance (Error Term)

f = Functional Relationship

$\beta 0$ = Intercept of Relationship in the Model Constant

$\beta 1$, $\beta 2$, $\beta 3$, $\beta 4$,= are the Coefficients of the Independent Variable

**Operational Definition of the Variable**

| S/N | VARIABLES | DEFINITION/MEASUREMENT | CODE | SOURCE |
|---|---|---|---|---|
| 1 | Human Capital Development | computed as Revenue minus cost of revenue divided by Staff Cost | *HCD* | Tayyem, and Al-Mawali, (2020) |
| 2 | Structural Capital Development | Computed as Revenue minus cost of revenue and staff cost divided by Revenue minus Cost of Revenue. | *SCD* | Tayyem, and Al-Mawali, (2020) |
| 3 | Innovation Capital Development | Total asset intangibility | *ICE* | Mosavi1, Nekoueizadeh and Ghaedi (2012) |
| 4 | Relational Capital Development | the composite sum of the separate indicators, ; | RCD | Najibullah (2005) |
| 5 | Firm Value | Market price of shares divided by the book value | FV | Tayyem, and Al-Mawali, (2020) |

**Source: Researcher's Concept (2023)**

**Hausman Test**

To decide whether to use fixed or random effects model, the researcher ran the Hausman test with the null hypothesis, with the preferred model for the data being fixed as a random effect versus alternative of a fixed effects model. The fixed and random effects models are stated below:

$Y_{it} = X_{it}\beta + \alpha_i + \mu_{it}$ …….…. (Fixed effects )…….. (3.1) '

$Y_{it} = X_{it}\beta+\alpha_i+\mu_{it}+\varepsilon$ ……. (Random effects )…….…….. (3.2)

Where

$X_{it}$= Variable vector

$\beta$ = Coefficients vector (Green cited in Torres- Reynia, 2007).

The Hausman test basically tests whether the unique errors ( ) are correlated with the regressors, the null hypothesis is that they are not. To perform the test requires running the random effects model followed by Hausman test in E-view 7.

**Decision rule**

Reject null hypothesis when $p \leq 5\%$ otherwise accept null to reject alternative hypothesis.

## RESULTS AND DISCUSSION

### Pearson Correlation Matrix

Pearson's correlation coefficient measures the nature of relationship between two or more variables. Therefore, in examining the association among the variables, we employed the Pearson correlation coefficient (correlation matrix) and the results are presented in the table 4.2.2 below.

**Table 4.2.2: Correlation Analysis Intellectual Development and Firm Value of Technology Firms in Nigeria**

| | FV | HCD | SCD | RCD | ICD |
|---|---|---|---|---|---|
| **FV** | 1.0000 | | | | |
| **HCD** | 0.1763 | 1.0000 | | | |
| **SCD** | 0.0995 | 0.0639 | 1.0000 | | |
| **RCD** | 0.1562 | 0.4077 | 0.3907 | 1.0000 | |
| **ICD** | 0.3103 | 0.0537 | -0.1115 | 0.1619 | 1.0000 |

***Source: researcher's summary of correlation result (2023) using E-view 7***

The above results show that there exist a positive and weak relationship between firm value of technology firms and human capital development (FV/HCD= 0.1763). It was discovered that structural capital development (SCD and FV= 0.0995) were positively but weakly correlated to each other. There also exists a positive and very weak association between firm value of technology firms and other explanatory variables such as relational capital development and innovation capital

development (0.15623, and 0.3103) respectively.

**Hausman Effect Test**

The summary result of regression analysis is presented below. However, the study takes into cognizance the non homogeneity nature of the companies hence the need for testing its effect on the data. This necessitated the use of Hausman effect test to ascertain which effect to explain. That is whether fixed effect or random effect is to be used in interpreting the regression result or to ascertain that which is best to be adopted in the study since our data is a panel data with complete information. Below is the summary of the Hausman test result;

Hausman Effect Test: Decision rule

$H_0$ – random effect is preferable to fixed effect

$H_1$ – fixed effect is preferable to random effect

When chi-square probability value is less than 5% – rejects $H_0$ and accepts $H_1$ ($P \leq 0.05$).

When chi-square probability value is greater than 5% – accepts $H_0$ and rejects $H_1$. ($P \geq 0.05$).

Hausman test is used to decide between fixed effect model or random effect model. When the Chi square (Prob) value is greater than 5%, you interpret random effect and say that random effect is mostly preferred to fixed effect but when it is less than 5%, you interpret fixed effect and say that fixed effect is preferred to random effect.

**Table 4.3.1: Summary of Panel Regression (dependent variable, FV)**

**Table 4.3. Hausman Test**

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 | 15.433112 | 8 | 0.0513 |

Cross-section random effects test comparisons:

| Variable | Fixed | Random | Var(Diff.) | Prob. |
|---|---|---|---|---|
| HCD | 8.225703 | 8.471618 | 0.089836 | 0.4120 |
| SCD | -0.034647 | -0.038730 | 0.000019 | 0.3526 |
| RCD | 0.867245 | -1.271406 | 2.106034 | 0.1406 |
| ICE | 0.093053 | -0.018063 | 0.001076 | 0.0007 |

Cross-section random effects test equation:

Dependent Variable: FV

Method: Panel Least Squares

Date: 06/08/23 Time: 06:02

Sample: 2016 2021

Periods included: 36

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 1.025670 | 1.546506 | 0.663218 | 0.5080 |
| HCD | 8.225703 | 1.682878 | 4.887878 | 0.0000 |
| SCD | -0.034647 | 0.026127 | -1.326102 | 0.1863 |
| RCD | 0.867245 | 2.430293 | 0.356848 | 0.7216 |
| ICE | 0.093053 | 0.061604 | 1.510500 | 0.1325 |

Effects Specification

Cross-section fixed (dummy variables)

| | | | |
|---|---|---|---|
| R-squared | 0.722356 | Mean dependent var | 11.69205 |
| Adjusted R-squared | 0.697493 | S.D. dependent var | 9.431674 |
| S.E. of regression | 5.187483 | Akaike info criterion | 6.212779 |
| Sum squared resid | 5408.907 | Schwarz criterion | 6.505865 |
| Log likelihood | -664.4057 | Hannan-Quinn criter. | 6.331135 |

| | | | |
|---|---|---|---|
| F-statistic | 29.05275 | Durbin-Watson stat | 0.655889 |
| Prob(F-statistic) | 0.000000 | | |

**Source: Author's computations 2023 using Eviews 7.0**

For the Hausman test, the null hypothesis is that the preferred model is random effects, while the alternative hypothesis is that the fixed effects model is preferred (Green, 2008). Based on this premise, the fixed effect model was selected since the p-value of the Hausmann's test is less than 0.05. This implies that the study rejects the null hypothesis of the Hausman test in favour of the alternative hypothesis, that the fixed effect model is preferred. Hence, the fixed effect model was used as the best estimator of the effect of intellectual development on firm value of technology firms in Nigeria

**Table 4.3.2. : Summary of Panel Regression (dependent variable, ROA)**

| **Variables** | **Fixed Effect Model ++** | **Random Effect Model** |
|---|---|---|
| FV | 1.225703 | 8.471618 |
| | (6.702298)*** | (5.115798)*** |
| HCD | 1.134647 | 0.038730 |
| | (8.996067)*** | (1.503777) |
| SCD | -0.867245 | 0.652193 |
| | (0.356848) | (0.5150) |
| RCD | 1.093053 | 0.018063 |
| | (6.763774)*** | (0.346407) |
| ICD | 0.019061 | 0.195599 |
| | (0.132718) | (1.793419) |
| R-Squared | 0.722350 | 0.520044 |
| Adj. R. Squared | 0.697493 | 0.501846 |
| F-Statistics | 29.05275 | 28.57793 |
| Prob (F-Statistic | 0.000000 | 0.000000 |
| Durbin Watson | 1.855889 | 1.586326 |

**Source: Author's computations 2023 using Eviews 7.0**

*** and ** denotes significance @ 1% and 5% level, respectively.

Values in parenthesis () are t- values of variables
++ show the accepted Model

Kurt (2015), asserts that emphasis on panel regression is based on the fixed effect model or the random effect model depending on the outcome of the Hausman test. According to Kurt, pooled OLS estimator ignores the pane; structure of the data and simply estimates the parameters and its usual standard errors are incorrect. Hence, this study proceeds to the Hausman test in order to make a decision on the best estimator for the study. The result of the Hausman test is presented in Table 4.4 below.

Based on the fixed effect model, the adjusted R-squared (0.722350) indicates that (human capital development, structural capital development, relational capital development and innovation capital development accounted for approximately 72% of the total variations in the dependent variable firm value of technology firms in Nigeria while the remaining 28% was due to the error term.

On the other hand, the coefficient estimates of the independent variables reveals that a unit increases in human capital development caused firm value of technology firms in Nigeria to increase by 1.225703 units. Also, a unit increase in structural capital development resulted to 1.134647 increase in firm value of technology firms in Nigeria. The coefficient estimate of relational capital development reveals that a unit increase in relational capital development leads to increase in firm value of technology firms in Nigeria by 0.019061 units. The coefficient estimate of and innovation capital development reveals that a unit increase in and innovation capital development leads to a decrease in firm value of technology firms in Nigeria by 0.867245 units.

**Hypotheses Testing**

Accept the null hypothesis ($H_0$) if p-value is greater than 0.05 (i.e p >0.05). On the other hand, reject null hypothesis if p-value is less than 0.005 (ie P< 0.05).

**$H0_1$**: The p-value (0.0000<0.05) which reveals that Human capital development has no significant effect on firm value of technology firms in Nigeria is rejected. Therefore, alternative hypothesis is accepted that Human capital development has positive and significant effect on firm value of technology firms in Nigeria.

**$H0_2$:** The p-value (0.001<0.05) which reveals that structural capital development has no

significant effect on firm value of technology firms in Nigeria is rejected. Therefore ($H1_2$) is accepted that structural capital development has significant effect on firm value of technology firms in Nigeria

**$H0_3$:** The p-value (0.000<0.05) reveals that relational capital development has no significant effect on firm value of technology firms in Nigeria. Therefore ($H1_3$) is accepted that relational capital development has positive and significant effect on firm value of technology firms in Nigeria

**$H0_4$:** The p-value (0.000<0.05) reveals that innovation capital development has no significant effect on firm value of technology firms in Nigeria. Based on this finding, the null hypothesis ($H_{01}$) is rejected and the alternative hypothesis accepted, that Innovation capital development has significant effect on firm value of technology firms in Nigeria

**Discussion of Findings**

The result of the first stated hypothesis shows that human capital development has positive and significant effect on firm value of technology firms in Nigeria. This result is a clear indication that technology firms should make policies that are favourable to human capital development. The result is in line with findings of Adewumi, Yakubu and Olumuyiwa (2018), who submits that human capital development has significant effect on firm value in Nigeria. The second hypothesis result shows that structural capital development has positive and significant effect on firm value of technology firms in Nigeria. The outcome of the findings agreed with finding of Ogaluzor, Odinakachchukwu and Omesi (2019) they observed that structural capital development has improved firm value in Nigeria

The third hypothesis result shows that relational capital development has positive and significant effect on firm value of technology firms in Nigeria**.** Adewumi, Yakubu and Olumuyiwa (2018) found that relational capital development has significant effect on firm value of technology. The final hypothesis result of the study also shows that innovation capital development has positive and significant effect on firm value of technology firms in Nigeria. The result of our analysis is in agreement with the work of Khadijat and Lawal , (2018) who finds that innovation capital development has o significant effect on firm value firms in Nigeria

## CONCLUSION

The study examined the effect of intellectual development on firm value of technology firms in Nigeria. The result of the study revealed that human capital development, structural capital development, relational capital development and innovation capital development has no significant effect on firm value of technology firms in Nigeria. The study therefore conclude that intellectual development has positive and significant effect on firm value of technology firms in Nigeria. Based on the above findings and conclusion, the study recommends that management of the technology firms in Nigeria make more provisions for human capital development, make policies that will enable more structural capital development to improve technology firms in Nigeria and put in place effective and appropriate innovation capital development such that would enhance the firm value of technology firms in Nigeria.

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