

## Nexus between food sustainability, TVET and economic development in Nigeria

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### Abstract

The global aim to achieve sustainable food, economic growth and development is desired by all stakeholders around the world. The aim of this study was to examine the relationship between food sustainability, TVET and economic development. Using the Central Bank of Nigeria Data, Vector Autoregression was used to test the relationship among the series of yearly agricultural output and the technical service sector in Nigeria from 1982 to 2021. The Johansen Cointegration Test was used to test for convergence and long-term relations between agricultural industry and the technical service sector. The VAR shows that more than 98% variation in the Agricultural Output are explainable by variations in Technical Service Sector. 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:** Technical and Vocational Education and Training (TVET); Food Security; Food System; Economic Development; soft skills.

### 1. Introduction

In the contemporary world, nations are concerned with economic growth and development; the rate at which inherent human and capital resources in such nation could translate to an improved living condition for the populace.

According to Todaro and Smith (2012) the concepts of economic development and modernization represent implicit as well as explicit value premises about desirable goals for achieving the “realization of the human potential.”

But as much as economic development is desired, it not spontaneous. According to Lin (2012) modern economic development in nature is a process of continuous structural changes in technology, industry, socio – economic and political institutions. In fact, the profound changes in the modern world was as a result of the Industrial Revolution in the 18<sup>th</sup> Century; while before that, every country in the world was poor and agrarian. In the face of the leap in development around the world from 18<sup>th</sup> century till the present moment, development in most parts of Africa and some parts of Asia have been retrogressive. According to Adeboye (2018), the problems faced by African countries are legion; and the reality in comparing levels of development across the world is that Africa lags behind other regions of globally in achieving development.

The indication from several development indices at the moment shows that many African countries rank low in the development peck order. According to World Bank (2019), Nigeria is a developing country with high incidence of poverty. The Nigeria Bureau of Statistics (2020) putted Nigeria’s poverty rate at 40%; while the United Nations Development Programme (2019) ranked Nigeria in the 161<sup>st</sup> position out of 189 countries with 0.539 as her HDI. In measuring the level of development of a country, chief among the indicators is the attainment of a sustainable food

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security. Torero (2014) opined that economic growth would be sustainable if countries have food security. In fact, he opined that without a country-owned and country-driven food security strategy, there shall be obstacles and additional cost to global, regional and country level economic growth.

In order to entrench the need for the elimination of hunger around the globe, the United Nations in 2015 included food security as the Sustainable Development Goal 2, with the aim of achieving “zero hunger”. The official wordings were quite catchy; and they were: “end hunger, achieve food security and improve nutrition and promote sustainable agriculture”. The global aim to achieve sustainable food security is desired by all stakeholders around the world; however, it requires global transition from the traditional food systems to a sustainable one. A sustainable food system is required among many things, to respond to challenges of climate change, resources scarcity, youth employment and gender equality. Because of the close relationship between different aspects of food production and consumption; where activities in one part of the food system results in unintended outcomes in other areas of food, socio – economic and environmental systems, there is the need to balance the trade – offs and adopt a sustainable food system.

In order to achieve global sustainable food security, there is the need for concerted effort to educate and train farmers, who are mostly the smallholders in rural parts of the world. According to Gilespe and Bold (2017), over 80% of food consumed in the developing world comes from the smallholder sector. The World Bank (2015) opined that out of 70% of the people that live in the rural areas, agriculture is their main source of income and employment.

In the web of these megatrends, there is the need for reactive education and paradigm in skills acquisition that matches the structural changes in the economies of different countries in the world; which of course, had influenced the evolving labour markets. In 2015, the UNESCO – UNEVOC recommended the adoption of a flexible, evolving and responsive TVET systems to match these megatrends.

Stakeholders in education and international development from international to national and regional bodies from the private and the public sectors in many nations had formulated policies to make TVET the fundamental catalyst for development.

### *Objective of the study*

The study seeks to understudy the effect of TVET on food sustainability and economic development. The long run relationship between TVET, food sustainability and economic development is ascertained; while short run and long run causality relationship is tested for.

### **1.1. Research question**

Therefore, the question that this study seeks to answer is: “given the need for the global adoption of sustainable food systems, and the need for structural plan that should consider a balanced tradeoff between all the misaligned factors, could TVET be the needed bridge between sustainable food security and economic development in Nigeria?”

### **1.2. Conceptual issues**

#### *1.2.1. Agriculture in Nigeria in the face of Sustainable Food Security and Economic Development*

As every nation set their agendas to achieve a set of interrelated goals; to end hunger, achieve food security and improved nutrition and raise the productivity of small-scale food producers and food systems in a way that contributes to the preservation of ecosystems, enhances resilience to climate change and improves land and soil quality, a systemic approach is needed.

Ending hunger and malnutrition is a complex challenge in the face of rapid population growth, urbanization, growing wealth, changing consumption patterns, and globalization as well as climate change and the depletion of natural resources, there is the need to consider food security.

The developments in food systems have yielded many positive results, especially over the past three decades in developing countries. These results include the expansion of off-farm employment opportunities as food industries have developed, and the widening of food choices beyond local staples, thus satisfying consumers’ preferences in terms of taste, form and quality.

According to Izuchukwu (2011), farming systems in Nigeria are majorly smallholder-based and land use for agriculture are in fragments and scattered making proximate cluster farming a problem.

This explains the reason why Nigerian smallholders control some 80 to 90% of Nigeria's farmlands. The distribution of different categories of farmers and the capacity of their farmland is represented in Table 1 below:

**Table 1** Distribution of farm holdings in Nigeria

Category	Size (ha)	Average size (ha)	Total holdings (%)	Area (%)	Irrigated area (%)
Marginal farms	< 1	0.23	56	23	0.3
Small farms	1 – 2	1.42	24	36	2.2
Semi-medium farms	2 – 4	2.69	11	21	21.8
Medium farms	4 – 10	4.87	6.0	11	33.7
Large farms	>10	13.51	3.0	9	42.2

Source: Nigeria National Bureau of Statistics (2016)

Perhaps, the pattern of land holding which is scattered and small contributed to slow increase in value – added per capita in agriculture. Akinde and Vitung (2020) noted that between 2000 and 2020, less than 1 percent increase was recorded annually in the value added of agriculture. Also, Akinde and Vitung (2020) further noted that Nigeria loses USD 10 billion in annual export opportunity from groundnut, palm oil, cocoa and cotton due to persistent decline in the production of these commodities.

Abuka and Ebiemere (2013) asserted that food crops production have not kept pace with population growth in Nigeria, resulting in rising food imports and declining levels of national food self-sufficiency.

The key legal framework for the agricultural development in Nigeria to date had been the enactment of the Land Use Decree (1978) which vested land allocation in the urban areas on the Governors of each state accordingly; while land allocation in rural areas on the Local Government. However, despite the Decree, land allocation in Nigeria had been grossly irregular creating myriads of problem for land holding and usage.

The government intervention prior to the mid-1980s was largely rooted in development planning such that agricultural policies, programs and projects were given priority attention in the various plans. However, during the period from the mid-80s to the late-90s structural adjustment plan was favoured which created a room for diverse policies and programmes. The period between 2001 – 2010 saw the introduction of several policies and strategies which were based on frameworks by the Executives. Therefore, the legal frameworks for policies around these period were weak.

The National Economic Empowerment and Development Strategy (NEEDS I and II) which was implemented with the Presidential initiatives aimed at developing selected agricultural commodities. This was followed by the Seven-Point Agenda (2007 - 2010) which led to the preparation of the Food Security Strategy Document in 2009.

Funding for agriculture were by Government direct intervention through some programmes, Central Bank of Nigeria, the Nigerian Agricultural, Cooperative and Rural Development Bank (NACRDB), Bank of Agriculture and some commercial banks. Programmes like the Special Program for Food Security (SPFS), the FADAMA II Project, the Presidential Initiatives on Cassava, Rice, Vegetable oil, Tree Crops and Livestock, the Fertilizer Revolving Fund (FRF) were all floated by government to provide funding and support.

### 1.2.2. Sustainable Food Systems and Agricultural Technical and Vocational Education Technology

United Nations (2015) Adopted sustainable food system and included it in the Sustainable Development Goals (SDGs). the SDGs highlighted the need for transformations in agriculture and food systems in order to end hunger, achieve food security and improve nutrition by 2030. The realization of the SDGs was perceived such that the global food system needs to be reshaped to be more productive, more inclusive of poor and marginalized populations, environmentally sustainable and resilient, and able to deliver healthy and nutritious diets to all.

Food and Agriculture Organization of the United Nations (2018) asserted that a sustainable food system should be able to deliver food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised. The concept was that food sustainability should be profitable throughout all of its value chain and broad-based in order to benefit the society and positive or neutral in its impact on the natural environment. Food system has been noted to have positive relationship with economic growth and development. The food system was opined to be dynamic and influenced by varied trends which include urbanization, population growth, climate change, and factors such as technological change and innovation, government policy change.

FAO (2018) noted that sustainable food systems (SFS) suffice as part of the engines of growth and creator of value-added in five components that include salaries to workers, provision of return on investment to entrepreneurs and asset owners, tax revenues to the government, benefits to consumers; and impacts on the socio-cultural and natural environment.

FAO (2018) asserted that the value added affect four feedback loops that are related to economic, social and environmental sustainability, and profoundly impact poverty, hunger and nutrition. The four feedback loops are an investment loop, driven by reinvested profits and savings; a multiplier loop, driven by the spending of increased worker income; a progress loop, driven by public expenditure on the socio-cultural and natural environments; and an externalities loop, driven by economic, social and environmental impacts within the broader food system and on other systems.

These feedback loops are noted to possibly be positive or negative. The more positive, the more sustainable the food system would be and vice versa. Therefore, positive feedback loops for both behaviour change and value creation which enhances a transformative change of food systems which shall help countries to achieve the Sustainable Development Goals.

While using the natural resources responsibly and protecting the environment, wealth that contributes to poverty reduction, with an improved food supply, would ensure food security. Also, with the right socio-cultural and natural environments, more nutritious food products would be made available, accessible and desired, thus contributing to nutrition security.

Nigerian National Policy on Education (2014) defines technical and vocational education as: “A comprehensive term referring to those aspects of the educational process involving, in addition to general education, the study of technologies and related sciences and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in relation to various sectors of economic and social life.

Walker and Hofstetter (2016) noted that vocational technical education can be defined as a training approach which encompasses knowledge, skills, competencies, structural activities, abilities, capabilities and all other structural experiences acquired through formal, on-the-job or off-the job training with the aim of enhancing recipients’ opportunity for securing jobs in various sectors of the economy or even enabling the person to be self-dependent by being a job creator.

Akinde and Vitung (2020) asserted that education system in Nigeria was differentiated so that technical education and vocational education are two different sub-sectors. Institutions in the technical education sub-sector were noted to be of tertiary but non-university level in nature with the role of educating middle-and technical-level manpower for commerce, industry, agriculture, health care and teaching; while vocational education was planned to train low-level workforce, such as operatives, artisans, craftsmen and master craftsmen for commerce, industry, agriculture and ancillary services. Vocational courses and programs are often shorter, more focused and prepare trainees for immediate employment which often results in the issuance of certificate of completion.

The United Nations International Centre for Technical and Vocational Education and Training (UNEVOC, 2019) noted that TVET in Nigeria are formal, non – formal and informal in nature. The formal Technical and Vocational Education and Training (TVET) system in Nigeria is handled by different institutions including Technical colleges, mono and polytechnics as well as Vocational Enterprise Institutions (VEIs) and Innovative Enterprise Institutions (IEIs) These institutions are all under the supervision of the National Board for Technical Education. This involve teaching and training with different curricular and minimum entry requirements and period of completion stipulated.

## 2. Literature review

In a survey conducted by Okoiueocha and Taneh (2013) in Rivers State, Nigeria, the roles of TVET were found to include contribution to economic development and improvement of graduates' skills for employability; while the need for restructuring TVET to serve industrialization needs and high responsiveness of government to TVET needs was acknowledged. However, the study was quite explorative and qualitative.

Chukwuedo and Omofonmwan (2015) posited that TVET policy framework and TVET-industry partnership in Nigeria are the instruments necessary to salvage the manpower development of the industry via TVET education programmes in order to continually replace competent manpower in the industry. The need for the design of TVET policy framework for industrial manpower development be done by TVET scholars and policy experts was recommended.

Walker and Hofstetter (2016) in their study of TVET in developing countries, noted that formal TVET in many sub-Saharan African countries was often based on colonial systems, which emphasized formal education through a small number of elite universities and colleges.

Akide and Vitung (2020) in their Analysis of Agricultural Technical and Vocational Education and Training System in Nigeria using an explorative and qualitative data found that the Agricultural Technical and Vocation Education and Training system in Nigeria was very weak and not attractive to youths who could be trained and motivated to take up agriculture as a career.

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## 3. Methodology

The research methodology involves the usage of the Vector Auto Regression Model. First, the Augmented Dickey-Fuller (ADF) was used to detect the presence of unit roots such that if the series are cointegrated the residual would be stationary.

The Johansen's Cointegration Test was used to test for a long run relationship between Agricultural output and the technical services available in Nigerian economy. The VAR provides a full information maximum likelihood estimation model, in a single step can examine for cointegration in the equation without the need for normalizing a particular variable. The technique eliminates carrying over the error from the first to the second step. Also, VAR does not require a priori assumption of endogeneity or exogeneity of the variables.

### 3.1. Method of data collection

Data used in this study is collected from the Central Bank of Nigeria from its published Statistical Bulletin on Real Agricultural Output and Technical Services between 1982 and 2021. The data for agricultural output and technical services were valued at the nominal price of 2010.

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## 4. Results

This study used a VAR model because both Real Agricultural Output and Technical Services series are non-stationary in levels and differences, and the variables are integrated.

Both time series showed no stationarity at level, and they demonstrate a common trend. But at the difference of both series, stationarity and presence of cointegration were discovered. The Augmented Dickey-Fuller regression estimate based on levels with intercept, time trend and nine (9) lags for both variables. Table 2 shows the ADF test and the order of integration.

Using the Johansen Cointegration Test, the trace and the Max-Eigen statistics showed that there exist no cointegration between agriculture output and technical services. As it can be seen from the table, the trace and the Max-Eigen statistics 0.653280 is less than the critical value 3.841466 while the p – value is greater than 0.05. This shows that there exists no long run relationship between agricultural output and technical services.

**Table 2** ADF Test for Agricultural Output and Technical Services between 1982 and 2021

<b>ADF TEST</b>						
<b>Variables</b>		<b>Level</b>		<b>First Difference</b>		<b>Order of Integration</b>
		Constant & No Trend	Constant & Trend	Constant & No Trend	Constant & Trend	
Real Agricultural Output		-0.368878	-1.758382	-6.022142**	-5.942433**	I(1)
Technical Service		-0.949952	-3.014081	-3.562934**	-3.583417**	I(1)
Critical Values	1%	-3.610453	-4.211868	-3.615588	-4.219126	
	5%	-2.938987	-3.529758	-2.941145	-3.533083	
	10%	-2.607932	-3.196411	-2.609066	-3.198312	

**Table 3** Johansen Cointegration Test for Agricultural Output and Technical Services

<b>Unrestricted Cointegration Rank Test (Trace)</b>				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.275284	12.56638	15.49471	0.1317
At most 1	0.017501	0.653280	3.841466	0.4189
<b>Unrestricted Cointegration Rank Test (Maximum Eigenvalue)</b>				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.275284	11.91310	14.26460	0.1140
At most 1	0.017501	0.653280	3.841466	0.4189

**Table 4** VAR Estimates for Real Agricultural Output & Technical Services

<b>Vector autoregression estimates</b>		
	<b>RGDPAGRO</b>	<b>TECHSERV</b>
R-squared	0.989214	0.996309
Adj. R-squared	0.987907	0.995862
Sum sq. resids	0.192082	0.036920
S.E. equation	0.076293	0.033448
F-statistic	756.6466	2227.080
Log likelihood	46.54132	77.87566
Akaike AIC	-2.186385	-3.835561
Schwarz SC	-1.970913	-3.620089
Mean dependent	8.879094	7.095921

S.D. dependent	0.693772	0.519963
Determinant resid covariance (dof adj.)	5.84E-06	
Determinant resid covariance	4.40E-06	
Log likelihood	126.5024	
Akaike information criterion	-6.131707	
Schwarz criterion		-5.700763
Number of coefficients		10

**Table 5** Test of Significance of coefficients of Real Agricultural Output & Technical Services

<b>Method: Least Squares (Gauss-Newton / Marquardt steps)</b>				
<b>Dependent Variable: LRGPAGRO</b>				
LRGPAGRO = C(1)*LRGPAGRO(-1) + C(2)*LTECHSERV(-1) + C(3) *LRGPAGRO(-2) + C(4)*LTECHSERV(-2) + C(5)				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.956173	0.179745	5.319608	0.0000
C(2)	0.226266	0.345903	0.654134	0.5176
C(3)	-0.032701	0.184812	-0.176944	0.8606
C(4)	-0.135159	0.306705	-0.440680	0.6623
C(5)	0.078833	0.179776	0.438505	0.6639
R-squared	0.989214	Mean dependent var	8.879094	
Adjusted R-squared	0.987907	S.D. dependent var	0.693772	
S.E. of regression	0.076293	Akaike info criterion		-2.186385
Sum squared resid	0.192082	Schwarz criterion		-1.970913
Log likelihood	46.54132	Hannan-Quinn criter.		-2.109722
F-statistic	756.6466	Durbin-Watson stat		1.994897
Prob(F-statistic)	0.000000			

## 5. Interpretation of results and discussion

The several factors that determined the changes in Real Agricultural Output in Nigeria between 1982 and 2021 are explainable from the variation in the factor inputs from the technical service sector.

While the Johansen Cointegration test shows that there exists no convergence between Real Agricultural Output and the Technical Services. However, the VAR results show that more than 98% variations in Agricultural Output between 1982 and 2021 are explainable by the variations in the Technical Service sector in the long run. Therefore, inferences can be made that TVET represented by the contribution of Technical Service Sector to Agricultural Sector is significant.

### 5.1. Findings and recommendations

The findings of this study are that although, the impact of Technical Service Sector on Agricultural Output is significant, there exist a sharp contrast to what TVET offers labour and skill supply to the Agricultural Industries in Nigeria. This is

highlighted in the few numbers of Agricultural Technical and Vocational Education and Training institutions, the low ratio of graduates from these institutions in comparison to the population of farmers in Nigeria coupled with mismatch in required skill set.

The study also found that the public – private partnership is minimal between Agricultural Sector and many TVET institutions thereby causing the existence of a vacuum where theories taught in the classes could be put into practice in farms. The study recommended the need for the increase in the funding of TVET institutions, improvement in the quality of TVET training to include newer agricultural research and technology.

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## 6. Conclusion

This study investigated the relationship between food sustainability and the role of TVET in economic development. The study found the need to improve on TVET funding, setting up the framework for skill bridge between institutions and Agricultural Industry.

The study attributed a long run relationship between Agricultural Output and Technical Services.

Furthermore, this study prospects further study on the pattern of food security, economic development and the role of Technical and Vocational Education and Training.

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