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Diffusion of Technological Products: The role of selected technical and vocational colleges in Nigeria.

OYEBOLA, Abiodun Isaac
African Institute for Science Policy and Innovation (AISPI)
Obafemi Awolowo University
aoyebola@yahoo.co.uk

AKINTELU, Sunday Olufemi
Department of Management Technology
Faculty of Management Sciences
Lagos State University
sunday.akintelu@lasu.edu.ng

OKUNLOLA Abiodun Funso
Department of Business Management
College of Economic and Management Sciences (CEMS),
University of South Africa
abiodun.okunlola@stu.cu.edu.ng

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Abstract
The study aimed at determining the role played by TVET in diffusing technologically produced products in Nigeria, with an emphasis on Lagos state. Federal, State, and Private TVET located and registered in the state were adopted. Similarly, TVETs offering 100 percent related courses: agriculture, textiles, fashion, design, fabrication and welding, electrical electronics, block and brick-laying, information communication technology [ICT], energy and power generation, carpentry, printing and publishing, and building construction formed the basis for the TVET selection in the state as well. Thus, out of its two hundred and twenty (220) beginning and graduating year students and eighty (80) teachers' population across the three TVET purposively selected in the state, one hundred and seventy-one (171) sample sized using the Taro Yamane sampling technique was arrived at. Data sourced was arrived at through the administered questionnaire and the result were analysed using the descriptive, mean-frequency and percentage on a representative Likert scale of 1-5 indicating not diffused (NS), poorly diffused (PD), moderately diffused (MD), diffused (D) and highly diffused (HD). The result showed that, on the extent of diffusion, agricultural product is scaled 5 at 4.84 mean, followed by ICT, block and brick-laying and carpentry at 3.98, 3.64 and 3.45 mean respectively. Direct sales represent the most effective channels of diffusion at 23 percent. However, among the three arms, private TVET has the highest level of diffusion of technologically produced products. **(**ABS)
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1. Introduction

This is the age of technological disruption. The constantly diffusing world-of-technological innovation brings to bare the reality to which products are subjected to, and, in the way technical and vocation institutions must catch-up with the dynamics. On one hand, diffusion represents rate of spread (Sierra, Arends-Kuenning & Hewey, 2020; Shadaifat, Shadaifat, & Khateeb, 2020; Shikuku, Pieters, Bulte & Ladrach, 2019). However, unlike emerging economies of Asia, Africa and indeed, Nigeria technological rate of spread is considered very low (Owo & Ajie, 2020). The obvious is founded in its poorly funded and low acceptance of technical and vocational

education [TVE] and policy mismatched (Okoye & Arimonu, 2016; Isah, Che Kum & Md, 2013).

Practically, the meaning of technical and vocational education [TVE] or, and training [TVET] has been expressed from various view- points in the literature. For instance, Okoye & Arimonu, (2016) opined that the duo is separate concept that expresses specifics away from general. According to them, vocational education is specific to a job training prospects while technical is general to any job opportunities. This definition is corroborated in Shdaifat, et al, (2020), Braunerhjelm (2010) and Braunerhjelm & Svensson, (2008).

Similarly, in 2004, the National Policy on Education in Nigeria describes TVET as the 'comprehensive term of the aspect of educational process involving, in addition to general education, the study of technologies and related sciences and acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in the sectors of economic and social life'.

Specifically, the United Nations Educational Scientific and Cultural Organization [UNESCO], (2017), describes TVET as an integral fusion of education and lifelong learning process. That is, it has the ability to instil 'learning of knowledge, skills and attitudes relating to the world of work'. It is a three-set part comprising of education, skills and training for the desired human development and, ultimately, for the growth and development of the economy.

Globally, nations have established their TVET with specific mandate that is fussed into generating specific and general employment, improving quality of lower and producing middle level manpower, increasing skill and technical sets, reducing social vices, advance indigenous technology, integrating the younger population, innovating, technological advancement, growing the economy, to say the least (Shikuku, et al, 2019; Raimi & Akhuemonkhan, 2016). Invariably, development witnessed in some part of the emerging markets especially that of Asia, is linked to the manner in which their government emphasised TVET (Xiong, Payne & Kinsella, 2018; Paryono, 2017).

In the case of Nigeria, historical stance indicates that TVET, though part of the educational design as at the early days of independence, apathy soon relegated it to the background (Owo & Ajie, 2020, Raimi & Akhuemonkhan, 2016). The reason behind this stem from increased in favouring convention education rather than technical and vocational skill training. This is what, according to Raimi & Akhuemonkhan, (2016) says is responsible for the loss of interest in technical and science-oriented courses which, invariably bred, high level of unemployment, reduces youth employability, bred poor skill and technical knowledge set, increased poverty, poor technological advancement and many others.

Obviously, this is reflected in the economic life of the nation as well where it is observed that, larger percentage of semi/skilled/technicians of what should have been provided/produced in the country (should the TVET has long been developed) are brought from outside the country (Oyebola, Olaposi, Akarakiri & Adejuwon, 2018). This is typically metamorphosed into high level of unemployment and or employability level of skilled technical and vocational students to fill the available and high demand technical jobs. With this, unemployment in the country rose from 11.6 per cent to 12.7 percent in 2003, 23.1 percent in 2019 and, projected to reach 33.5 percent in 2020 (Nigeria Employers' Consultative Association – NECA, 2019).

To say the least, ninety-nine (99) technical and vocational enterprise institutes [TVEI's] has been established by the National Board for Technical Education [NBTE] as complimentary to the nation's colleges, aimed at reducing the incidence of absence of certified technicians and vocational graduates (Oyebola et al, 2018). They cut-across the ten TVET federal, state and private polytechnics, specialized institutions, colleges of agriculture and health, and innovation enterprise institute [IEIs]. In spite of this, a large depth of vacuum still exists between technical/vocational expertise and the demand for such in the real world. In order words, the study essentially carved out a niche at taking stocks of existing technological products (units/departments) in Nigeria's technical and vocational colleges (with special attention to South-West) and their relevance in the development aspiration of the country.

2. Literature Review

2.1 Technical and Vocational Education Training [TVET]

TVE is often referred to as Technical and Vocational Education Training [TVET]. However, there are series of taxonomies to which it is described. For instance, in Raimi & Akhuemonkhan, (2016) TVET, is also

apprenticeship education/training [AE/T], or occupation and technical education [OTE], or vocational education and training (VTE), or technical education [TE], vocational education [VE] and so on. Technically, TVET is a symbiosis of terms which are jointly married together. However, it is imperative that each term is individually understood.

(a) **Technical Education: Technical Education:** This type of education is offered for the purpose of producing lower, middle level manpower and technicians. Basically, they are studied at the upper secondary school and lower tertiary institution level. Often, jobs/careers under this class of education cut across but not limited to engineering, business, technologists, general education among others (Okoye & Arimonu, 2016). In the words of Nwafor & Ali, (2015) and Ukwuoma, Amade & Moghalu, (2013) 'technical education is the training of technically oriented personnel who are to be the initiators, facilitators and implementers of technologically development of a nation.'
(b) **Vocational Education:** similarly, vocational education is designed for people at a much lower level of education. Unlike technical education, vocational is usually for those at the senior secondary level and technical colleges. It is however, skilled-based programmes specific to any chosen vocation (Okoye & Arimonu, 2016).
(c) **Vocational Training (VC):** this qualifies you as been equipped with basic and relevant skills where the foundational rudiments or scientific fundamentals are relatively thought under a relaxed protocol or the foundational skill-rudiments are relaxed.
(d) **Education:** This can be defined as the process of acquiring knowledge, skills, aptitudes, and attitudes necessary for effective living.
(e) **Training:** Unlike education, the goal of training is to develop oneself in any skill set and knowledge in one area of competencies or specific competency, with the goal of becoming more productive, increase hand-on performance, capacity, capability and productivity.
(f) **Technical and vocational Education Training [TVET]:** Summarily, TVET would relate to sets of education or training received, which are dedicated to specific or some sort of general career, profession or occupation that will lead to the trainee becoming more specialized and with ability to fend for oneself.

According to UNESCO, (2017), Lundvall, (1988), Jensen, Johnson, Lorenz, & Lundvall, (2007), TVET is more comprehensive described to mean an integral fusion of education and lifelong learning process. That is, it has the ability to instill 'learning of knowledge, skills and attitudes relating to the world of work'. It is a three-set part comprising of education, skills and training for the desired human development and, ultimately, for the growth and development of the economy.

TVET cut across different facet of educational products/programmes and across different institutions and colleges saddled with the responsibilities of impacting TVET education, knowledge, skills and training. In Nigeria for instance, the National Board for Technical Education [NBTE] is the apex regulatory of all the colleges and technical education in the country. This role is however played in collaboration with the Federal Ministry of Education [FME] and other allied institutions. Below is a framework of TVET institutions in the country.

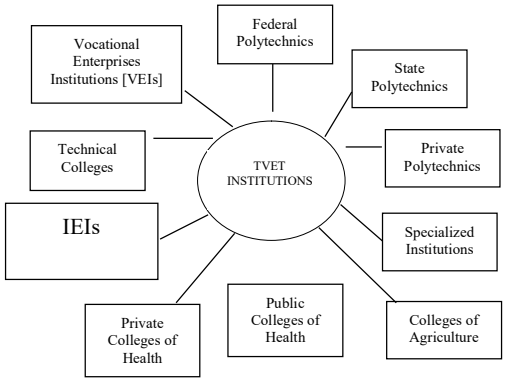

Figure 1. TVET institutions in Nigeria

2.2 Technology Diffusion

Technically, technology diffusion relates to the rate of spread and acceptability of new technology. Invariably, we say that, it is the rate to which new innovation is accepted. In essence, Rogers, (2003) observed that the manner in which new innovation is communicated for acceptance and indeed accepted, over a period of time is referred

to as technology diffusion. Or, technology diffusion relates to the process by which innovations are adopted and adapted by a population. This is made possible in that it becomes obvious in the nature, quality, and producers/origin from where the technology is coming from prior acceptance. For instance, technology-innovation may be in a way which a new machinery is accepted and seen to make or perform better from the past or previous processes or experience. This may also relate to whether the new technology is of good quality and dependent on its origin. Similarly, the Organization for Economic Co-operation Development (OECD), (1997, 2005, 2006), opined that, innovation, if centrally described, goes beyond mere creation of new ideas, process and technology, but to include applicability yielding new value. It is simply a better way in getting result than the previous known processes. Summarily, technology diffusion goes beyond the development of new technology but cut across acceptability and value improvement. For the basis of this study, technological diffusion stem from the ability of the trainees/students of technical and vocational education to be able to develop new acceptable product based on training or education they have received or, transform their lives in product-like manner, by either creating new products or improving on existing ones (Salazar, Raunair, Mora-Monge, & Shah, 2020).

2.3 Nigeria TVET History

Three (3) phases of TVET in Nigeria are crucial in understanding where it all begun. They are;

(a) The Pre-Colonial Era of TVET

Traditionally, most communities or states are often gifted in one form of local knowledge, skill or training of some sorts. Often, these skill-sets are pass from one generation to another in form of training and education. This is typically the case of Africa and, indeed, Nigeria prior the invasion of the colonial masters. In the words of Isah, et al, (2013), traditional Nigeria is rich in skill-sets, training and education of their wards in various occupations, business, craft, and trade, among others. Specifically, mining, blacksmithing (iron, goal, coal), pottery, agriculture, carving, fishing, craft, building, brewing, tie-and-dye and so on, were some of TVET replica that existed in this era (Okunlola, Osuma & Omankhalen, 2019a,b). In order words, prior the advent of formal education and now TVET, the traditional Nigerian community had series of technical and vocational training with which the society was known for.

(b) The Colonial Era

This era witnessed the invasion of the colonial masters into the country. As at that time, several reasons were alluded to the invasion. First, was for the reason to introduce religion. Second, the introduction of the former lead to trade. And along the line there was a need to communicate and have ways through which trade can be consummated and transported. Altogether, the invasion was the masterminding conspiracy that led to initial abandonment of the country's TVET like educational system. However, as the colonial master settled down, it became apparent that there is a need to train people in technical and in vocation jobs in order to get them to perform their enterprise. As such, as Sierra, et al, (2020), Oyebola, (2018), Xiong, et al, (2018), and Shane, & Venkataraman, (2000) observed, Hope Waddle Training Institute, Calabar belonging to the Roman Catholic Agricultural School in 1905, became the first technical and vocational institute in Nigeria. Similarly, Nassarawa Technical Institute came after in 1909. Thereafter, from one development plan to another came in 1944 and 1946 but without fulfilling the essence of Phleps-Stokes Commission Report, which produce a white paper as at the time favouring the establishment of more technical and vocational institutions. However, in 1949, the Nigerian College of Art and Technology became established with Eastern, Norther, and Western Regions branches (Oyebola, et al, 2018; Raimi & Akhumemonkha, 2016). This gave way to the country's preparation of independence through Ashby Commission that latter saw the reason to inculcate technical and vocational education in the nation's education curriculum.

List of Some Notable Establishments that gave rise to TVET

1. The Nigerian Railway Corporations [NRC] – 1901 [Nigerian Railway Training School].
2. Government School of Survey [GSS], Lagos – 1908
3. Marine Training School [MTS] – 1928
4. PWD – Public Works Department 1931 - [PWD Training School]
5. Post Office and Communication Office – 1931 [Post & Comm. Training School]

(c) The Post-Colonial Era

This era is tagged era where the country destiny is left in its hands. It is the era where, after independence in 1960, the country leaders needed to design a path of economic prosperity in which they want for their citizens. Specifically, after experimenting the kind of educational style and system inherited from the colonial masters, it became apparent that the country needed to design her own educational destiny. This is specifically so because it seems, at that time, the conventional education style was not adequate for moving the country from where it was, to where they want it to be. As a consequence, National Policy on Education [NPE] was established and gave

rise to the National Board for Technical Education in the country in 1977. Subsequently, this was refined in 1977, 1981, 1998, 2004 and up till the present day (Owo & Ajie, 2020, Isah, et al, 2013; Adejuwon, 2014,). Some of the country attempt at improving TVET education led to the establishment of some technical and vocational institutions in the country like; National Business and Technical Education Board [NABTEB], National Open Apprentice Scheme [NAOS], Industrial Training Fund [ITF], National Directorate of Employment, Technical Teacher Training Programme [TTTP], Metallurgical Training Institute (MTI), Polytechnics, Technical Colleges, Colleges of Education, Vocational training centres in some universities and Technical Universities.

2.4 Challenges of TVET in Nigeria

While there are peculiarities in challenges facing the growth and development of TVET across nations, emerging nations like Nigeria faces array of challenges which had refused TVET to grow and contribute meaningfully to economic prosperity (Okoye & Arimonu, 2016, Ukwuoma, et al, 2013). Some of these include;

1. Poor Funding: Without doubt setting up effective and efficient technical and vocation educational institute involve huge outlay often out of reach of public and private individual. As such, Okoye & Arimonu, (2016), opined that this is one of the inimical features that prevent progressive technological growth and development of a country.
2. Societal Stigmatization: Similarly, the society attitude towards those studying any technical or vocational education is repulsive. Society and even parents rather shower encomium and regard on those studying seemingly more prestigious courses at the university level than the technical and vocational ones.
3. Dearth of Qualified Professionals: Often, the country suffers from two sides-of-the-coin in this regard. On one side, available technical and vocational experts, who have been trained, most in the past, seem not to be certified with the current state of human capital and facility provided to carry out their responsibilities appropriately. Hence, are demoralized and poorly motivated in imparting knowledge. On another hand, and just as Okoye & Arimonu, (2016), puts it, most qualified technical and vocational professionals have left the country for greener pastures. Particularly, this includes 45 percent of Nigerian professionals and about ten thousand (10,000) middle and high-level managers leaving the shores of the country around 1997 and 2007.
4. Poor Motivation: Both teachers and students are poorly motivated in every aspect especially as it relates to technical and vocational education. For instance, the teachers are not as well remunerated and recognized within the society unlike their regular higher tertiary institution's colleagues. This goes a long way in affecting the psyche of these professionals. This similar act is also reflected in the students of these institutions when compared to their counterparts from the university system.
5. Poor Government Policy: One critical factor facing the growth of technical and vocational education in Nigeria is the poor handling of policy issues around the system. Indeed, they are policies summersault, counter-policy and policy duplication that have affected the smooth running of the technical and vocational college system.

2.5 Previous Studies

Plethora of studies have examined the influence and the role that technical and vocational training can play in advancing the wheel of economic progress and development and, at the same time, improving the living standard of the populace. Particularly, some countries have taken advantage of what TVET has in the offerings by concentrating TVET to the area/sector to which they need the speediest growth and or development in their economy policy agenda. For instance, Sierra, et al, (2020) study in Nicaragua, concentrated their TVET energy on high school students with emphasis on agricultural technology. Their study aimed at providing evidence of acceptance of technological diffusion in the rural areas among farmers (of students and parents) particularly, of the adoption of new technology. Using a theoretical approach, their findings shows that there exists improvement in the acceptance of technology among concerned elements. This assertion is also found in Shikuku, et al, (2019) study where, they observed that incentives are key to diffusing agricultural knowledge among the people of Uganda especially, if the gains therein are vital to the well-being of the country.

Similarly, Salazar, et al, (2020) study concentrated on the examination of diffusion of innovative technology in the energy sector in the United States of America. The survey analysis methodology was used to ascertain whether the choice of variables: complexity, trialability and observability are vital tool of innovation. The result concluded that there is the presence of positive correlation between innovation and technology and, that, in fact, embracing new innovative technology is a strong driver for organization's success.

Owo & Ajie, (2020) also examined the need to rejuvenate the TVET in the polytechnics in Nigeria especially, in the midst of the COVID-19 pandemic. Their concern was in the poor treatment to which concerned authorities of TVET and even the students, poor infrastructure of the laboratories, absence of modern facilities, lack of synergy between town-and-gown, defective curricula and many more are subjected to. In arriving at their inquiry,

descriptive survey design was purposefully implemented. Also, emphasised was placed on final year students of electrical/electronic engineering students and lectures of Nigeria polytechnics. Thus, from the mean and standard deviation result, findings show that compounding challenges that include poor/inadequate training facilities, lack of funding among others are some of the reasons behind the poor performance of TVET in Nigerian polytechnics.

Paryono, (2017) study was an overview between global and regional importance of TVET, especially at sustaining development in the Shanghai countries. His emphasises cut across continuous implementation of TVET at the school level and also as a matter of policy direction to sustain the growth witnessed by these countries. Essentially, he argued that to meet the labour market demand, to sustain development and create green jobs, it is essential that TVET should be seen as rather as a policy issue needing sustainability than it currently appears.

Similarly, Nwafor & Ali, (2015) examined the issue of TVET from the eye of entrepreneurship innovation and the promotion of industrial skills needed for development of South-Easters states of Nigeria. Accordingly, they argued that for any technological advancement, innovation and industrialization then, TVET must be made a matter of national priority that will trickle-down the ladder. From the theoretical study, they concluded that, the people of the region need to embrace technological base TVET education in order to contribute meaningful to the industrialization of the region and the country at large.

Also, in Isah, et al, (2013) study, the challenges facing the development of the Technical and Vocational Education [TVE] in Katsina, Nigeria was the central theme. Adopting five TVE in the state based on convenience, data gathered with the aid of questionnaire was analysed using the Chi-square analysis technique. Three concerned group – the principals, teachers and attendees of TVE workshop formed the study's respondents. One of the findings of the study was to establish a ministry of technical and vocational education to curb the historical and ever-lingering problems bedevilling the institution.

3. Research method, data analyses, and result

Essentially, the work builds on the study of Raimi & Akhuemonkha, (2014) and Isah, et al, (2013) with major modification. At first, the population of the study was ascertained via confirmation of the number of TVET and Centres in the state. After that, the sample of the study is determined using the Taro Yameni sample size determination. Thereafter, the study validated the methodological process of the study and equally performed the reliability test. Specifically, the study begun the process of determining the presence or otherwise of the significant relationship subsisting between technological diffused products and the role played by selected TVET in the state by first providing the descriptive statistics of the study respondents. Here, the demographic features of the respondents identified. Similarly, the cronbach alfa test is provided as evidence of confirming the appropriateness of the variables that are gathered for the study (Kothari & Garg, 2015). Thus, the frequency distribution, percentage and mean of respondents was applied on the basis of: low (L), moderately low (ML), very low (VL), High (H) and very high (VH), and 1= Not diffused 2 = poorly diffused, 3= moderately diffused, 4= Diffused, and 5 = highly diffused for the basis of determining the TVET/Centres products that is fully diffused. All of this was achieved with the aid of administered questionnaire.

3.1 Population

The South-West states formed the core emphasis of the study. However, for convenience experimentation, approved technical and vocational colleges based in Lagos state are used as basis for the study. The reason for this is because the state is unanimously referred to as the commercial nerve of the country. It is also the most populated state and, doubles as the fastest-growing state (economically) in Africa. In order words, TVET is expected to be rooted in the state. Also, six (6) TVET are registered in the state: Government Technical college, Ado-soba, Government Technical College, Agidingbi-Ikeja, Government Technical College Ikorodu, Government Technical College, Ikotun, Government Technical College Odomola-Epe and Federal Science Technical College, Yaba and; forty-eight (48) vocational centres have presence across the state. Similarly, there are more than fifty programmes available in the institutions. For the purpose of the study, a hundred percent course-offering common to each TVET/Centres is used as the basis for the pool estimation. They include: agriculture, textiles/fashion/design, fabrication and welding, electrical electronics, block and brick-laying, information communication technology [ICT], energy and power generation, carpentry, printing and publishing, building construction. Thus, based on this, each of the selected TVET/Centres, have a population of two hundred and twenty (220) populations across beginning and graduating year, as well as eighty (80) teachers across different field of study.

3.2 Sampling Technique

Further, the three hundred (300) selected population undergo a Taro Yameni sample size determination. Thus, the questionnaire instrument serves as the tool of eliciting responses. This is in two folds – bio-data, and the responses. It is equally subjected to content analysis. As such, validity and reliability is confirmed. The cronbach alpha test submission is also checked. In all, descriptive, frequency and percentage will be the tool of analysis undertaken with the aid of SPSS version 23

Taro Yameni Size determination:

$$TY = n = \frac{N}{1+N(e)2}$$

Where: n = Sample Size sought
e = Level of significance (at 95% confidence level)
N = Population Size (300).

$$\frac{300}{1+300\ (0.05)2}$$

$= 171.43 \approx 171$

3.2.1 Validity Test

To ascertain the rightfulness of tools adopted for this study, the face validity and content validity are confirmed using experts' opinions. First, the face validity [FV], allows the researcher to know whether his assertion of truth of measures of concepts in the study has measured what it ought to measure. Secondly, the content validity just tells of the appropriateness of wordings in the study (Brace, Kemp & Snelgar, 2003). The essence of this is to ascertain the appropriateness in scope, length, coverage, instruments, sufficiency and efficiency criterion.

3.2.2Reliability Test

This simply put a check on reproducible attribute of the work. In essence, reliability ascertains the consistency and precision of measures used in the study (Baridam, 2001, Brace, et al, 2003). Most often, the Cronbach Alfa range of 0.6, 0.70 or 0.75 are considered appropriate (Baridam, 2001, Brace et al, 2003; Kothari & Gaurav, 2015).

3.2.3 Data analysis and Results

First, the study ascertained data gathered using the cronbach alfa. Specifically, what CA does is to give further insight into the progress of determining whether or not data sourced are suitable for its purpose.

Table 1: Cronbach Alfa Result

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
.701	.707	4
Source: Authors' computation		

The study started its analysis by first testing for the consistency/reliability or otherwise of the variables. This is done using the cronbach alfa test for reliability of the data. As specified from table above, the test result of .701 conform to scholars generally acceptable standard form for reliability test. By implication, the internal consistency of the results reliability of Cronbach alfa = .701, which is consistent. Thereafter, the study proceeded to determine the frequency and percentage level of the study.

3.2.4 Descriptive Statistic

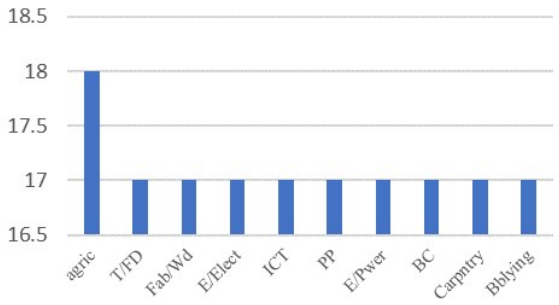

Figure 2. Institution/TVET selection respondent unit

Figure 2 shows the rate of responses based on programmes examined among the TVET institutions

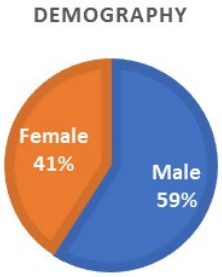

Figure 3. Demographic characteristics

This is the demographic characteristics. This shows that males are dominant in the field of TVET, especially from the chosen TVET programmes in the state. From the analysis, 59 percent are male, and 41 percent are female.

Extent of Diffusion of Technological Products

The extent of diffusion of technological products innovated in the technical colleges is presented in Table 4. The highly diffused products were food and beverages, electrical and electronics, ICT, chemicals and textile and leather products respectively. The poorly diffused products were pulp, papers, printing and publishing products, metal and fabricated products and building construction products. The results indicate that the extent of diffusion of innovated products in Nigerian colleges varied according to the types of products innovated. As the results indicate, food and beverages products with a mean level of 4.84 were well diffused relative to other products. This is followed by electrical and electronics (Mean = 4.01) as well as ICT (Mean =3.98) products, respectively.

Table 2: Extent of diffusion (Mean Result)

PRODUCTS	MEAN
Block & Brick-laying	3.64
Carpentry	3.45
Building construction [BC]	3.01
Energy & power generation [E/Power]	2.01
Printing & Publishing [PP]	2.08
ICT	3.98
Electrical Electronics	3.01
Fabrication/Welding	2
Textile/Fashion Designing	3.31
Agriculture	4.84

The outcome as shown in Table 4 and compared with the paramenters indicate that, products not diffused in 1; poorly diffused = 2; moderately diffused = 3, diffused = 4 and highly diffused = 5. Here, agriculture is diffused, others apart from energy and power, printing and publishing and fabrication, are moderatley difussed

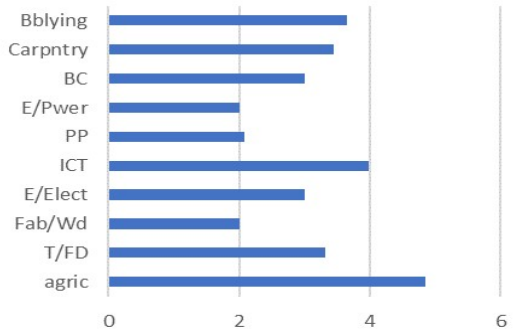

Figure 4. Graphical reprsentation of extent of diffusion

Figure 4 shows the graphical representation of the extent of diffusion associated with each selected TVET products

Table 3: Channel of diffusion responses

CHANNELS	PERCENTAGE
Setting up new coy [NC]	5.2
Consultancy services [CS]	10.2
Setting up New industry [SNC]	0
Marketing	0
General operations [OPS]	0
Internal sales (collaborations)	36
Mass Media [MM]	20
Self-Marketing [face-to-face]	6
Direct sales [DS]	23

The channel of diffusion of products produced by selected TVET is shown in Table 3. The channel with the most impactful is internal sales of products, followed by direct sales, mass media and consultancy respectively. What this imply is that, products are diffused more through individual/group internal sales.

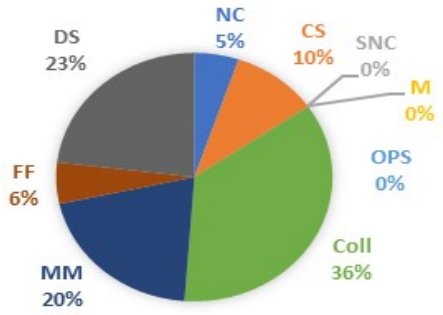

Figure 5. Graphical Representation of Channel of Diffusion

The extent of diffusion of products could be constrained by channels through which the products are diffused. Hence, channels of diffusion of the products were examined and the findings are presented in Table 3 and Figure 5 respectively. The highest percentage of the products is self-utilized by the college itself. This is an indication of poor extent of diffusion of technological products produced by Nigerian colleges among greater population. Expectedly, developed products from technological units should diffuse from its base to different channels up to the point where more products are requested from technological base. About 23% of the products were directly taken (DS) to the market by the producing colleges and technical institutions. Even though, mass media (MM) contribute to the diffusion process of the technological products, only 20.4% could be attributed to them. Although technological products from institutions could be diffused through other effective channels such as specific market, industry and OPS, the findings of this study show that no single unit of technological products

in the colleges is diffused through these three channels. Rather, the poor extent of diffusion of the products led to the setting up of private companies by the colleges to undertake the business. This indicates that the producers of the technological products become the marketers of the products. Even at that, only 5% of the products could be diffused through the channels.

Level of adoption and usage of technological products in Nigerian colleges

Table 4: Adoption and Usage of Technological Products

Products	Frequency	Percentage	Mean
Level of Adoption			3.1
Very Low	6	5.3	
Low	7	6.1	
Moderately low	60	52.6	
High	21	18.4	
Very High	12	10.5	
Level of Use			3.2
Low	4	3.5	
Moderately low	52	45.6	
High	25	21.9	
Very High	15	13.2	

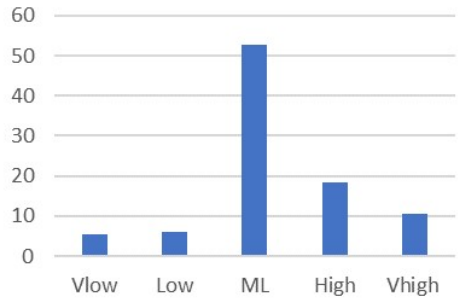

Figure 6. Level of technology adoption

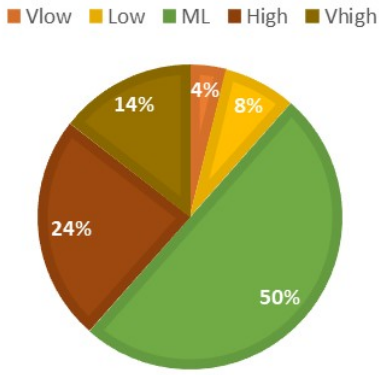

Figure 7. Level of usage of technology

Results in Table 4 show the level of adoption and usage of products innovation in Nigerian colleges as presented graphically in Figure 6 & 7. The perceptions of respondents varies in relations to the levels of adoption and stage of the products. A low percentage of respondents (6.1%) indicated that the level of adoption of college technologies was generally low. However, 52.6% indicated that the level was moderately low, while 18.4% showed that the level of adoption was high. The results indicated that most of the respondents thought that the level of adoption of innovated products in the colleges was neither high nor low; rather it was moderate. Given the level of adoption of new technologies in the market, the usage of the identified products was also examined. The results revealed the perceptions of respondents concerning the level of usage of the products was similar to that of adoption9. A low percentage of respondents (7%) indicated that rate of usage was generally low, 45.6% indicated that the rate of usage was moderate while (21.9%) indicated that the rate of usage was generally high.

Findings from the studies have shown that various types of technological products are being developed in Nigerian technical colleges, and this will amount to wasted efforts if they are not beneficial.

Products Adoption by Colleges

Table 5: Level of adoption of products in different colleges

Colleges	Mean
Federal colleges	2.79[a]
State Colleges	3.3[a]
Private Colleges	3.21[b]
Source: Field Work, (2021)	

The difference in mean of the items was significant at the 0.05 level. Mean with the same letter are not significantly different ($F = 4.36$, $p < 0.05$). Parmeter 1= very low, 2 = Low, 3= Moderate, 4= High, and 5 = Very high

Across the different TVET colleges examined (Table 5), the mean level of adoption of products from federal colleges is low while the mean level of adoption of products from state and private colleges was moderate. The result is an indication that the level of acceptance of technological products from the state and indeed, the country, into the market is low, suggesting a need for concerted effort to create more awareness of local products in order to increase the level of adoption and consequently usage of the products.

Conclusion

Findings from this study has shown that technological products produced by Nigerian colleges varied in their rate of diffusion. It is obvious that the technological products produced in Nigerian technical colleges are not highly diffused. This may be because Nigeria technical colleges do not have collaboration with any SMEs, multinational company, and Research and Development institutes which has led to most of the products been self-utilized. This is an indication of poor extent of diffusion of technological products produced by the colleges. For Nigerian technical colleges to be effective, the capacity of its diverse actors must be built and strengthened, many actors will increasingly possess special skills that contribute to the diffusion of innovative products. Successful management of developed products requires a dynamic process that will promote uninterrupted commercialization and diffusion of the products. Product developers may not necessarily be the driving force behind commercialization and market development of the products. They may decide to license or go into venturing. In summary, the general aspects of this study are emphasizing that Nigerian technical colleges cannot develop and commercialize technological products in isolation and the continuous interaction with the other components of the system is crucial. It will allow accumulation of knowledge on the workings of the innovation and increase in the user- producer competence Adejuwon, (2014). It is the interaction between the local technological capabilities and other innovative organizations that determines the capacities of technical colleges to develop technological products that will be beneficial to the society. Most importantly, to join the league of developed nations and the New Industrial Countries, by integrating TVET in the Nigerian educational systems as emphasised by the UNESCO (2017) Third International Convention in Shanghai to a reasonable extent, will eradicate poverty and cushion high levels of unemployment.

Recommendation

The outcome of this study reviews some critical insight into which, when tapped into by all tier of government, would, to a great extent, not only improve the technological capabilities of students in the TVET institutions but also provides TVET that adequate recognition it deserves among its contemporaries locally, regionally and internationally. Likewise, it would also place the country's economic, especially that of the TVET institutions into the path of advancement. In order words, to build on this gain, it is most appropriate at this juncture in the life of the economy, TVET and other institutions generally, that, first, there must be deliberate funding of TVET, especially by government, of TVET programmes and allied matters. Similarly, it is essential to create deliberate policy approach in synergizing TVET programmes with the industry so as to bridge programme-need gaps of the industry and of the larger society. As a matter of facts, the study also recommends that, all state apparatus must be seen to adopt and use products emanating from TVET for ease of diffusion and creating confidence in the society at large.

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