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Strengthening TVET in Nigeria to meet the industry 4.0 needs in the changing world of works

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Abstract

The modern workplace had dramatically changed because the nature of work, workforce and work relations had changed; hence, the changes in the needs of industries. The aim of this study was to examine the relationship between Nigerian industries and the factor inputs that formed the needs of industries with keen aim on the Technical and Vocational Education and Training. Using the Central Bank of Nigeria Data, Vector Autoregression was used to test the relationship among the series of yearly output of all industries and the service sector in Nigeria from 1982 to 2021. The Technical and Professional Service subsector was used as one of the independent variables in the service sector. The Johansen Cointegration Test was used to test for convergence and long-term relations between industries and the service sector. The Wald Test was used to test for the significance of coefficients of Technical Services inputs on the Industrial Output. The VAR shows that more than 95% variation in the Industrial Output are explainable by variations in the factor inputs. The pairwise Granger Causality Test was used to test for the short run causality between the industrial output and the factor input. The study found that of Technical and Telecommunication services impacted on the changes in the Industrial Output in in the short run. The study recommended the need for the increase in the funding of TVET institutions, improvement in the quality of TVET training to include soft skills in order to meet the industrial requirements for the changing world of works and increased public – private partnership in order to transfer class training to the field.

Keywords: Industry 4.0; TVET; Changing world of works; Factor input; Industrial needs

1. Introduction

The Industrial Revolution indeed had profound impacts on development around the world, and in fact changed the conditions of living and affected different spheres of human life.

It reduced the reliance on farming and led to urbanization; and also, significantly caused shift to manufacturing where inventions and innovations where characterized by increase in the usage of machines which led to production efficiency, lower pricing and improved wages and improvement in working conditions and workers' welfare.

However, as much of the activities that characterized these periods led to spontaneous development, the change in human needs and the fast pace of technological improvement led to ever changing industrial needs in the changing world of works.

In theory, economists consider the industrial needs to mainly include the factors needed for production of goods and services. These are land, labour, capital and enterprise. While land, labour and capital are regarded as primary factors,

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the material needed for production is often termed the secondary. However, functional relationships are often depicted between output, labour and capital; hence, many production functions are formulated to show capital and labour.

Meanwhile, in recent times, the paradigms had been on Industry 4.0 and the conceptualization of high technology, smart automation and use of machine learning to increase industrial efficiency. But with these changes comes the need for managing people and organizations in the context of the changing world.

In the different stages of the Industrial Revolution, different skills and materials were needed and utilized. These ranges from invention of steam engines in the first industrial revolution, to electricity in the second and electronics and information technology in the third. According to Umachandran, Jucric, Corte and Ferdinand – James (2018), the use of electronics and information technology increased the complexity of manufacturing process and made it more automated.

However, in contrast to the previous revolution eras, the Industry 4.0 requires a more sophisticated skill, training and expertise. Qin, Liu and Grosvenor (2016) noted that Industry 4.0 shall be more decentralized, automated and interdependently managed.

With this comes the changing world of work. The modern workplace had dramatically changed from the workplace of the old. This is because the nature of work, the workforce and work relations constantly change as a result of changes in the demography of the world, change in values and realization of diversities that exist as a result of global integration and technological interconnectivity.

In the web of these megatrends, there is the need for reactive education and paradigm in skills acquisition that matches the changes in industrial needs; which of course, had influenced the changing world of works. Therefore, Technical and Vocational Education and Training well – grounded in a firm policy is needed to meet up with these industrial needs.

In 2015, the UNESCO – UNEVOC recommended the adoption of a flexible, evolving and responsive TVET systems to match the megatrends. Stakeholders in education and international development from international to national and regional bodies from the private and the public sectors in many nations were urged to formulate policies to make TVET the fundamental catalyst for "industrial capitalism".

In response to the global financial crisis in 2008 that created a gap in the industrial needs of firms around the world, TVET systems had since focused on increasing employability of graduates through trainings in acquiring soft and hard skills needed.

However, UNESCO (2013), noted in its policy reviews in Cambodia, Lao and Benin Republic that TVET systems may not yet sufficiently support the development of soft – competencies needed for the Industry 4.0.

1.1. Objectives of the study

This study seeks to explore the universal industrial needs for the Industry 4.0 in the context of the changing world with comparison between the developed and the developing nations; particularly in Africa. Also, the study seeks to understudy the ways to strengthen TVET to meet the changing industrial needs in Nigeria. The study further seeks to compare the available TVET structures to the industrial factor input demand and ascertain the areas that TVET could be improved if the industrial needs are not met.

1.2. Conceptual issues

1.2.1. Dynamics of Industrial Needs in the Changing World of Works

In modern history, the change from handicraft and agrarian economy to the one where industry and usage machines in manufacturing did change the dynamics of the needed factor input and industrial need.

The term "Industrial Revolution" was popularized by Arnold Toynbee in the description of economic development in Britain from 1760 to 1840. However, this term had been broadly applied to the process of contemporary economic transformation rather than a period. And after the first industrial revolution recorded in Britain, the dynamics of industry and industrial needs had constantly been changing.

With each revolution cycle comes inventions, production models and the requisite industrial needs. According to Pennel (2021), periods between 1800 and 1920 saw the invention of railway and steam engines; while massive mechanical production replaced the handicraft systems, production models were structured on "Taylorism" and "Fordism". The basic need of the industry during that period was labour force which followed routine job specifications diligently with obedience and intelligence.

According to Matar, Ahamat and Ismail (2021), skilled "handicraft" labourers were replaced with unskilled ones from the agricultural sector which led to overcrowded rapid urban areas.

Workplace Paternalism was pronounced, while workers' welfare and protection were limited only to the workplace. Works were standardized and subjected to routines. Learning was made formal, while knowledge was explicitly measured and values would have to be tangible or not accepted.

According to Matar, Ahamat and Ismail (2021), the second industrial revolution saw the introduction of scientific principles and methods to production. Inventions like televisions and radios changed the communication and information trajectories; which was aided by the improvement in telephone. Calls could then be made directly without calling the operators for redirection. Also, inventions like electricity and combustion engines changed production models and the needs of industries. Coals which were hitherto, been used for steam engines in factories, railways and ships were no more so important.

With the introduction of Ethernet in 1973 and personal computers in 1974, the industrial needs had constantly been changing. However, the introduction of Internet in 1983 had a great impact on industries and the factor inputs needed in them. According to Hamel (2000), this period is the age of revolutions in business concepts because with the Internet, geographical locations are no longer problem. Because global capital flows have become a raging torrent; coupled with extremely low cost of communication and increased access to cheap and affordable information, the skill set needs of industries had since been changing geometrically.

Therefore, company that is not evolving would go into extinction because the change in the 21st century is discontinuous, abrupt, and distinctly non-linear.

The workforce, work and business interactions have also changed drastically. According to Stearns (2019), the reasons for these changes are the increasing alternative of working patterns such as part – time working, flextime employment, telecommunicating, job sharing and compression of working weeks.

Need of industries in this period is defined by material factor inputs needed for production; however, with the new environment, the employer and employee relationship has to be determined by flexibility, use of talent and reward for it and inclusive interaction.

Chukwuedo and Omofonmwan (2015) noted that the world of work is undergoing dramatic changes leading to global macro shift in today's open talent economy which applies to almost every sector of industries around the world. It was further noted that these changes require employers and employees to come to terms with a new environment, in which flexibility and adaptability have priority over job security and long-term cum lifelong employment, structured environments, and standardized roles and responsibilities.

1.2.2. Industrial Needs in Nigeria and its Dynamics

The empirical evidence available attributed the beginning of industrial development in Nigeria to the activities of the mercantile companies from Britain when Lagos and many areas known now as Nigeria were British Colonies. The basic industrial activities were primary and extractive because many of the goods produced were meant to provide raw materials for Industries in Britain. Therefore, the industrial need was limited to provision of the factor input; which was mainly, for agriculture and local extraction.

According to Okoiueocha and Taneh (2019), manufacturing was tangible in the latter part of 1950's when some foreign firms invested in the production of consumers good like biscuits, detergent, beers and the likes. Many of these manufacturing firms had skilled expatriates from the countries working as supervisors while the unskilled labourers were sourced from the local communities. The working conditions were tailored around the "factory like" nature of British textile era where working hours were stretched and determined by the management. According to Ayanda and Laraba (2011), numbers of industries during this period was numerically small and the level of employment of labour was low.

Therefore, industrial needs in Nigeria had been characterized by the pattern and spate of development and growth. That was as a result of the influx of multinational corporations between 1960 and 1970 where the basic goods for households and small scale commercial firms were the main products being produced. However, with Nigeria leading in the production of cocoa, groundnut and palm oil during that period, manual labour formed the basic need of the agricultural sector. While the agricultural sector employed about 70% of the population.

The effect of the indigenization policy in 1972 had a profound effect on the industrial needs in Nigeria. By 1974, more than one thousand companies had been indigenized while ownership by Nigerians in both large and small firms soared.

Also changing the perspective for factor input demand in Nigeria is the local content act which provided that Nigerian content must be mandatorily considered as a key element of production and project development. According to the Nigerian Content Development and Monitoring Board (2023), the draft regulations of the law were tailored to increase in – country value retention from 30% to 70% over ten years' period.

1.3. Method of data collection

Data used in this study is collected from the Central Bank of Nigeria from its published Statistical Bulletin on Industrial Output and Financial, Technical, Telecommunication, Transport and Storage Services between 1982 and 2021. The data were valued at the nominal price of 2010.

2. Results

This study used a VAR model because Industrial Output and Service Sector series showed no stationarity at level, and they demonstrate a common trend. But at the difference of all the series, stationarity and presence of cointegration were discovered. The Augmented Dickey-Fuller test estimates at level and first difference using nine (9) lags all the variables are shown in Table 1.

Table 1 ADF Test for Real Industrial Output and Services Sectors between 1982 and 2021

ADF TEST						
Variables		**Level**		**First Difference**		**Order of Integration**
		Constant & No Trend	Constant & Trend	Constant & No Trend	Constant & Trend	
Real Industrial Output		-0.724711	-4.321636	-5.439979**	-5.319957**	I(1)
Financial Service		-1.725037	-1.663828	-5.525505**	-5.529544**	I(1)
Technical Service		-1.743345	-2.449562	-3.680246**	-3.965261**	I(1)
Telecommunication		-0.071899	-1.861929	-5.756026**	-5.704512**	I(1)
Transportation & Store		0.495354	-3.681978	-6.425136**	-6.563477**	I(1)
Critical Values	1%	-3.605593	-4.205004	-3.610453	-4.211868	
	5%	-2.936942	-3.526609	-2.938987	-3.529758	
	10%	-2.606857	-3.194611	-2.607932	-3.196411	

Using the Johansen Cointegration Test, the trace indicated two (2) cointegrating equation and the Max-Eigen statistics showed that there exist at most, one cointegrating equation between agriculture output and technical services. As it can be seen from the table the trace and the Max-Eigen statistics 0.671480 is less than the critical value 69.81889 and 33.87687, while the p – value is less than 0.05. This shows that there exists a long run relationship between real industrial output and the factor inputs from the service sectors.

Table 2 Johansen Cointegration Test for Industrial Output and Financial, Technical, Telecommunication and Transport Services between 1982 and 2021

JOHANSEN COINTEGRATION TEST				
UNRESTRICTED COINTEGRATION RANK TEST (TRACE)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.671480	91.57094	69.81889	0.0004
At most 1 *	0.468712	49.27099	47.85613	0.0366
At most 2	0.293481	25.23784	29.79707	0.1531
At most 3	0.229148	12.03646	15.49471	0.1552
At most 4	0.054924	2.146636	3.841466	0.1429
Trace test indicates 2 cointegrating equation(s) at the 0.05 level				
UNRESTRICTED COINTEGRATION RANK TEST (MAXIMUM EIGENVALUE)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.671480	42.29995	33.87687	0.0039
At most 1	0.468712	24.03315	27.58434	0.1336
At most 2	0.293481	13.20138	21.13162	0.4339
At most 3	0.229148	9.889826	14.26460	0.2193
At most 4	0.054924	2.146636	3.841466	0.1429
Trace test indicates 1 cointegrating equation(s) at the 0.05 level				

Table 3 Vector Autoregression Estimates of Industrial Output and Service sectors input

VECTOR AUTOREGRESSION ESTIMATES					
	Real Industrial Output	**Financial Services**	**Technical Services**	**Telecom**	**Transportation and Store**
R-squared	0.966527	0.975686	0.997102	0.981126	0.992064
Adj. R-squared	0.954572	0.967003	0.996066	0.974385	0.989230
Sum sq. resids	0.057126	0.442451	0.031383	4.946286	0.127014
S.E. equation	0.045169	0.125705	0.033478	0.420301	0.067351
F-statistic	80.84867	112.3610	963.2466	145.5492	350.0290
Log likelihood	71.91942	32.00164	83.60013	-15.07257	56.33828
Akaike AIC	-3.124073	-1.077007	-3.723084	1.337055	-2.325040
Schwarz SC	-2.654863	-0.607798	-3.253874	1.806265	-1.855830
Mean dependent	9.394241	6.862543	7.072339	5.692141	5.915434
S.D. dependent	0.211922	0.692013	0.533793	2.626101	0.648989
Determinant resid covariance (dof adj.)		1.63E-11			
Determinant resid covariance		3.12E-12			

Log likelihood	239.9350			
Akaike information criterion	-9.483848			
Schwarz criterion	-7.137799			
Number of coefficients	55			

The Vector Autoregression is represented in table 3. The R-squared and adjusted R-squared showed that more than 95% variation in the Industrial Output is explained by the variation in the factor inputs.

The test for the significance of the coefficients is done using the Least Squares method (Gauss-Newton/Marquardt steps), while the significance of the Technical Service Sector on the Industrial Output is ascertained using the Wald Test. These are both represented in Table 4 and 5:

Table 4 Test for significance using least squares (gauss-newton/marquardt steps)

LEAST SQUARES (GAUSS-NEWTON / MARQUARDT STEPS)				
DEPENDENT VARIABLE: LINDUSTOUTPUT				
LINDUSTOUTPUT = C(1)*LINDUSTOUTPUT(-1) + C(2)*LINDUSTOUTPUT(-2) + C(3)*LFININS(-1) + C(4)*LFININS(-2) + C(5)*LTECHSERV(-1) + C(6)*LTECHSERV(-2) + C(7)*LTELECOM(-1) + C(8)*LTELECOM(-2) + C(9)*LTRANSSTORE(-1) + C(10)*LTRANSSTORE(-2) + C(11)				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.468522	0.160646	2.916495	0.0069
C(2)	-0.116087	0.149567	-0.776152	0.4442
C(3)	0.052040	0.069764	0.745941	0.4619
C(4)	-0.011365	0.063462	-0.179091	0.8592
C(5)	0.048259	0.235749	0.204707	0.8393
C(6)	0.127892	0.222669	0.574357	0.5703
C(7)	0.011905	0.019894	0.598395	0.5544
C(8)	0.058592	0.024342	2.407047	0.0229
C(9)	-0.149464	0.111067	-1.345708	0.1892
C(10)	-0.125070	0.090859	-1.376530	0.1796
C(11)	5.805476	1.152688	5.036469	0.0000
R-squared	0.966527	Mean dependent var		9.394241
Adjusted R-squared	0.954572	S.D. dependent var		0.211922
S.E. of regression	0.045169	Akaike info criterion		-3.124073
Sum squared resid	0.057126	Schwarz criterion		-2.654863
Log likelihood	71.91942	Hannan-Quinn criter.		-2.955724
F-statistic	80.84867	Durbin-Watson stat		2.032764
Prob(F-statistic)	0.000000			

Table 5 Test for significance of coefficients of Technical Services using Wald Test

Wald test			
Test Statistic	**Value**	**df**	**Probability**
F-statistic	3.745664	(2, 28)	0.0362
Chi-square	7.491328	2	0.0236
Null Hypothesis: C(5)=C(6)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(5)		0.048259	0.235749
C(6)		0.127892	0.222669
Restrictions are linear in coefficients.			

Table 6 Pairwase Granger Causality Test between Industrial Output and the Service Sectors

Pairwise granger causality tests			
Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
LFININS does not Granger Cause LINDUSTOUTPUT	39	3.18958	0.0538
LINDUSTOUTPUT does not Granger Cause LFININS		2.49036	0.0979
LTECHSERV does not Granger Cause LINDUSTOUTPUT	39	8.12770	0.0013
LINDUSTOUTPUT does not Granger Cause LTECHSERV		1.69982	0.1979
LTELECOM does not Granger Cause LINDUSTOUTPUT	39	4.53244	0.0180
LINDUSTOUTPUT does not Granger Cause LTELECOM		0.64808	0.5294
LTRANSSTORE does not Granger Cause LINDUSTOUTPUT	39	2.10322	0.1377
LINDUSTOUTPUT does not Granger Cause LTRANSSTORE		2.75610	0.0778

3. Discussion

The several factors that determined the changes in Real Industrial Output in Nigeria between 1982 and 2021 are explainable from the variation in the factor inputs from the financial, technical, telecommunication, transport and storage service sectors.

While the Johansen Cointegration Test shows that there exists a long run relationship between the Output in the Industry and the Service Sectors, the VAR results show that more than 95% variations Industrial Output between 1982 and 2021 are explainable by the variations the Service sectors in the long run.

The Pairwise Granger causality test depicting the short run causality between Industrial Output and the Service Sectors show that the Technical at 0.01 significance level and Telecommunication Service Sectors at 0.05 significance level granger cause the changes in Industrial Output.

While inferences can be made that TVET represented by the contribution of Technical Service Sector to Industrial Sector is significant, the attribution of this could be as a result of the improvement in Telecomunication which aids Technology in this new age.

Findings and recommendations

The findings of this study are that although, the impact of Technical Service Sector on Industrial Output is significant, there exist a sharp contrast to what TVET offers labour and skill supply to the Industries in Nigeria. This is apparent in the unemployment rate and the employability scale of the graduates from TVET institutions.

Adedeji and Oyebade (2015) noted that large numbers of graduate in Nigeria are unable to meet the employment requirements of the labour market due to inappropriateness of the curricula in various higher institutions of learning. Also, funding in many institutions were found to be grossly inadequate. According to Suleiman (2022), 7.9% of the 2023 Appropriation Budget was allocated to education. This was low at a comparable level in a nation where TVET institutions were envisaged to be the driver of the economy.

The study also found that the public – private partnership is minimal between industries and many TVET institutions thereby causing the existence of a vacuum where theories taught in the classes could be put into practice in the industries. The study recommended the need for the increase in the funding of TVET institutions, improvement in the quality of TVET training to include soft skills in order to meet the industrial requirements for the changing world of works and increased public – private partnership in order to transfer class training to the field.

4. Conclusion

This study investigated the deeper relationship between industrial growth, factor needs of industry in the changing world of works and the importance of TVET. The result of this study suggested the need to improve on TVET funding, setting up the framework for skill bridge between institutions and industries; including public – private partnership.

The study attributed a long run relationship between industry and factor needs under study; while it particularly established a short run causal relationship between Industry, Technical Services and Telecommunications.

Furthermore, this study presented a window of opportunity to closely examine the curious relationship between the modern industrial need and the changes that has occurred in the world of works where jobs are more specified to rigid routines but intuitive ideas, skills, talent and innovations.

References

[1] Adedeji, O. A., & Oyebade, S. A. (2015). Graduate employability in Nigeria: Thoughts Travails and Tactics *British Council Report* 2015/ES85

[2] Ayanda, A. M., & Laraba, A. S. (2011). Small and Medium Scale Enterprises as a survival strategy for employment generation in Nigeria. *Journals of Sustainable Development* 1(4) 200 - 206

[3] Central Bank of Nigeria Statistical Bulletin 2021. Retrieved April 4, 2023 from *www.cbn.gov.ng*

[4] Chukwuedo, S. O., & Omofonmwan, G. O. (2015). Developing Industrial and Technological Manpower via Technical Vocational Education and Training (TVET) in Nigeria. *University of Mauritius Research Journal (21) 507 – 524*

[5] Hamel, G. (2000). Leading the Revolution: How to thrive in turbulent times by making innovation way of life, *Harvard Business School Press.*

[6] Matar, H., Ahamat, A., & Ismail, N. (2021). Industrial Revolution 4.0 Competencies: A literature review of Manufacturing Industries, *Journal of Legal Studies Education* 24(6) 123.

[7] Okoiueocha, C. N., & Taneh, N. A. (2013). Roles of TVET in the Industrialization and Economic Development of Nigeria, *International Journal of Innovative Education Research* 1(1): 1- 7.

[8] Pennel, D. (2021, March 5). The future of work might look a lot like the past. LinkedIn. Retrieved June 13, 2023, from https://www.linkedin .com/pulse/future-of-work-might-look-like-past

[9] Qin, J., Liu, Y., & Grosvenor R. (2016). A categorical framework for of manufacturing for Industry 4.0. *Science Direct* (52) 173 – 178.

[10] Stearns, P. N. (2019). *Industrial Revolution in World History* (4th ed. 3) Routledge, New York

[11] Umachandran, K., Jucric, I., Corte, V. D., & Ferdinand – James, D. S. (2018). *Industry 4.0.: The New Industrial Revolution* (1st ed. 138 – 155) IGI Global

[12] UNESCO. (2013). Policy Review of TIVET in Cambodia, Lao and Benin. Paris, UNESCO