International Journal of Sciences, Engineering & Environmental Technology (IJOSEET), 6(1): 1-10, 2021
ISSN 0794-9650

www.repcomseet.com

Polytechnic Education: A Tool to Sustainable Economy and Technological Growth

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Abstract - The vision and mission of establishment of polytechnic is to develop the need of the society technologically. It is unfortunate that the vision on polytechnic education in Nigeria was dead before its implementation because of lack of vision, drift from industry to polytechnic staffers, corruption and political propaganda. The paper presents some major challenges confronting polytechnic education in Nigeria and proffer best practices possibly for economy and sustainable technological growth. It also suggested that polytechnic graduates should be given right environment to study and work so as to contribute to the economy and growth of this nation. Finally, the paper recommends, among other measures, that the government at all levels are to improve the funding of polytechnic education in order to overcome the deplorable conditions of infrastructure and facilities in the polytechnic system.
Keywords: Blended learning, collaborations, entrepreneurship, industrialization, job qualifications, skill acquisition.

1.0 Introduction

Polytechnic education is quite inevitable in the pursuit of technological development of any country. Elements that contributed to sustainable development of polytechnic education are creativity, innovation, networks and partnerships, staff development programme, teaching methods, generic skills, industrial relations and internships, counseling, entrepreneurship, ICT skills, interest, recognition, knowledge, competency-based training, articulation, and commitment of management.

A large number of polytechnic graduates are out there roaming the streets for white collar jobs. The students before graduating need to be prepared for competent technical/vocational and entrepreneurial skills for future economy. It is therefore expedient that polytechnic education is reposition for skill acquisition, vocational and entrepreneurial training for veritable empowerment. Graduates of polytechnics are required to be stimulating the economy as job creators through training received from technical and entrepreneurial skills. The institutions responsible in producing these graduates need to partner with industries in training of students, upgrading of workshops/laboratories and bring in experts to strengthen the curriculum and introduction of new technologies.

Nigeria established polytechnics to produce middle level manpower. The foremost is the Yaba College of Technology, which was initially established by the colonial masters as technical college in 1934 but later upgraded to polytechnic status in 1963. Kaduna Polytechnic, Kaduna was established in 1968, Ibadan Polytechnic, Ibadan in 1970, while the Institute for Management and Technology, Enugu was upgraded to the status of polytechnic in 1973. Presently there are over 100 private and public polytechnics in Nigeria. Polytechnic education plays prominent roles in national technological transformation and industrialization. It has the mandate to provide training of professional character with great attention devoted to manipulate skills and practical in the areas of engineering, forestry, survey teacher training, medicine, legal studies and business (commercial) studies. It is unfortunate that Nigeria education system, which includes the polytechnic education, is plagued with a malady of disastrous confluences; gross under funding (Sanni, 2009). Quality issue, poor quality students and staff and decayed infrastructure. Others include unemployment of her products (Okebukola, 2013), leadership problem, inadequate if not lack of tools and equipment. Unfortunately, polytechnic education has not been given the required attention it deserves.

2.0 Vision 2020 and Polytechnic Education

The vision and mission of establishment of polytechnic is to develop the need of the society technologically. Provision is made for polytechnic education and the necessity of skill acquisition and training: entrepreneurship, well-equipped workshops and laboratories in Vision 2020. About 80% of what humanity embarks upon worldwide requires technical and vocation skills (Dung-Gwon, 2014). Polytechnic education through skill acquisition is the master key that unlocks the country's future that will facilitate the Nation to harness and distribute her vast resources in manufacturing, mining, industry and agriculture (Dung-Gwon, 2014). It has the potential to address youth unemployment and empower self-employment in the nation through science and technology. These youths can then be transformed into competent citizens and highly skilled men and women capable of competing word wide.
Former President Goodluck Jonathan government transformation agenda plan in continuation of his predecessors on Vision 2020 craves to develop Nigerians capacity needs to meet development objectives, through:

i. Highly-skilled world-class manpower and
ii. World class institutions in Nigeria with:
   - World class infrastructure;
   - World class learning resources; and
   - World class teachers.

In order to achieve these objectives, a 4-year strategic plan was set, which includes:
i. Establishing National Vocational Qualification Framework (NVQF).
ii. Polytechnics to award B.Tech. degrees.
iii. Parity between degree and HND.
iv. Increase awareness and sensitization for Technical Vocational Education and Training (TVET).
v. Review of 2001 blueprint on TVET.
vi. Production of science equipment for laboratories.
vii. Fabricating science and technical instruction materials for technical colleges, etc.

These goals and objectives are not far from the ones contained in the National Policy for Education and the National Board for Technical Education (NBTE) Act of 1985.

It is unfortunate that the vision on polytechnic education was dead before its implementation because of lack of vision, drift from industry to polytechnic staffers, corruption and political propaganda. As industries are collapsing so also the vision and mission of establishing polytechnics is going down. The products of polytechnics are expected to be self-sufficient and employable. Therefore, polytechnic curricula need to be re-examined to meet job market. Figure 1 depicts requirements for graduates to be employable.

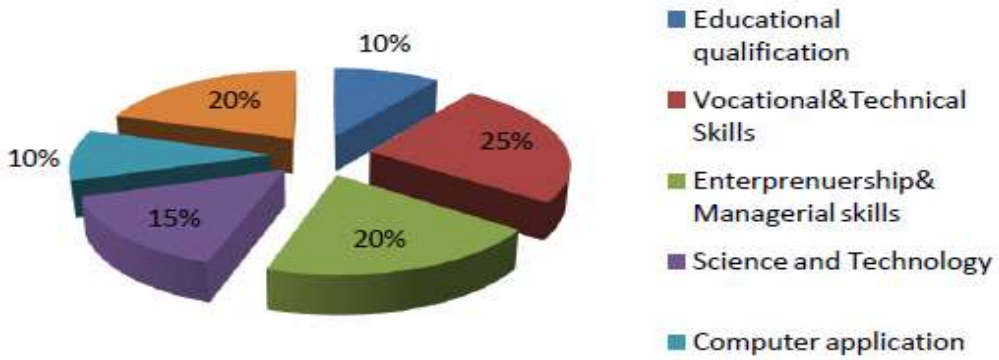

Fig. 1: Requirements for graduates to be employable (Dung-Gwon 2014)

3.0 Polytechnic Reformation

Polytechnic education is not just the acquisition of practical skills; it involves skill application that utilizes scientific knowledge (Reagan, 2012). It constitutes a vital engine for economic, social, practical and all-round development of any nation. It has been identified as a tool for sustainable, virile and stable economy. Akpomie (2009), asserts that no nation can move forward technologically, industrially and economically without developing a strong partner initiative in the creation of wealth, poverty reduction and employment generation with required skills.

Gone are those days that students were proud to be products of Yaba Tech, IMT Enugu, Kaduna Poly and Ibadan Poly. The products of these institutions were hot cake in industries with better remunerations. They were not job seekers but employers/jobs hunt for them in those years of industrialization. Unfortunately, due to bad leadership, corruption, poor/epileptic electricity and many other things, the industries hunting for these graduates faded away. Such industries as Ajaokuta and Osogbo Steel Rolling, Nigeria Machine Tool, Paper Mill, Textile Company, Sugar Company, PZ and many others. Many of them were dead while others relocated to neighbouring countries due to epileptic electricity.

Colleges of Education (COE) offering either NCE or B.Ed., Colleges of Medicine (Nursing) offering either Nursing certificate or B.Sc run a single straight program while Colleges of Technology (Polytechnics) offering Higher National Diploma (HND) runs two certificate programs National Diploma (ND) and HND. Students are subjected to double admission rigour. While COE and University sit for one common entrance examination through UTME, Polytechnic requires two, one through UTME into ND and another through the Polytechnic Admission Committee into HND program. The Colleges of Technology (Polytechnics) needs to harmonize its own program to offer a single certificate and admission processes. Apart from the Students Industrial Work Experience Scheme (SIWES) program done after the second semester in ND, the Industrial Training (IT) at the end of fourth semester of the ND program must be part of the polytechnic program just as internship in the College of Medicine or teaching practice in the College of Education. IT training that is part of requirement for HND admission is just a formality but not reality. About 75% of students coming back with the IT letters obtained such in their respective fathers' house, many of them did not have the IT experience.

Polytechnic education is therefore required to be restructured for qualitative and industry fitted graduates who can be proud of himself and never seen as second-class citizen. There should just be a five years single program. Students offered admission through UTME by relevant body (JAMB) and graduated after five years. Such student must have passed through at least six months not four months SIWES program and one-year IT program in related industry well organized and supervised by the institution concerned during these five years *and be awarded B.Tech at the end of training*. At the end of the program, a graduate of polytechnic should be given equal rights, privileges and treated same as First degree graduates who can aspire to any level without discrimination or dichotomy.

Polytechnics and their products should be given right environment to study and work so as to contribute to the economy and growth of this nation. It is difficult to give what you did not have. No lecturer lectures in the COE without certificate in education, at least Nigeria Certificate in Education (NCE) or Post Graduate Diploma in Education (PGDE). The same goes for lecturer in the University, No lecturer lectures in the University without First degree in relevant field or College of Medicine without First degree in medical sciences. Polytechnic education is characterized with the application of practical aspects supported by appropriate theory. Its contents composition of practice is greater than the composition of theory in percentage. Therefore, a skill-based education like polytechnic should have its lecturer to have obtained at least National Diploma with his or her degree before such can be qualified to lecture in the polytechnic. Due to differences between theory and practice, polytechnic courses curriculum preparation should not be left only in the hands of those who only had teaching/theoretical experience but involve practitioners who are believed to have passed through polytechnic system or aware of the conditions that exist in the working world (Haider, (2016).

4.0 Polytechnic Administration and Management

Polytechnic administration and management are different from other institutions. While COE and Universities are under Commissions, the Polytechnic is kept under NBTE who is saddled and too busy with multiple responsibilities. This is a clog in the wheel of progress of Polytechnic Education. The product of COE and University is the Provost and Vice Chancellor respectively while most of Polytechnic Rectors never passed through Polytechnic system. No wonder, a lot of maladministration in the polytechnic system. Many of the

requests for consumables, tools and equipment for laboratories and workshops are turned down by the Management because the man at the hems of affairs never had polytechnic laboratory/workshop experience. The policy makers in and on polytechnics are non-products of polytechnic. Apart from the fact that majority of COREN executive members are university degree holders, University still has four representatives while polytechnic has just only one representative. No wonder, COREN stipulated additional master degree for HND holders before they could be registered as Engineers by the year 2021 whereas such additional Master degree is not stipulated for B.Eng/B.Sc degree holders. Discrimination of the highest order in a regulating body.

Polytechnic graduates are looked down and seeing as second-class citizen, both in admission and appointment. The institution that produced them did not even value or recognize them. Sorry to say, because of these inadequacies and discriminations, they seem not marketable and fit in the society for industrial job for economic and sustainable development of this country. The truth is that polytechnic curricula are developed to fit into the industrial programmes and not purely academic, but this does not make polytechnic graduates inferior in any way to university graduates. It is high time the polytechnic education is restructured, reformed and repositioned. Truth may be bitter but it is better said. The present workforce be allowed in the system until they are retired, subsequent appointment should be among those that have passed through the system with or without additional higher education depending on the category of employment.

5.0 Funding

Funding of polytechnics in Nigeria can be considered to be the worst when compared with other nations. China is investing heavily on polytechnic education and even proposing to convert 600 universities to polytechnics (Yojama, 2014), Nigeria is proposing to convert polytechnics to universities. China government took their decision so as to reduce academic theory that does not guarantee jobs (Yojama, 2014). They want their polytechnic to focus on Engineering and Technology. Vocational college graduates receive slightly higher average starting salary compared to graduates from universities in China, the reverse is the case in Nigeria. Good funding and good practice of polytechnic education will go a long way in economic and technological development of a nation. Nigeria polytechnics may not necessarily be converted to universities before they can award B.Tech, M.Tech. even PhD as it is in some countries such as India if properly funded.

I looked back into the 80's during my diploma days at Federal Polytechnic, Ado Ekiti; laboratories and workshops were well equipped. Consumables were sufficient for students use with functional laboratory tools and equipment. It is pathetic that most of Nigeria polytechnic laboratories are empty nowadays. No money to purchase consumables, some of the laboratory tools and equipment are obsolete and no money to replace them with modern ones. More so, student laboratory/workshop ratio are not taking into consideration while students practical have turned into alternative to practical. Poor funding has made most of the courses in the polytechnic unaccredited.

For technology education to play its definite role for effective productivity and sustainable development in Nigeria, Government must cultivate a certain standard of scientific and technological culture, government should provide proper and adequate funding, adequate and modern facilities should be provided, polices concerning technical and vocational education should be left to those in the field to formulate and implement (Abdulrahaman 2013).

6.0 Blended Learning

There is need not to limit teaching and learning activities to face-to-face alone to enhance effective realization of the objective of polytechnic education, but emphasis should be on the concept of collaboration and integration of curriculum. Blended curriculum and networking of teaching and learning with appropriate agents, organization, commerce and industry in other to bridge the existing gap between theory and practice. This will improve the quality of polytechnic products in meeting the competency required in the nation's job market and technological growth.

Polytechnic learning is still lacking behind in the use of ICT as medium of teaching in support of effectiveness of learning but depends much of convectional system of learning, that is, face-to-face learning (Mutaqin, Marethi,, & Syamsuri 2016). Limitations of laboratories, workshops, classrooms, facilities and infrastructures have not been able to afford students to have ideal learning process. One of the learning methods that can be applied in the polytechnic to improve quality of learning is blended learning as against face-to face learning. It is more active than regular face-to face learning. Blended learning has considerable merits of overcoming the

problem of time, study space and availability of practice facilities (equipment) and other infrastructures. Student motivation is increased when supported with online learning and this has positive effect on student's academic success (Yagci 2016). Blended learning encourages constructive and collaborative learning which is strongly emphasized in learning styles currently (Wong et al. 2016). Implementation of blended learning in the learning process are found differs in student characteristics, students been taught and learning outcomes and has a student-centered approach to learning design (Saliba, Rankine, & Cortez 2013).

Model used in blended learning must conform to instructional learning, time, the technology used, and effectiveness in improving student skills. The most appropriate instructional model in blended learning is rotational model. There are four types of rotational model namely: rotational laboratory, station model, individual rotation and flipped classroom model. Individual rotation cannot be applied because of course unit system. In the station model, students are divided into groups with different learning tasks where one of the groups can take the advantage of online media. This develops student independence attitude, general skills, special skills and knowledge. The laboratory rotational model affords students rotate in learning on scheduled time while some students learn independently using online media on lecturer's instruction; some may study in the laboratory with the supervision of the instructor. But lecturer presents his material through online media and use face-to-face method to explain to the student in flipped model approach. Lecturers and students must be strengthened in utilization of ICT and promote cultural change to center more on online learning method. (Kadek, Putu, Herman, Priyanto 2018).

The seven principles for good practice in education for effective teaching and learning presented by Chickering and Gamson's (1987) can be used to provide the instructors feedback about their online teaching practice. The principles have been successfully researched into and applied to develop and guide courses in online education in literature (Creasman 2012, Hathaway 2013 and Crews, et al. 2015). The principle stated that good practice in education:

i. Encourages cooperation among students

ii. Encourages student-faculty contact

iii. Promotes active learning

iv. Emphasizes time on task

v. Provides prompt feedback

vi. Respect of different talents and way of learning

vii. Communicates of high expectation

The seven principles did not only represent best practices for higher education in online courses only but also traditional courses (Baldwin and Trespalacios 2017).

7.0 Training for Industry and Global Certification

The quality of polytechnic education in Nigeria is a master key to national development (Hassan 2018). Technical/vocational and entrepreneurial education is required to be prioritized and made the foundation of national development for sustainable economy and technical development to be attained. There must be real commitment to Technical and Vocational Education Training (TEVET), research, development and innovation. Innovation in addition to the existing qualification and adoption of Nigeria Skills Qualification Framework (NSQF) and National Vocation Qualification Framework (NVQF) based on National Occupation Standards (NOS) in collaboration with private sectors/industries will provide the skills-based industry validated certifications and internships. These will enable polytechnic graduates not only to acquire global certification but industry validated portfolio and evidences of skills acquisition. They will also be self-employed, job creators, inventors and techno-entrepreneurs who will be able to stand against future challenges.

It is high time to stop being a consumer nation but redirect the economy to grow local industries. Potentials of each department must be harnessed; proposals to TETFUND on research, development and innovation support in value addition in collaboration with industries must be encouraged to enhance institution-industrial research.

Results of the research will lead to the springing up of local industries and further drive technological education in Nigeria.
For the actualization of Nigerian aspiration to be fully actualized there must be a perfect congruent between the job qualification offered in the polytechnic and the needs of the nation. Most of the job qualifications obtained in the polytechnics nowadays are not relevant to the nation industrial plans and development.

The Academic Board of each institution must therefore recognize qualifications that are needed in the country and introduce those qualifications through our technical institutes. Some of the qualification relevant to the present industrial plan are: Electrical/Electronic, Data Telecommunication, Television and Film Production, Telecommunication, Solar/Renewable Energy, Software Development/Coding, IT Robotics, Database/Network Administration, Music/Instrument Technology, Medical Equipment Repairs and Maintenance, Mobile APP Development, Network, Computer, Intelligence and Security Studies, Web Developing, Network & Cyber Security, Satellite Communication, Satellite Ground Station, Satellite Control, Aerospace Engineering, Online Marketing, Public Procurement Strategy Development, Drawing and Animation, Satellite Image Analysis, Geographic Information System (GIS)/Remote Sensing, Intelligence and Security Studies and Statistics/Record Analyst.

A short-term re-skilling program can be designed to train those that had already graduated with the non-relevant industrial qualification to meet up with the current needs of the industry. This calls for all polytechnic to collaborate with industry sector for standardized job qualifications and competences across levels.

In the same vein, polytechnics must interface with business community for proper understanding and identification of technical skills relevant for promoting business activities such as: technical services, information technology, deep sea welding for oil and gas, allied maritime services, housing and infrastructure, transportation and the likes. The training offered in the polytechnic will be uniquely different from that of the universities and polytechnic graduates will be highly market demanding if polytechnic education curricula could be tailored towards job qualifications relevant to the present industrial plan that will promote business community (Olawumi, 2019).

8.0 Students' Capacity Building in Polytechnic Education

Human capacity is one of the major factors that can bring about sustainable development and capacity building of any country. This involves education and training intended to develop and strengthen graduates with skills, knowledge instincts and attitudes related to jobs in different sectors of economic for sustainable development (Olaitan, Asogwa, & Eze 2011). Graduates from polytechnics need a passion for learning, creativity, a dedicated work ethics, problem-solving abilities and life-long learning opportunities to survive in a new, worldwide competitive market. For the best practice in polytechnic education, institution-industry collaboration apart from SIWES needs to be encouraged to ensure a qualitative education grounded on competency and skilled acquisition for sustainable development and capacity building (Ovaiawe, Uwamaiye and Uddin 2017). This collaboration between formal education in the polytechnic and industry will create an enabling environment for polytechnic graduates to acquire hands-on experience, skills, knowledge and better attitude to work. Industries will provide functional facilities, high skilled workforce of production and raw materials which are useful in the practical training of polytechnic students. The collaboration will afford graduates opportunity of the training which is replica of the actual work environment of where to work upon graduation (Ibik 2014). It will equally assist on the development and planning of relevant curriculum that will take cognizance of the students' needs to meet with society.

9.0 Entrepreneurship Education, Capacity Building and Economic Development

Entrepreneurship plays a major role in development and economic growth of any nation. It is a form of education targeted towards skill acquisition and knowledge about entrepreneurship aimed at encouraging innovation, creativity, critical thinking, social/self-awareness and opportunity recognition. It thrives in economic system where stakeholders such as government, politicians, educationists, and social change agents play key roles. Graduates and even instructors acquire organizational skills, interpersonal skills; time management and leadership development required to organize or established a private sector needed to promote economic growth and development. Self-employment in the light of dwindling opportunities for white collar job is a viable option through entrepreneurship as one of the ways of solving youth unemployment, a serious indicator of economic unhealthiness. Economy of Nigeria has remained undeveloped due to lack of entrepreneurial awareness. This

has caused stagnation in the economy to be private-sector driven which at the same time lead most of the youth due to unemployment to many social vices.

There is need for education and exposure to principles and practice of entrepreneurship for people to become entrepreneurs and get out of the challenges of growing unemployment, poverty and social vices. Proper coordinated education and capacity building is of great importance. It is therefore necessary for Nigeria to learn from United States of America (USA), India and China who are well developed in entrepreneurship capacity. Considering the enormous resources Nigeria is endowed with, collaborations with these developed countries on capacity building for some exchange program and training of lecturers and instructors would be a step in the right direction (Eze and Nwali, 2012).

10.0 Conclusion

This paper presented Polytechnic education as a tool to sustainable economy and technological growth. Challenges facing polytechnic sector and solutions are proffered. Polytechnic education is not just the acquisition of practical skills; it involves skill application that utilizes scientific knowledge. But it is unfortunate that the vision on polytechnic education was dead before its implementation because of lack of vision, drift from industry to polytechnic staffers, corruption and political propaganda. Polytechnic education is therefore, required to be structured for qualitative and industry fitted graduates who can be proud of themselves and never seen as second-class citizen. Polytechnic education and its graduates should be given right environment to study and work so as to contribute to the economy and growth of this nation.

For technology education to play its definite role for effective productivity and sustainable development in Nigeria, Government must cultivate a certain standard of scientific and technological culture, provide proper and adequate funding, adequate and modern facilities should be provided, polices concerning technical and vocational education should be left to those in the field to formulate and implement. The Academic Board of each institution must therefore, recognize job qualifications that are needed in the country and introduce those job qualifications through our technical institutes.

One of the learning methods that can be applied in the polytechnic to improve quality of learning is blended learning as against face-to face learning. It is more active than regular face-to face learning. Blended learning has considerable merits of overcoming the problem of time, study space and availability of practice facilities (equipment) and other infrastructures.

Graduates from polytechnics need a passion for learning, creativity, a dedicated work ethics, problem-solving abilities and life-long learning opportunities to survive in a new, worldwide competitive market. For the best practice in polytechnic education, institution-industry collaboration apart from SIWES needs to be encouraged to ensure a qualitative education grounded on competency and skilled acquisition for sustainable development and capacity building.

Economy of Nigeria has remained undeveloped due to lack of entrepreneurial awareness. This has caused stagnation in the economy to be private-sector driven which at the same time lead most of the youth due to unemployment to many social vices. Therefore, there is need for education and exposure to principles and practice of entrepreneurship for people to become entrepreneurs and get out of the challenges of growing unemployment, poverty and, social vices. Proper coordinated education and capacity building is of great importance.

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