TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING (TVET) AND HUMAN CAPITAL DEVELOPMENT IN NIGERIA

Olabisi Olaniran-Akinyele & Memunat Iganyi
Department of Banking and Finance, Federal Polytechnic, Ilaro, Ogun State, Nigeria
olabisi.olaniran@federalpolyilaro.edu.ng; memunat.iganyi@federalpolyilaro.edu.ng

Abstract

This study considered Technical and Vocational Education and Training (TVET) and human capital development in Nigeria by analysing the effect of gross fixed capital formation (gfcf), education expenditure (edexp) and the stock of labour force (lf) on per capita real gross domestic product (rgdpp). Annual dataset on the variables were sourced from the World Bank-World Development Indicators from 1990 to 2021. The Auto Regressive Distributed Lag (ARDL) model revealed the existence of cointegration amongst the variables in the steady state. The error correction model was, therefore, constructed and estimated with the speed of adjustment to steady state equilibrium from shock being around 46 percent. The short-term dynamics revealed that both edexp and lf have positive and relevant prospects for attaining output growth and sustainable development through its influence on human capital development while gfcf has an inverse but relevant prospects with output growth and development. The long run dynamics reflected a positive and relevant prospect between edexp and rgdpp, a direct but irrelevant prospect between lf and rgdpp and, an inverse but relevant prospect between gfcf and rgdpp. The outcome of this study suggests need for paradigm shift from having an educational curriculum that is explicitly dependent on general education but also enshrine technical and vocational education and training in the curriculum and calls for policy makers and stakeholders to focus on both general and technical and vocational educational and training-TVET at present to achieve growth miracles in the country.

***Keywords*:** TVET, Auto Regressive Distributed Lag, Per Capita Real Gross Domestic Product, Gross Fixed Capital Formation, Education Expenditure, Labour Force.

Introduction

Technical and vocational education and training (TVET) as a term is used interchangeably with Technical Education and Vocational Training (TEVT), Vocational and Technical education (VET), Technical and Vocational Education (TVE) (Gyimah, 2020). Technical and Vocational education and training (TVET) is a line of education and training required to improve the skills, technical expertise, aptitudes, potentials, and horizons of individuals to grant them access to gainful employment in various sectors of the economy, thereby expanding their quality of living with positive outcome for economies.

Technical and vocational education and training (TVET) is envisaged to have a positive and significant implications on inclusive growth and sustainable development of economies (Gyimah, 2020; Bagale, 2015; Adekunle & Aghedo, 2015). Governments, policy makers and stakeholders prioritise investment in TVET to facilitate skills acquisition and development to bridge the gap between the knowledge-based labour force and their skill-based counterparts (Audu, 2013).

Owais et. al. (2020) opined that technical and vocational education and training involves career-oriented education that is usually non-academic, offering technical knowledge in education as the building block of qualitative education for sustainable national development. Technical and Vocational Education and Training (TVET) can be defined as a form of education that offers life-long learning capable of granting individuals skills required for employment in specific and recognized occupations (Bagale 2015; Okoro, 1993).

As enshrined in the Sustainable Development Goal (SDG, 2015) agenda four "to provide not just education but quality education", this quality education covers general education alongside technical education and vocational training with the prospects of expanding the skills, technical know-how and aptitudes of individuals which will help to reshape their horizon in a way that is beneficial to the society, smoothen their consumption patterns and record

substantial rise in their productivity translating into rise in productive investments in an economy with prospects for achieving inclusive growth and sustainable development.

Bagale (2015) opine that technical education and vocational training unlike general education proffers lifelong learning for respondents. TVET explicitly considers acquisition of employable skills to prepare individuals for sustainable living. According to Bagale (2015) developed economies focused on technical education to spur their economies as sustainable education reverses the index of poverty with positive prospects for the individual and economy in general.

TVET is also associated with recording self-reliance amongst individuals and widening their horizon of entrepreneurship. Investment in vocational education and training forms the bedrock for attainment of sustainable national development given its positive outcomes on human resources development, investment, and economic growth (Bagale, 2015; Alam, 2007).

The fundamental objective of TVET all over is to provide individuals with skills and technical expertise to grant them access to gainful employment (Strong, 1990). This has undergone various changes due to the trends of globalization and changing economies. Lilies and Hogan (1983) considered TVET from the full approach perspective whereby the general educational curriculum is restructured to accommodate and offer occupational skills, the parallel approach whereby vocational and technical education is adopted alongside the general education in the educational curriculum, the core approach which adopts TVET as a minor but relevant system within the general educational curriculum with vocational and technical courses introduced as core or optional courses and the non-formal approach or method which offers individuals not engaged in schooling or out of school children and adults, to have access to technical and vocational education and training for employment in the formal or informal sector or make them successful and independent entrepreneurs. The parallel approach is, however, the mostly preferred approach.

Human capital development is at the core of world development indices as it is recorded to facilitate swift transformation of economies to industrialization from agrarian. It is not just provision of education but providing quality education that can drive productivity, healthy competition, inclusiveness, industrialization with positive outcomes in an economy especially the developing economies of the world. This qualitative education is reflected in vocational and technical education, which is capable of spurring human capital, a critical argument of inclusive growth.

Audu et. al. (2013) observed that growth and development is fostered by productivity of human capital acquired through improvement in skills, technical knowledge/ effectiveness of labour and aptitudes. Furthermore, it was observed that post-independence educational system laid greater emphasis on academic excellence and qualification at the detriment of vocational skills and technical knowledge (Audu et. al. 2013).

Human capital implies the stock of capabilities, skills, knowledge, and traits individuals possess which improves their performance in the labour force and contributes to development of personal and socio-economic values (OECD, 2001). Human capital implies education and training of workers to increase their productivity in terms of quantum and expertise "stock of human capital" while also stretching their lifelong earnings (Fagerlind & Shah, 1989).

Education is considered as a critical investment in human capital. Schultz (1961) discovered in the 1960s that education is mostly relevant in the attainment of rapid growth in the United States of America. Alam (2007) considering the human capital theory posits that investment in education and training have positive outcomes for individuals and economies.

Education is considered as a fulcrum for human capital development (Adekunle & Aghedo, 2015) which is a continuous and conscious process geared towards proffering on individuals' requisite knowledge, innate skills, expertise and zeal imperative for economic development (Adekunle & Aghedo, 2015; Atoyebi et al, 2013).

Adenikinju (2005) asserts that sustained output growth is achievable through a sustained increase in productivity. According to Anyawu (2007), productivity implies ratio of output to input over a stated period while Grayson (1982) sees productivity as what is gotten from what was given.

There is need to build skills for individuals, make them focus more on being target-driven and result-oriented, reduce their dependence on consumption and imports to being productive and engaged in more investment for developing economies to achieve inclusive growth and sustainable development. This investment will not only cover investment in physical capital, social capital but human capital. The gamut of which will be influenced by technical and vocational education and training in comparison with general education.

The Solow model and Lucas model of human capital development were adopted for this study. Hansen and Prescott (2002) observed that education, health, and technology are the major components of human capital development. Attention is also focused on nutrition as additional argument of human capital development. The Solow model presented the causes of wealth of rich nations as commitment towards investment in education in terms of the general educational framework and technical and vocational education; TVET with the rich nations recording higher capital per worker; that is higher productivity of labour.

In the dynamics of the exogenous growth model (Solow-Swan model), effectiveness of labour and capital were adopted as baseline arguments for productivity in an economy. The model assumed the evolution of labour and technical knowledge is exogenous to the system bringing the focus to the evolution of capital in the model. Given the intensive form of the production function, the rate of change of capital stock per unit of effective labour is stated as the difference between actual investment and the break-even investment in an economy.

2. METHODOLOGY

This study collated annual series data on per capita real gross domestic product (rgdpp), gross fixed capital formation (gfcf), education expenditure (edexp), and total labour force (lf) in the Nigerian economy to consider the relationship between TVET and inclusive growth in Nigeria. The dataset was sourced from the World Bank-World Development Indicators (WDI, 2022).

The Neo-classical growth model was extended to include human capital to examine the significance or otherwise of TVET (proxied by human capital) on output growth/ productivity in an economy, following the analysis of Romer (2012).

2.1 MODEL AND EQUATION PRESENTATION

The baseline model adapted for this study is poised in a continuous version as

$$Y_t = f[K_{(t)}^{\alpha}, (A_{(t)}H_{(t)})^{\beta}] \quad \text{.....(1)}$$

; with Y_t representing output growth, $K_{(t)}$ capital stock, $A_{(t)}$ effectiveness of labour/knowledge, $H_{(t)}$ amount of productive services supplied by workers-including contribution of raw labour skills and human capital (acquired) skills. α implies output elasticity in terms of capital and β, output elasticity in terms of human capital input.

The intensive form of the production function is expressed as.

$$y = f(k) \quad \text{.....(2)}$$

And the intertemporal first order difference equation for the evolution of k is

$$k_{(t)}^{*} = sf(k_{(t)} - (n + g + \delta)k_{(t)} \quad \text{.....(3)}$$

Introducing the arguments adopted for this study, the baseline model is respecified as follows,

$$rgdpp_t = f(gfcf_t, ed\exp_t, lf_t) \quad \text{.....(4)}$$

The statistical representation of equation (4) is presented as follows.

$$rgdpp_t = \delta_0 + \delta_1 gfcf_t + \delta_2 ed\exp_t + \delta_3 lf_t + \varepsilon_t \quad \text{.....(5)}$$

The long run representation taking lead from Pesaran et. al. (2001) is expressed as,

$$rgdpp_t = \lambda_0 + \lambda_1 rgdpp_{t-i} + \lambda_2 gfcf_{t-i} + \lambda_3 ed\exp_{t-i} + \lambda_4 lf_{t-i} + \varepsilon_t \quad \text{.....(6)}$$

The Unrestricted Error Correction Model/ Auto-Regressive Distributed Lag Model is specified as follows.

$$\Delta rgdpp_t = \gamma_0 + \varphi_i rgdpp_{t-i} + \varphi_j gfcf_{t-j} + \varphi_k ed\exp_{t-k} + \varphi_l lf_{t-l} + \sum_{i=1}^{p}\gamma_i \Delta rgdpp_{t-i} + \sum_{j=0}^{q_1}\gamma_j \Delta gfcf_{t-j}$$

$$+\sum_{k=0}^{q_2}\gamma_k \Delta ed\exp_{t-k} + \sum_{l=0}^{q_3}\gamma_l \Delta lf_{t-l} + \varepsilon_t \quad \text{.....(7)}$$

The Error Correction Model adapted for this study is presented as follows.

$$\Delta rgdpp_t = \phi_0 + \sum_{i=1}^{V_1}\phi_i \Delta rgdpp_{t-i} + \sum_{j=0}^{V_2}\phi_j \Delta gfcf_{t-j} + \sum_{k=0}^{V_3}\phi_k \Delta ed\exp_{t-k} + \sum_{l=0}^{V_4}\phi_l \Delta lf_{t-l}$$

$$+\lambda ECT_{t-1} + e_t \quad \text{.....(8)}$$

Where rgdpp denotes per capita real gross domestic product; gfcf, gross fixed capital formation; edexp, education expenditure; and lf, total labour force.

3. RESULTS

3.1 Data Issues and Preliminary Analysis

This study employed annual data from the World Development Indicator from 1990 to 2021. The group statistical features of the series following the standard procedures for variables with time series features was conducted (Yusuff & Olaniran-Akinyele, 2020). The descriptive statistics of the series are presented as follows.

Table 1: Descriptive Statistics of Variables

	RGDPP	**EDEXP**	**GFCF**	**LF**
Mean	1969.846	1.81E+09	28.11087	46348658
Median	1913.100	1.23E+09	26.11488	46542286
Maximum	2688.267	4.49E+09	53.12219	62151626
Minimum	1414.101	2.16E+08	14.16873	31787602
Std. Dev.	476.0853	1.45E+09	11.72930	9053207.
Skewness	0.198237	0.397397	0.434707	-0.016301
Kurtosis	1.398560	1.579777	1.979301	1.778145
Jarque-Bera	3.402253	3.310914	2.247132	1.867489
Probability	0.182478	0.191005	0.325118	0.393079
Sum	59095.37	5.44E+10	843.3262	1.39E+09
Sum Sq. Dev.	6573059.	6.08E+19	3989.716	2.38E+15
Observations	30	30	30	30

Per capita real gross domestic product was adopted in the stead of its nominal counterpart to reflect the impact of inflation on intertemporal output (Yusuff & Olaniran-Akinyele, 2020). It is given as the sum of gross value added inclusive of taxes and exclusive of subsidies as proportion of mid-year population in constant 2015 US dollars. Education expenditure implies current operating expenditures inclusive of remuneration and exclusive of buildings and capital equipment in education. Gross fixed capital formation includes capital equipment purchases, land, buildings including residential and official, commercial, and industrial buildings, schools, hospital, and net acquisition of valuables (World bank, 2022). Labour force is made up of individuals aged 15 and older currently employed or unemployed but are willing to offer their labour services for producing goods and rendering services within a stated duration (ILO, 2022).

3.2 UNIT ROOT TEST RESULTS

Table 2: Unit Root (Stationarity) Test

Variable	Augmented Dickey Fuller (ADF) Test Statistic		Phillip Perron (PP) Test Statistic		Dickey Fuller (GLS) Test Statistic	
	Level	First Difference	Level	First Difference	Level	First Difference
rgdpp	-3.1792(4)**	-2.1511(0)	-0.6527(4)	-2.2539(7)	-3.2078(4)***	-2.5824(0)
Gfcf	-1.8389(1)	-3.4836(0)***	-2.4886(1)	-3.3980(2)	-0.9650(1)	-3.2097(0)***
Edexp	-0.0893(0)	-3.5016(0)**	-0.2499(1)	-3.2616(7)**	-2.8510(7)**	-3.2635(0)***
lf	0.5335(0)	-2.8377(7)*	0.4807(3)	-3.6238(5)**	0.7764(1)	-3.9740(0)***

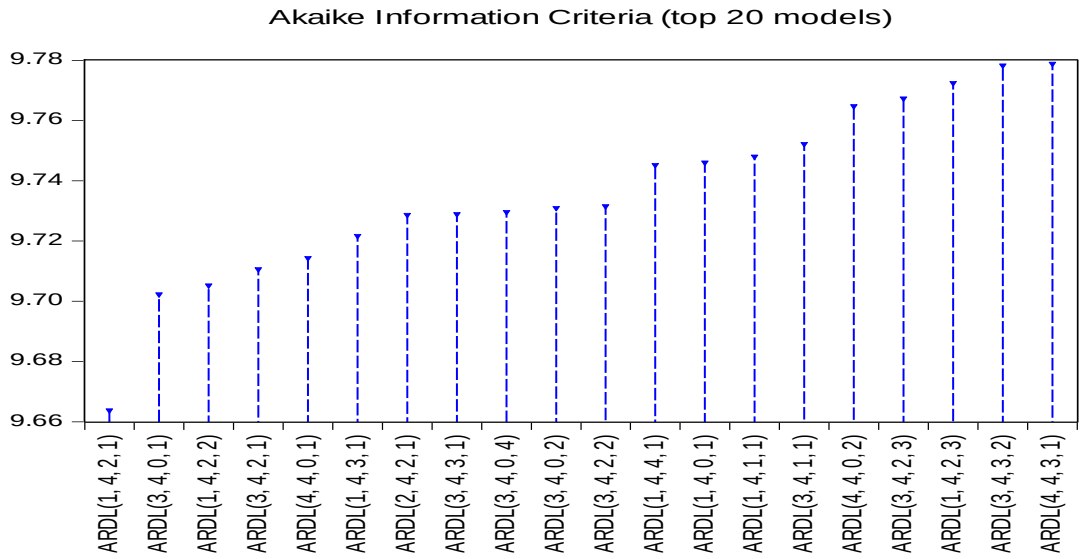
Note: Presented in parenthesis for the ADF and DF-GLS test statistics are the selected delay lengths for the Schwarz Information Criteria when the optimal delay length is 7. Adopted for the PP test statistics is Newey-West Bandwith (Automatic Selection) criteria using Bartlett Kernel (default) spectral estimation method. *, **, *** indicate statistical significance at 10%, 5% and 1% levels respectively.

The variables adapted for this study are combination of level and differenced stationary processes.

3.3 SELECTION OF OPTIMAL LAG LENGTH

The optimal lag length used in the estimation of the model was determined using the Akaike Information Criteria (AIC). The criteria graph for the optimal lag selection given as (ARDL 1,4,2,1) is presented below

Figure 1: Optimal lag length criteria graph



3.4 COINTEGRATION TEST

The ARDL-Bounds test approach to determination of long run relationship amongst variables is applicable individually to I(0) and I(1) series or combination of both (Pesaran et. al., 2001). The ARDL-Bounds test of cointegration result is presented as follows

Table 3: Bounds Test Result

Test Statistic	Value	Sig.	I(0)	I(1)
F-statistic	13.5870	1%	4.29	5.61
k	3	2.5%	3.69	4.89
		5%	3.23	4.35
		10%	2.72	3.77
t-statistic	-4.9468	1%	-3.43	-4.37
		2.5%	-3.13	-4-05
		5%	-2.86	-3.78
		10%	-2.57	-3.46

We conclude the existence of steady state relationship amongst the series as the computed F-statistic result (13.5870) exceeds the 1% critical value of the upper bound I(1) of 5.61.

Table 4: The Vector Auto Regression Analysis; Detection of delay length for lag length.

Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-1223.970	NA	1.24e+36	94.45920	94.65275	94.51493
1	-1109.053	185.6350	6.27e+32	86.85021	87.81797	87.12889
2	-1087.336	28.39883	4.46e+32	86.41045	88.15243	86.91208
3	-1065.054	22.28241	3.62e+32	85.92719	88.44339	86.65177
4	-1015.431	34.35417*	5.13e+31*	83.34083*	86.63124*	84.28835

Note: * denotes the lag order selected by a criterion. LR implies sequential modified LR test statistic, FPE; Final Prediction Error, AIC; Akaike Information Criterion, SC; Schwarz Information criterion, HQ; Hannan-Quinn information criterion. All the criterion asterisked the 4th lag and subsequently, lag 4 was chosen for the estimation.

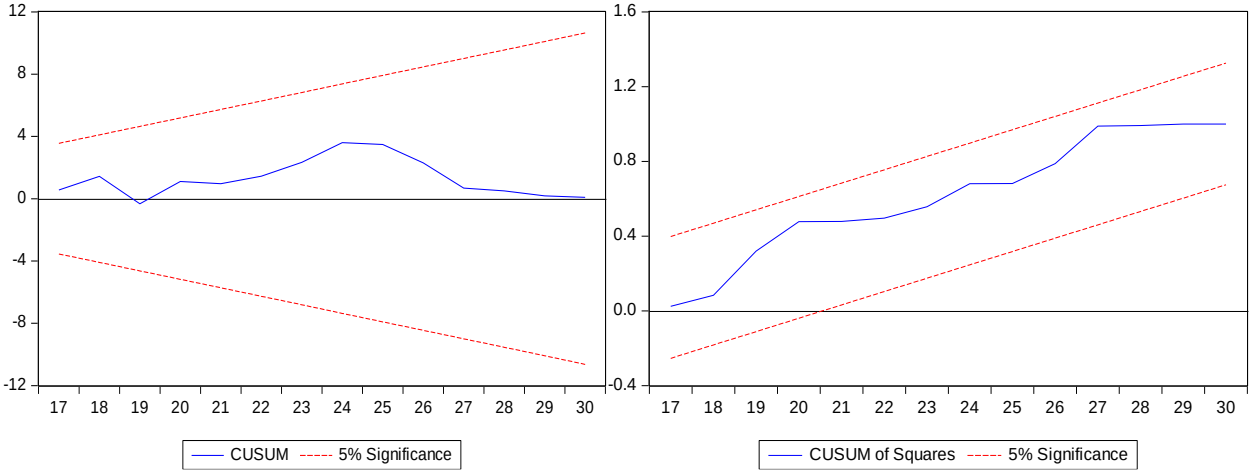
Table 5: ARDL (1,4,2,1) Model Estimated Result

Variable	**Coefficient**	**Standard error**	**P-value**
Long run			
gfcf	-30.1913***	8.8840	0.0043
edexp	1.23E-07***	3.84E-08	0.0064
lf	4.85E-06	8.96E-06	0.5965
Short run			
Δgfcf	-7.8133***	1.8900	0.0000

Δedexp	8.28E-08***	1.70E-08	0.0020
Δlf	2.19E-05***	8.31E-06	0.0194
ECT(-1)	-0.4575***	0.0563	0.0000
R^2 0.9158	BG(LM) Test 0.8005 (0.2165)	BPG (Het.) Test 1.5188 (0.2250)	JB 0.7410 (0.6904)
$\bar{R}^2$ 0.8762	F-stat 23.117 (0.0000)	Wald Test 74.5506 (0.0000)	DW 2.4680

Note: The probability values for the coefficient diagnostic tests (Wald test; Breusch-Godfrey Serial Correlation LM (BG-LM) test; Breusch-Pagan-Godfrey (BPG) heteroscedasticity test; Jarque-Bera (JB) Normality test) are presented in parenthesis. Δ represents the difference operator for the short run analysis. ARDL (1,4,2,1) implies the optimal lags for the series; rgdpp, gfcf, edexp and lf.

Figure 2: Recursive charts



4. DISCUSSION

The Auto Regressive Distributed Lag (ARDL) technique was adopted for the analysis of this study. The unit root tests revealed the series are a combination of I(0) and I(1) processes. The F-statistics from the unrestricted error correction model (table 3) revealed the existence of steady state relationship amongst the series. The lag length chosen by all the test statistics except for the likelihood ratio indicated an optimal lag of 4. The Akaike information criterion; AIC was used to select the optimal lag for the model resulting into choice of ARDL (1,4,2,1) for the analysis. The levels equation estimate revealed the existence of steady state relationship between gfcf and rgdpp with p-value of 0.0043 and edexp and rgdpp with p-value of 0.0064. The estimate, however, showed absence of steady state relationship between lf and rgdpp with p-value of 0.5965. The error correction regression estimate revealed the existence of negative short-term relationship between the contemporaneous value of gfcf and rgdpp, positive short-term relationship between the contemporaneous values of edexp and rgdpp as well as lf and rgdpp. The F-statistics with p-value 0f 0.0000 implies that the overall model is significant, and the criterion chosen for the analysis; Akaike Information Criterion-AIC had the least value amongst all the criteria implying a right choice of criterion for our analysis. The error correction term-ECT denotes the speed of adjustment and a negative ECT ensures the system reverts to equilibrium in the event of divergence.

The value of the ECT depicts the resilience of our model to shocks. A significant negative coefficient of the ECT, -0.4575 implies about 46% of short-term deviations are self-correcting in the steady state. It explicitly implies that around 46% of adjustment to steady state equilibrium occurs following a divergence in the short term. Post diagnostic tests conducted for this study include the coefficient diagnostic tests, residual diagnostic tests, and the stability diagnostic tests. With the Wald test having a p-value of 0.0000, we reject the null hypothesis and conclude on the existence of short run causality amongst the variables in the model. The histogram normality test with p-value of 0.6903 indicated that the residuals are normally distributed and are therefore, desirable for our analysis. The serial correlation LM test with p-value of 0.2165 led us to accept the absence of serial correlation in the residuals. The

Breusch-Pagan-Godfrey heteroscedasticity test with p-value of 0.2250 also led us to accept that the residuals in the model are homoscedastic.

The model's plots of Cumulative sum of recursive residuals (CUSUM) and Cumulative sum of squares of recursive residuals (CUSUMQ) tests revealed that the intercept of the model, the slope coefficients and the variance of the stochastic disturbances are stable over time.

5 CONCLUSION

The relevance of TVET in attaining positive outcomes for economies cannot be under emphasized, coupled with its prospects to attain inclusive growth and spur sustainable development. TVET is targeted towards not just provision of education but quality education. It is on this backdrop that this study was conducted to examine the place of TVET in attaining HCD in Nigeria. It is only a productive economy that will be able to attain inclusive growth and record a sustainable level of development. TVET is also set to attain paradigm shift by reshaping the horizon of individuals from being consumption and import dependent to being enterprising and productive by widening their skills, technical expertise, aptitudes.

TVET fosters the attainment of favourable human capital development index which is recorded to transform economies towards development. To drive productivity, there is need to focus on technical education and not wholly general education to widen the horizon, skills, aptitudes, and technical expertise of individuals.

Furthermore, the SDG Agenda 2030 stressed the need for provision of quality education which cannot be obtained explicitly from the general education. However, qualitative education is largely reflected in technical and vocational education and training-TVET, which is capable of spurring human capital, a critical argument of inclusive growth.

The outcome of the short-term dynamics of this study revealed that education expenditure has positive and relevant prospects for attaining inclusive growth and sustainable development through its influence on human capital development. In the same vein, the stock of labour force in the economy also exerts a direct and relevant prospect on output growth and development with gross fixed capital formation having an inverse but relevant prospects with output growth and development. The long run dynamics reflected a positive and relevant prospect between education expenditure and per capita real gross domestic product, a direct but irrelevant prospect between the stock of the economy's labour force and per capita real gross domestic product and, an inverse but relevant prospect between gross fixed capital formation and per capita real gross domestic product.

The outcome of this study suggests need for paradigm shift from having an educational curriculum that is explicitly dependent on general education but also enshrine technical and vocational education and training in the curriculum to have a high level of productive labour force who are committed towards expanding the level of investment in the country to achieve inclusive growth and sustainable development.

The outcome also calls for policy makers and stakeholders to focus on both general and technical and vocational educational and training-TVET at present to achieve growth miracles in the country.

REFERENCES

Adekunle, S. A & Aghedo, E. M. (2015). Human capital development and productivity growth in Nigeria. *Management Sciences Review, 6(1/2),* 286-308.

Adenikinju, O. J. (2005). Productivity performance in developing countries: country case studies of Nigeria. https://www.unido.org/productivity_performance_in_DCs_Nigeria.pdf

Akaakohol, B. M. & Ijirshar, V. U. (2018). Human capital development and economic growth in Nigeria. *Lafia Journal of Economics and Management Sciences, 3(1)*

Alam, G. M. (2007). *Private Higher education in Bangladesh:the impact on Higher education, governance and legislation.* Unpublished Ph.d. thesis, University of Nottingham, United Kingdom

Anyanwu, U. O. (2007). Productivity and capacity building. *Nigerian Economic Society (NES), 44th Annual Conference*, May 14.

Atoyebi, K. O., Olaleye, S. O. Ishola, A. S. Adekunjo, F. O., & Kadiri, K. I. (2013). Human capital and economic growth in Nigeria (1970-2010): An empirical analysis. *International Journal of Humanities and Social Science Invention. 2(2),* 58-69.

Audu, N., Igwe, C., & Onoh, C. (2013). Human capital development in Technical Vocational Education (TVE) for sustainable development. *Journal of Education and Practice, 4(7),* 100-106

Bagale, S. (2015). Technical education and vocational training for sustainable development *Journal of training and development, 1(1),* 15-20. https://doi: 10.3126/jtd.v1i0.13085

Chowdhury, N., Uddin, M., Uddin, N. & Uddin, S. (2018). Human capital development an economic growth in Bangladesh. *Journal of World Economic Research, 7(2),* 52 https://doi:10.11648/j.jwer.20180702.12

Fagerlind, I., & Saha, L. (1989). *Education and National Development: A comparative perspective*. Oxford, UK.

Grayson, P. A. (1982). *Concept of productivity.* Macmillan Publishing Plc. London.

Gyimah, N. (2020). Assessment of technical and vocational education and training (TVET) on the development of the World's economy: Perspective of Africa, Asia and Europe. *SSRN Electronic Journal*. https://doi:10.2139/ssrn.3541072

Hansen, G. D., & Prescott, E. C. (2002). Malthus to Solow. *The American Economic Review, 92(4),* 1205-1212. https://dx.doi.org/10.1257/00028280260344731

International Labour Organisation (ILO). (February 8, 2022). ILOSTAT Database

Okoro, O. M. (1993). *Principles and methods of vocational and technical education*. Nsukka.

Organization for Economic Cooperation and Development-OECD (2001). *The well-being of nations. The role of human and social capital*, OECD publications, Paris, OECD.

Owais, A., Hussein, E., Al Abidi, S., & Al Hatamleh. Z. M. (2020). Technical and vocational education and training in the UAE. *International Journal of Emerging Technologies in Learning (IJET), 15(13).* https://doi.org/10.3991/ijet.v15il3.13801

Pesaran, M. H., Shin, Y., & Smith, R. (2001). Bound testing approaches to the analysis of level relationships. *Journal of Applied Econometrics, J. Appl. Econ. 16(3),* 289-326. https://doi.org/10.1002/jae.616

Romer, D. (2012). *Advanced macroeconomics*. University of Carlifonia, Berkely

Schultz, T. (1961). Investment in human capital. *American economic review. 51(1),* 1-17

Solow, R. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics, Oxford Journals, 70(1),* 65-94

Solow, R. (1999). Neoclassical growth theory. *Handbook of macroeconomics, 1,* 637-667. https://dx.doi.org/10.1016/S1574-0048(99)01012-5.

Sustainable Development Goal (SDG) (2015). United Nations Department of Economic and Social Affairs. Sustainable Development Goals 2030 Agenda https://sdgs.un.org

Swan, T. W. (1956). Economic growth and capital accumulation. *Economic Record. Wiley, 32(2),* 334-361

United Nations Educational, Scientific and Cultural Organization UNESCO (2006). *Participation in*

formal technical and vocational education and training programs worldwide.

World Bank (2022). World Development Indicators. World Bank Group, World Bank National Accounts data. https://data.worldbank.org

Yusuff, M. A., & Olaniran-Akinyele, O. F. (2020). Women in science, technology, engineering, and mathematics towards economic growth in Nigeria. *Journal of Women in Technical Education and Employment (JOWITED), The Federal Polytechnic, Ilaro Chapter, 1(1),* 188-198