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INTELLECTUAL CAPITAL VALUE ADDITION AND THE EFFICIENT ASSETS MANAGEMENT OF LISTED MANUFACTURING FIRMS IN NIGERIA

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Abstract

Research background: One crucial area that has not received good research attention is intellectual property. Even organizations engage the services of recruiting firms to get the best labour, and some workers earn more than others. But intellectual value addition is not ascertained.
Purpose: The goal of this study is to examine the effect of intellectual capital value addition on the efficient asset management of manufacturing firms in Nigeria.
Research methodology: Data was sourced from the published annual accounts of 24 manufacturing firms. The VAIC was adapted to measure Intellectual capital value addition which is the predictor variable, while Return on Assets was used as a determinant of efficient assets management. The ordinary least square regression of the panel data was used to test the hypothesis.
Result: The outcome of the regression revealed that HC is a determinant of ROA with a co-efficient of regression and a significant value of (0.102 > 0.5). SC has an adverse and noteworthy influence on ROA as indicated (–0.046 > 0.05) while CEE has a positive and significant influence on ROA (0.825 > 0.50). The paper affirmed that a weighty and constructive relationship exists amid intellectual capital and efficient assets management of the manufacturing companies and endorsed that listed manufacturing businesses in Nigeria should efficiently and effectively manage intellectual capital.
Novelty: This has contributed to extant literature as it's the first study to investigate the effect of intellectual capital addition on efficient assets management in listed manufacturing companies in Nigeria. There is no study of this nature in Nigeria that has successfully adopted VAIC and it has proved that corporations consider hiring the best-skilled labour because of its contribution which improves the performance of such business. Again, this study covered 240 firm years, that is, ten years each of twenty-four companies, which no other previous study has done.

Keywords: human capital, structural capital, capital employed efficiency, assets management, revenue generation, return on assets

JEL classification: M12, M52, M54

Introduction

The recent collapse of high-profile organizations the world over have ushered in a great deal of nervousness in corporations, permitting the skill of corporate managers as crucial in corporate financial management. On the other hand, the nascent advancement in technology experienced in the corporate sector has also introduced a shift in corporate decision-making to concentrate on intellectual capital rather than traditional factors of production (Adesina, 2019; Madugba, Egbide, Jossy, Agburuga, Chibunna 2021; Raze 2011; Borneinan, 1999; Ekwe 2013; Ifsu, Fang, 2010).

Currently, both developing and developed countries alike are experiencing economic downturns hence organizations nowadays do not just hire labour but the skills that are capable

to fit into the modern production system thereby enhancing corporate performance (Alipour, 2012) opine that intellectual capital increases the competitive edge of corporations. Suffice it to say that the degree of difference between two firms with an identical number of physical assets lies in the management strategies adopted by these firms (Madugba, Agburuga, Egbide, Fadoju, Falaye, 2021; West, Salter, Vanhaverbeke, Chesbrough, 2014; Brennan, Connell, 2000).

Again, skill and expertise are vital in the management of the organization as can be evidenced by the great importance that investors and the financial market attach to it as a change in top executive members manifests in an alteration in share costs Martinez, Cricelli, Ferrandiz, Greco and Grimaldi (2020). Bontis (2001) argued that if knowledge is not vital in corporations subsequently stock value will not respond to variations in the managerial as a division of intellectual capital (Lev, Zaowin, 1999; Lev, 2001; Bontis, 2001). However, the invisibility and not tangibility nature of the worth of skill cannot be reported accurately by the traditional measure accounting that corporations adopt in reporting activities (Ekwe, 2013; Egbide, Agi-Ilochi, Madugba, Taiwo, Ayomide, 2022). Hence, the adequacy and reliability of traditional accounting in present times ought to be questioned as it has been unsuccessful in incarcerating the worth of skills in a worker.

There are deviations on the importance of IC in business performance, though the studies of Obedient, Abdallah, Aqqad, Akhoershiedah and Maqabled (2016), strongly agreed that there is knowledge role in organizational performance. Wright, Kemar, Mcmahan and Deleemo (1995) found out that there is affirmative alliance linking acquaintance and managerial performance.

The available literature on intellectual capital within the scope of the study is in the studies of Ogujiuba (2013), Oni, Akinsanya, and Aminkan (2014), Adelakun (2011) Amah and Amauwa (2017), Eigbiremolen and Anaduaka (2014) and Jaiyeoba (2015) that is studies on intellectual capital and economic growth. To tackle the deficiencies, these studies employed Gross Domestic Production (GDP) as a measure of economic growth and government expenditures in health, education, and enrolments as determinants for intellectual capital. The study of Ekwe (2013) employed value-added intellectual capital as a measure of intellectual capital but concentrated in the banking sector of Nigeria's economy.

To the researchers' knowledge, there is no study in Nigeria in IC that is focussed on listed manufacturing that considered 24 firms for ten years making a total of two hundred and forty firm years especially when consideration is given to the fact that manufacturing firms need less and less physical assets but more and more human/intellectual assets. This study sets out to fill the gaps identified above.

One of the challenges facing corporations nowadays is changes in plans and strategies (Shah, Shah, 2010) in retort to social development and demographical modifications like the dominance of capitalist models, increasing antagonism, industrial development, and the swift senescent of the populace (Garaverts, Kyndt, Dochy, Baert, 2011; Masa'deh, 2013, Masa'dah, Shannak, Maqableh, Tarhim, 2016; Obedient, Masada, Abdallah, 2014, Shannak, Masadah, Obedient, Almajali, 2010; Shannal, Masadeh, Al-zu'bi, obedient, Alshurideh, Altamony, 2012). Consequently, ascent organizational administration styles are not appropriate and effective (Ho, 2008). Hence, organizations now channel their resources into areas like employee education, client associations, etc. (OECD, 2008). These are known as intellectual capital and have become dominant in management decisions (Zeghal, Maaloul, 2008, Kamukama, Ahiauzu, Ntayi, 2010).

Lee, Wu and Chao (2015) opine that IC is a skill that can be transformed into value and it is a professional skill for achieving an aggressive advantage. It can be said that skills are unseen or insubstantial resources that are tough to situate into value and are not ever accounted for in an annual statement such as talent, employees, etc. Discoveries, skills, acquired practical experiences, etc. are encapsulated in intellectual capital. Stewart (1997) and Fredriksen (1998) asserted that it is packaged knowledge.

Divergent opinions exist as regards to mechanisms of intellectual capital (Badrbadi, Akbarpour, 2013) among them is the widely accepted pigeonholed of IC into HC, SC, and RC (Bontis, 2010; Chen, 2008; Hsu, Fang, 2009; Shih, Chang, Lin, 2010).

One major dimension of intellectual capital is human capital which is the aggregate of employees' proficiency, acquaintance, know-how, innovativeness, ability, and dedication (Wang, Wang, Liang (2014). Corporations retort on human capital a lot as it assists corporations to counter environmental changes resourcefully (Madugba, Egbide, Adedoyin, Agburuga, 2020; Kong, 2010; Santos-Rodrigues, Faria, Renfield, Morais, 2013). Edvinsson and Malon (1997) defined (HC) as the hard wares, software, etc. that improve efficiency. It is the mechanisms and structural novelty thereby that make crucial organizations resourceful (Kong, 2010).

Orugun and Aduku (2017) opine that relational asset has to do with the consciousness that a corporation has for its clients, the contentment that turns patrons on and thus keeps their benefaction.

Financial performance is the yardstick for determining and reporting corporate performance as it appears in the financial statements of corporations (Chang, Lee, 2012). Suffice it to say that it is a display of how a corporation performs comparatively to profitability etc. (Ho, 2011). Luo, Huang and Wang (2012) posit that financial performance is the accomplishment

of corporate financial goals which is displayed in the outcome of financial indices and market indicators. Hernaus, Bach ad Vuksi (2012) asserted that financial performance is calculated with the listed yardsticks.

One financial performance measure used in this study is the return on assets which is a portion that indicates the extent a corporation's revenue exceeds its costs. It shows the viability of a business relative to its entire properties. It depicts management competency in the use of assets to engender income (Madugba, Okafor, 2016). It is the percentage of the mesh returns that subtract first-choice shareholders' returns alienated by the original costs of entire assets contained in the financial statement (Ekwe, 2013; Clarke, Seng, Whiting, 2010).

Extant literature establishes that many researchers have examined the relationship between intellectual capital and operating performance. Such studies include Ali, Murtaza, Hadvicaova, Jiang, and Nadeem (2022) their investigations found that an affirmative association exists between structural capital and capital employed in companies quoted in Pakistani and Indian. Austay and Ubaidillah (2023) in their investigation of Islamic banks in which data were sourced from 49 banks covering 2014 and 2018 discovered that a noteworthy link exists between IC and the performance of banks. However, it was observed that capital employed efficiency and human capital had more rapport while structural capital showed a minor association. Madumere and Ubani (2022) found a good association between value-added human capital and the return on assets of DMBs in Nigeria. Though this study was conducted in Nigeria but not in the manufacturing sector and does not cover the same period as our study. Martinez, Cricelli, Ferrandiz, Greco, and Grimaldi (2020), employed a sample of 3,744 firms in Spain and established that acquired skill has an affirmative upshot on open innovation-related performance but relational and human capital were subject to diminishing returns. The study was silent on the duration and failed to adopt the VAIC model and did not also state how open innovation was determined. Adesina (2020) utilized the panel data of 339 commercial banks functioning within 31 African countries for the period 2005–2015. He indicated that worker skill wields a significant effect on bank profitability. In a study from the Malaysian context employing the partial least squares method, Yusoff, Omar, Zaman and Samad (2019) explored the contribution of green intellectual capital toward business sustainability focussed on SMEs in the manufacturing industry, 840 questionnaires were distributed and only 176 responses were received. The outcome indicated a significant association between green structural and relational capital with corporate viability. Mahmood and Mubarak (2020) researched 217 small and medium-scale industries in Pakistan. Primary data sourced from key players in enterprises were used and the outcome revealed that there is a positive and significant influence

of intellectual capital on the technology assumption capacity of the enterprises. In another study in Taiwan, Huang Huang (2020) considered intellectual capital contribution in transport companies and adopted the partial least square regression approach and found that there is the helpful effect of intellectual on innovation capacity. Pinar, Findikli, and Kose (2019) obtained data from 234 participants and adopted a structural equation approach using the resource dependency dimension as a tested variable and found that skill exhibits a responsible stimulus on solidarity and intellectual capital when related to dependency and uncertainty and showed a balanced association in terms of its moderating effect. Oppong and Pattanayak (2019) in their attempt to determine the contributions of knowledgeable workers to productivity in money-making banks in India used panel data covering 2006–2017 and avowed that the component of intellectual capital improves productivity. Patthirasinsiri and Wiboonrat (2017) classified intellectual capital into four different categories and later divided it into six parts. The study revealed that IC contributes immensely to the performance of the newly established science parks. In a similar study in Taiwan accounting firms, Lee and Lin (2019) tested the contribution of the four categories of intellectual capital on operating performance using the ordinary least square regression model and affirmed that a firm with young employees enjoys more improved performance than others. Curiously, investigating the measures of IC, Kianto, Ritala, Vanhala, and Hussinki (2020) vehemently suggest that firms should as a matter of urgency revisit the foundation of intellectual capital to determine what knowledge is hence its measurement. Castillo, Pacheco, Hernandez-Fernandez, Manotas, Barroro, and Silva (2019) in their study adopted a quantitative approach and found a relationship existing between the tested variable. Ahangar (2011) in his study of an Iranian company, which spanned from 1980–2009 also adopted VAIC and ROA, and secondary data sourced from the financial statement was used to test the hypotheses, found that corporate profitability and productivity are explained by intellectual capital. Clarke, Seng, and Whiting (2010) in their study which focussed on Australia between 2004 and 2008 adopted VAIC as a determinant of IC. The source of the data was secondary and the findings revealed that there is a direct affiliation connecting IC and financial performance. Bramhandkar *et al.* (2007) found that companies with highly concentrated IC had a more interesting result. Tan *et al*. (2007) also in their study corroborated the finding of Bramhankar *et al.* (2007). Kamath (2008) in his study affirmed that IC is completely and considerably linked with profitability. Pal and Soriya (2012) and Makki *et al*. (2009) also affirm that IC impacts financial performance.

However, Joshi *et al.* (2013) in their investigation to find out the effect of IC on the performance of the Australian financial sector, confirmed that operational performance

is extremely prejudiced by human capital. Mondal and Ghosh (2012) in their study which spanned from 1999 to 2008 with data from the yearly reports of the banks adopted VAIC as a measure of IC while ROA and ROE were employed to quantify profitability and productivity as measures of assets turnover ratio (ATO). The result revealed varied opinions amid IC and Performance.

From empirical literature, there is evidence of mixed findings on the subject matter. While a good number of studies have confirmed that intellectual capital impacts positively and significantly on financial performance, others uphold an adverse result. More so, it is evident that most of these studies are in developing countries where compliance with regulations regarding workforce motivations is strictly implemented, hence the need for this study in Nigeria. Again, no study in Nigeria has thus far adopted the VAIC model to evaluate the contributions of IC on Assets management in 24 manufacturing companies for 240 firm years.

This study adopted the Human Capital Theory which conjectures that schooling enhances the proficiency of a worker through the improvement of their cognitive skills. The theorist holds prima facia that the essence of schooling is to improve human capacity which is an amalgamation of instinctive talent with speculation in human beings (Madugba, Howell, Nwanji, Egbide, Saya, Eluyela, 2020; Egbide, Madugba, Otekunrine, Adenike, Oludare, 2022; Babalola, 2000, as cited in Adelakun, 2011). It is expedient to state that the supply of human resources improves in an era only when the gross venture is greater than reductions over time, with concentrated use or lack of use. This theory will be adopted in this study because it canters on enhancing employees' productivity which leads to increased profitability.

Owing to the debt of literature on the subject matter especially when consideration is given to the fact that manufacturing firms need less and less physical assets but more and more human/intellectual assets. The above gaps necessitated the curiosity to ask what is the effect of human capital, structural capital, and capital employed efficiency on the return on assets of listed manufacturing companies in Nigeria? This paper sets out to examine the effect of human capital, structural capital, and capital employed efficiency on the return on Assets of manufacturing firms in Nigeria with the adoption of value-added intellectual capital (VAIC) while the hypotheses of this study is that the relationship between human capital, structural capital, and capital employed efficiency in listed manufacturing companies in Nigeria is not significant.

1. Methodology

The *ex-post facto* research design was chosen on the account that the data on intellectual capital value addition and the assets management of registered production businesses in Nigeria already exist in the published annual accounts of the companies hence, are not subject to manipulation. Out of 151 manufacturing corporations in Nigeria, 24 companies were selected for the study using a purposive sampling technique. The accessibility and availability of data guided the selection of the companies. The study covered the years 2010–2020. Ordinary Least Squares (OLS) regression was adopted to test the hypothesis. The predicted variable is financial performance proxied by Return on Assets, while the predictor variable is intellectual capital (IC). Value-added intellectual capital (VAIC) which is a composite variable was proxied for intellectual capital in line with Pulic (1998).

VAIC has three elements namely: human capital (HC), structural capital (SC), and capital employed efficiency (CEE). These elements are all additive as shown in Equation 1

$$VAIC = HC + SC + CEE \tag{1}$$

To compute each of these elements, value-added (VA) will first be calculated. VA is therefore the disparity linking output and input. The output here is net sales revenue and input comprises all the charges incurred in generating sales revenue except for labour costs which are considered to be a value-creating entity (Tan, Plowman, Hancock, 2008). VA is described as the net value produced by the firm in a particular year (Chen, Cheng, Hwang, 2005). It is expressed as:

$$VA = I + DP + D + T + M + R + WS \tag{2}$$

where: VA (value added) for the banks are computed as the sum of interest expenses (I); depreciation expenses (DP); dividends (D); corporate taxes (T); equity of minority shareholders in net income of subsidiaries (M); and profits retained for the year (R) wages and salaries. Alternatively, VA can be calculated by deducting operating expenses (materials costs, maintenance costs, other external costs) from operating revenues (Pulic 1998).

Pulic (1998) further states that CEE is the ratio of total VA divided by the total amount of capital Employed (CE) where the capital employed is defined as the book value of a firm's net assets. Equation (3) presents the CEE relationship algebraically:

$$CEE = VA/CE \tag{3}$$

where:

CEE – capital employed efficiency,

VA – value added of the companies,

CE – book value of the net assets of the companies.

"HCE= is the ratio of total VA divided by the total salary and wages spent by the companies on its employees.

$$HCE = VA/HC \tag{4}$$

where:

HCE – human capital efficiency coefficient of the manufacturing companies,

VA – value added of the manufacturing companies,

HC – total salary and wage costs of the manufacturing service companies.

To calculate SCE, Pulic (1998) as cited in Ekwe (2013) opined that the value of the firm structural capital should be determined first.

$$SC = VA - HC \tag{5}$$

where:

SC – structural capital of the manufacturing companies,

VA – value-added of the manufacturing companies,

HC – total salary and wages expenditures of the manufacturing companies.

$$SCE = SC/VA \tag{6}$$

where:

SCE – structural capital efficiency coefficient VA of the manufacturing companies,

SC – structural capital of the manufacturing companies,

VA – value added of the manufacturing companies.

$$ROA_{it} = f(VAIC) \tag{7}$$

$$VAIC = f(HC, SC, CEE) \tag{8}$$

therefore,

$$ROA_{it} = f(HC, SC, CEE) \tag{9}$$

$$ROA_{it} = \beta_0 + \beta_1 HC_{it} + \beta_2 SC_{it} + \beta_3 CEE_{it} + e_t \tag{10}$$

where:

ROA is returned on the assets of manufacturing firms in our study, β means Beta that is the parameter of the estimation, HC, Sc, and CEE has been defined previously.

2. Results and discussion

Evidence from Table 1 indicates that the average value of the Return on Assets of the manufacturing firms is 1.4528. This value is positive and is supported by a standard deviation value of 0.24277. The minimum and maximum values indicated for the same variable are 1.01 and 1.99. Human Capital (HC) is indicated to have an average value of 1.3309 with a standard deviation value of 0.20632. The minimum and maximum value of 1.01 and 1.89 was also indicated for the human capital of the manufacturing firms in our study.

Table 1. Descriptive statistics

	N	Minimum	Maximum	Mean	Std. deviation
ROA	240	1.01	1.99	1.4528	0.24277
HC	240	1.01	1.89	1.3309	0.20632
SC	240	1.00	1.89	1.3453	0.22170
CEE	240	1.01	1.99	1.4204	0.24589
Valid N (listwise)	240	–	–	–	–

Source: authors' computation, 2023.

There is an indication from Table 1 that structural capital is exposed to having an average number of 1.3453, and is supported by a standard deviation of 0.22170. The minimum and maximum values are 1.00 and 1.89. Table 1 indicates that CEE has a middling confident number of 1.4204. This is validated by a customary deviation of 0.24589. The minimum and maximum values are 1.01 and 1.99.

The normality test in this study was piloted with the use of the Kolmogorov-Smirnov and histogram. Table 2 indicated that the return on assets has a statistical value of 0.055. This value is positive and is validated by a probability value of 0.072 implying that the variable is good for further analysis. In addition to confirming the goodness of the ROA data, one can see that the histogram in Figure 1 divulges a round-shaped curve meaning that the data is good.

Table 2. Tests of normality

	Kolmogorov-Smirnov*		
ROA	0.055	240	0.072
HC	0.072	240	0.004
SC	0.112	240	0.000
CEE	0.050	240	0.200**

* Lilliefors Significance Correction.
** This is a lower bound of the true significance.

Source: authors' computation, 2023.

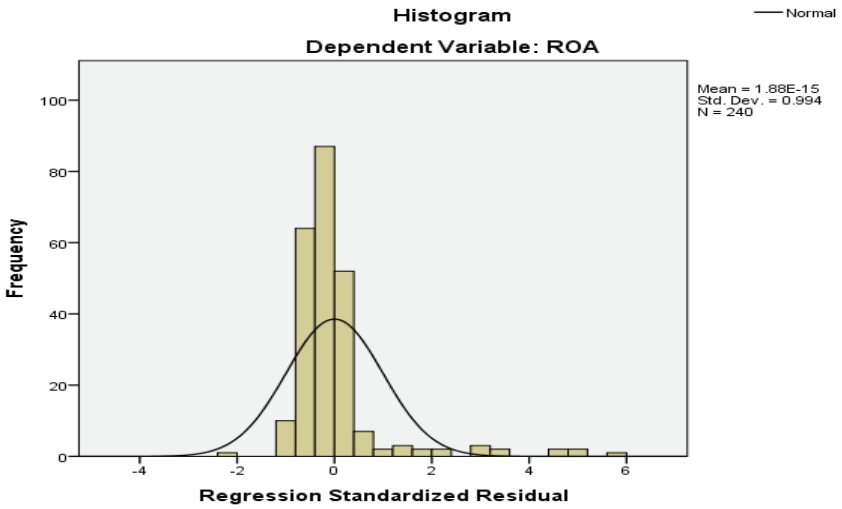


Figure 1. Histogram showing the normality test for ROA

Source: chattered by authors' 2023.

Table 3. Model Summary*

Model	R	R-square	Adjusted R square	Std. error of the estimate	Durbin-Watson
1	0.844**	0.712	0.708	0.13110	1.852

* Dependent variable: ROA.
** Predictors: (Constant), CEE, SC, HC.

Source: authors' computation, 2023.

The results displayed in Table 3, revealed that the association (R) is 84.4% which signifies a very high affirmative affiliation amid the ROA and the predictors. The R-squared of 0.712 proposes that the self-governing variables (HC, SC, and CEE) introduce only 71.2% of the dissimilarities in ROA. About 28.8% transmits to factors not considered in our model. The outcome signposts ROA regulates the IC of registered manufacturing establishments in Nigeria. The adjusted (R) is 0.708 meaning 70.8%, infers that the input of each variable is unimportant to sway the reliant variable in this study. The Durbin-Watson of 1.852 is nearly 2 which designates the non-appearance of autocorrelation in the distribution.

Table 4. ANOVA*

Model		Sum of Squares	df	Mean Square	F	Sig.
1	regression	10.030	3	3.343	194.531	0.000**
	residual	4.056	236	0.017		
	total	14.086	239			

* Dependent variable: ROA.

** Predictors: (Constant), CEE, SC, HC.

Source: authors' computation, 2023.

The F-ratio of 194.531 is significant at $p < 0.001$. This outcome proves that the model of a good fit. Thus, the human capital, structural capital, and capital-employed efficiency variables jointly impact the dependent variable (Return on Assets).

Table 5. Regression results*

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
		B	std. error	Beta			tolerance	VIF
1	(constant)	0.208	0.081	–	2.562	0.011	–	–
	HC	0.102	0.043	0.086	2.345	0.020	0.899	1.113
	SC	–0.046	0.040	–0.042	–1.144	0.254	0.901	1.110
	CEE	0.825	0.035	0.835	23.875	0.000	0.997	1.003

* Dependent variable: ROA.

Source: Authors' computation, 2023

The tolerance numbers of 0.899, 0.901, and 0.997 are far lower than 0.10, signifying that the effects of multi-collinearity are met. Indication from Table 5 signpost that HC has an optimistic and significant link with ROA as corroborated by a co-efficient of 0.102. Pointing

out that, 10.2% of changes perceived in ROA are influenced by HC. This implies that HC has a positive and significant association with the ROA of the companies in our study. It also means that HC influences the ROA of the manufacturing companies in our study. This outcome validates the work of Xu and Wang (2019) and Abbasi *et al.* (2019).

Structural capital (SC) is shown to have a coefficient of –0.046, the implication is that there is an adverse and insignificant link between the ROA and SC of manufacturing firms in Nigeria. It showed that SC is not a determinant of ROA. It further implies that SC does not influence the ROA of the manufacturing companies in Nigeria as shown in Table 5. This conclusion does not agree with the study of Khalique *et al.* (2019). The reason could be traced to the geographical location of the study and the sector where the study was carried out or perhaps the nature and type of data used and number of years covered by this study.

Table 5 exhibited that CEE has an encouraging and significant affiliation with the ROA of listed manufacturing enterprises in Nigeria. This is confirmed by a co-efficient regression value of 0.825 and a t-value of 23.875 which further proved to be significant at 0.05. It further implies that CEE influences the ROA of the manufacturing companies in Nigeria. Our finding is corroborated by the study of Ali *et al.* (2022) though the latter study is not in Nigeria. But this study is in Nigeria and covered 240 firm years with a sample of 24 manufacturing companies, adopted the VAIC model and used an ex-post-facto research design which the later study did not use.

Conclusions and recommendations

The paper probed the effect of intellectual capital addition on the efficient asset management of registered manufacturing firms in Nigeria. The outcome of the test of the hypothesis revealed that HC and CEE have positive and significant links with the return on assets of the manufacturing companies while SC has a negative and insignificant association with the return assets of the companies in this study. Hence, the paper concluded that intellectual capital addition can be trusted to elucidate the efficient asset management of listed manufacturing firms in Nigeria. This implies that the survival, sustenance, and continued existence of any organization is wholly a function of the labour force that is operational in an organization. No wonder then that organizations spend a huge amount of money to ensure that the best possible labour is engaged for effective productive reasons. The paper, therefore, recommends that manufacturing firms in Nigeria must cogitate intellectual capital addition basics in driving their goals. Investment in intellectual capital is a necessity, therefore it should

be given a paramount position in management decisions. There is a need for effective in-service training for active workers to enhance efficiency. This study is the only in Nigeria that has successfully adopted VAIC and has proved that the desire of corporations to hire the best-skilled labour is a necessity and crucial since intellectual capital will certainly improve the financial performance of corporations. Again, though some studies such as this study was conducted on listed manufacturing companies in Nigeria, subsequent studies can be carried out in other sectors of the Nigerian economy like transport, financial, and construction sector either of the same economy or other countries where the same work has not been conducted. One of the constraints experienced in this study was the availability and accessibility of data. However, the authors were able to overcome this through perseverance, making use of the internet to download the financial statements and compute the required data for the study.

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