TECHNICAL EDUCATION, INNOVATION AND ENTREPRENEURSHIP: ACHIEVING ECONOMIC DEVELOPMENT IN NIGERIAN POLYTECHNICS

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Abstract
The paper proposes a human capacity growth-development model for Nigeria. The model is based on the pivotal role of Polytechnics in providing technical education, innovation and entrepreneurship training. The paper proposes that with an estimated population of 170 million people, Nigeria can begin to climb on a growth path if polytechnic education is properly harnessed to give technical education for a living; and, to turn out innovators with sufficient entrepeneurship skills to employ themselves rather than become job seekers. This will create employment and income leading to output and gross domestic product growth in Nigeria.

Keywords: *Technical education, innovation, entrepreneurship, growth, development*

Introduction

Despite the prevalence of polytechnics and monotechnics in Nigeria, these important institutions remain perhaps the least understood amongst the categories of tertiary institutions in Nigeria. It is easy for a layman on the street to say that universities are to provide high level manpower to government and private institutions; and that colleges of education are to cater for a country's desire for qualified and competent teachers. But ask any layman on the street (or even a polytechnic graduate or their teachers) on the specific role of polytechnics, one is most likely to be confronted with a plethora of conflicting and often confusing responses.

This paper commenced with a submission that polytechnics (or monotechnics as the case may be) though the least understood amongst the group of tertiary institutions in Nigeria, are certainly the most important especially in highly populated developing economies. Polytechnics have the capacity to create jobs through technical education, the promotion of innovation and the production of home-grown entrepreneurs. According to Mercer and Ponticell (2012):

> *Of particular interest to students and faculties in polytechnics is the emphasis on Science, Technology, Engineering, and Mathematics (STEM) education - where applied learning, research and technology*

prepare students to be innovators and entrepreneurs in knowledge-based economies by more closely connecting academia with industry.

In addition, the paper is of the view that in a country of an estimated 170 million people, where government cannot provide adequate jobs to the teeming unemployed, polytechnics through technical education, innovation and entrepreneurship are the bedrock of the Nigerian society. In a nut shell, Nigerian polytechnics have the capacity to usher into society skilled and qualified innovators and entrepreneurs who in turn have the capacity to propel economic growth and prosperity in Nigeria. If in 2009, there were 311, 581[1] students in Nigerian monotechnics and polytechnics (Shu'ara, 2010) then the future of Nigeria lie in the future and performance of Nigerian polytechnics. 311, 581 prospective innovators and entrepreneurs can create an equal amount of businesses and can further create jobs for more than 1.5 million people in an estimated time space of three or four years. If a trend like this is sustained, then Nigerian polytechnics can within a decade or so bring the disturbing menace of unemployment, poverty, crime and other social challenges to the minimum level.

A Brief Background on Polytechnic Education in Nigeria

The history of polytechnic education in Nigeria started as far back as 1932 with the establishment of the Yaba College of Technology, which was then known as Yaba Higher College. According to Oduwobi (2006) the Yaba Higher College was established to provide training of professional character, with great attention to practical skills in the areas of engineering, medicine, survey, forestry, teacher training and commercial studies. Thus, the first post-secondary institution in Nigeria was a polytechnic and this first and oldest polytechnic is sixteen (16) years older than the first and oldest Nigerian university, the University of Ibadan, established in 1948.

In 1969, the Federal Government of Nigeria Decree 23 established the Yaba College of Technology as an autonomous institution, mandated to "provide…instructions and training in technology…relevant to the needs of the development of Nigeria…and for research" (Sanni and Akinpelu, 2005) thereby giving way to the emergence of a full-fledged polytechnic in Nigeria. It is obvious from here that as far back as 1969, Nigerian governments view polytechnics as agents of Nigeria's development and established them to pursue such all important objectives. Whether these pivotal institutions have served this very important function remains the proverbial question begging for answers.

After the pioneer Yaba College of Technology, many state governments made efforts to establish polytechnics to promote science, technical and business education. The Federal Military Government in 1979 also established seven federal polytechnics. Some of the pioneering efforts include The Polyechnic Ibadan, 1961, Kaduna Polytechnic, 1968, The Petroleum Training Institute, Effurun, 1972, Kwara State Polyechnic, Ilorin, 1972, The Institute of Management and Technology, Enugu, 1973, Kano Polytechnic (now Abdullahi Wase), 1976, The polytechnic Birnin Kebbi (now Waziri Umaru Federal Polytechnic), 1976 (US Embassy, 2001) and many other subsequent efforts; one of the most recent efforts is the Kebbi State Polytechnic Dakin Gari taking off some time this year. According to the National Board for Technical Education, NBTE (2013) at present there are 21 federal polytechnics[2], 38 state polytechnics[3], 22 private polytechnics[4], 36 federal and state colleges of agriculture and 27 federal, state and private monotechnics offering curricula

[1]Out of the 311, 581 total enrolment in Nigerian monotechnics and polytechnics in 2009, 183, 717 were male, 127, 864 were female students.

[2]See Appendix 1

[3]See Appendix 2

[4]See Appendix 3

similar to those offered in polytechnics.

The mandate of government to polytechnics was to produce middle level manpower (Oduwobi, 2006). It is important to mention here, that inspite of this controversial mandate given to Nigerian polytechnics (i.e. the production of *middle level* manpower), which has over the years raised a lot of dust and generated heated debates and controversies, the significance and pivotal roles of polytechnics to national development cannot be lost.

Wherever polytechnics are established, the purpose and intent is to link academia to developmental needs of a country. Without risking overemphasis, this developmental role makes polytechnics peculiar academic institutions. When in 1985, the Federal Military Government promulgated Decree No. 16 to strengthen Nigerian monotechnics and polytechnics, it specified for them 70% enrolment in science and technology related courses and 30% enrolment for business related courses. This provision gave emphasis to technical education in polytechnics but recognised the need for business and entrepreneurship programmes to enable polytechnic graduates translate their technical knowledge and skills into brilliant business ideas. Polytechnic management must as a matter of serious importance continue to pursue this synergy of technical and business education.

In conclusion of this section, it is apt to itemise Momoh's (2005) list of seven goals of polytechnic education:

a. The provision of trained manpower in engineering, applied science, technology and commerce at all professional grades.
b. The provision of technical knowledge and vocational skills necessary for agriculture, industrial, commercial and economic development.
c. The provision of qualified and well equipped personnel to apply scientific knowledge to the improvement and solution of environmental problems for use and convenience of man
d. The introduction of professional studies in engineering and other technologies.
e. The provision of training to impart the necessary skills leading to the production of craftsmen, technicians, technologists, engineers and other skilled personnel who will be enterprising and self-reliant.
f. Enable men and women to have an intellectual understanding of the increasing complexity of technology and the role technology plays in the world around them.

Polytechnics, "The Three Constructs" and Economic Development

The crux of this presentation is to show that Nigerian polytechnics are centers of technical education, innovation and the production of entrepreneurs; the three ingredients that gives meaning to polytechnics as agents of national development. In all fairness, polytechnics are the only tertiary institutions ***primarily*** saddled with this triple responsibility: technical education, promotion of innovation and entrepreneurship education.

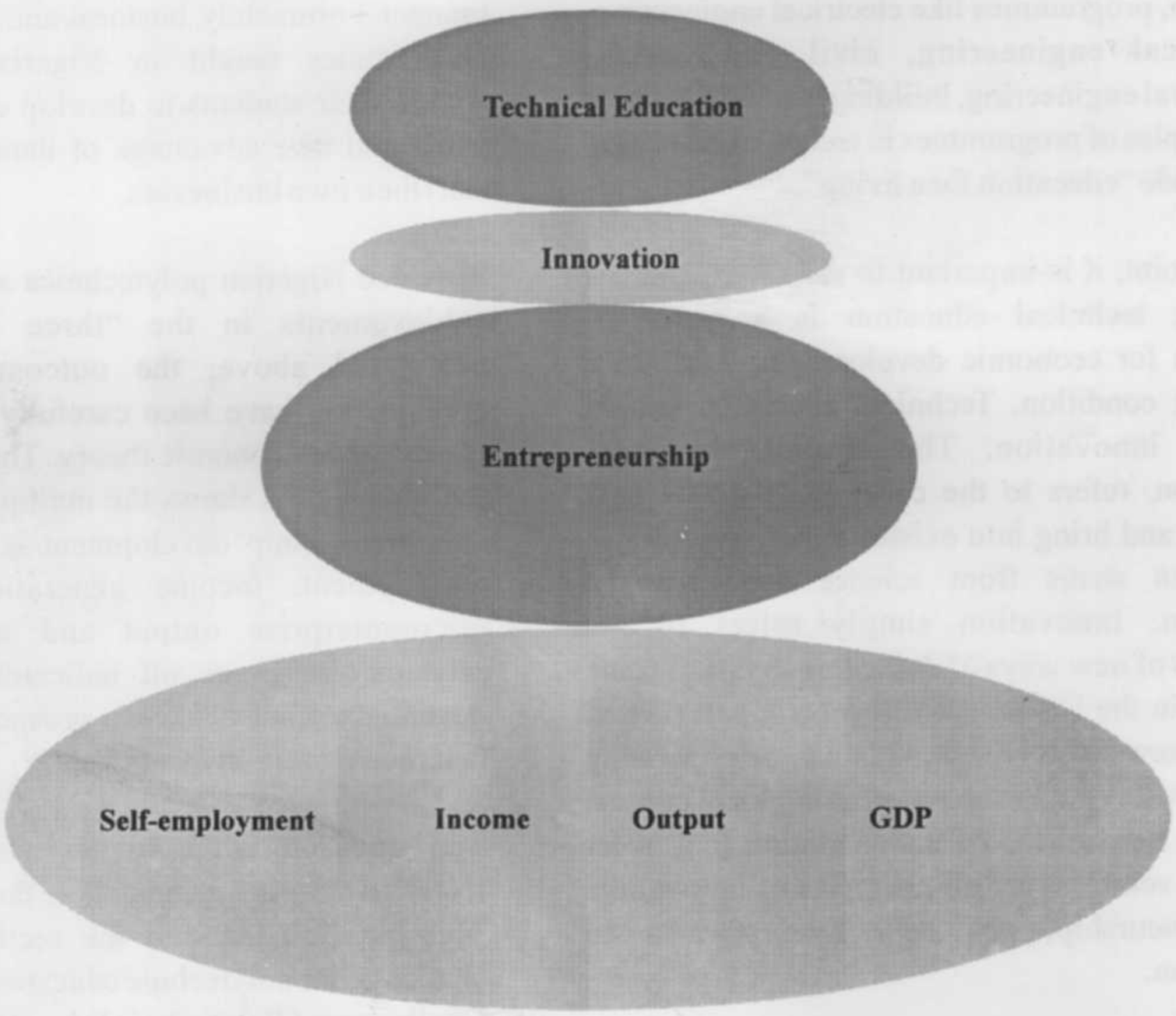
Empirical evidence revealed that Nigerian polytechnics have played various roles in national deveopment. This can be witnessed through a number research that were carried in this regard. (See for example:Liang, 2002; Erik, 2008; Hussain, Afzal, Asif, Ahmad and Bilal, 2011; Nkechi, Ikechukwu and Okechukwu, 2012; Mercer and Ponticell, 2012).

The theory and evidence in the works cited above suggest that polytechnics are designed and well-situated to contribute to workforce and economic growth. They are designed to blend theory and practice to solve real world problems for the benefit of society. The Chancellor of a Polytechnic in the US, Charles W. Sorenson describe polytechnics as comprehensive institutions offering professional, career-focused programs that engage students in active, applied learning, theory and research essential to the future of society, business and industry (Mercer and Ponticell, 2012).

However, the central argument in this paper is tied to "three constructs" through which polytechnics

are seen as agents of change, economic development, and prosperity in any society. Technical education, innovation and entrepreneurship are the "three constructs". For the avoidance of doubt, these "three constructs" represent the philosophy of science as "hypothetical construct". A hypothetical construct is an explanatory variable which is not directly observable; it has properties and implications which have not been demonstrated in empirical research (Wikipedia, 2013). The three contructs that were utilized in this paper for the purpose of operationalisation, is to enable to strengthen the arguments that have not been put to empirical test, but which can be used as basis for empirical research.

Like Alexander Dumas' three musketeers and their popular slogan "all for one, one for all", the "three constructs" are simultaneously pertinent to understanding a polytechnic's relevance, they are inseparable, and they must be understood together in the overall context of a polytechnic's developmental role. In otherwords, polytechnics are centers of technical education, grooming innovators and their innovations, running concomitant entrepreneurship education that can produce entrepreneurs capable of translating their technical education into innovations and their innovations into ventures that can create jobs, output and money. The following illustration, depict the relationship of the "three constructs" and how they impact national development.



The National Policy on Education (FRN, 2004) defines Technical Education as "that aspect of education which leads to the acquisition of practical and applied skills as well as basic scientific knowledge." From this definition, two basic forms of education are identifiable: "education for life" and "education for a living". According to Akerejola (2003) in Siyanbola (2010) "education for life" prepares students to interact and integrate with other people in the society, while "education for a living" provides them with the competence to generate the

wherewithal to sustain them and contribute to society's growth and development. In technical education, polytechnics are more concerned with "education for a living". Siyanbola (2010) explains that "education for earning a living" is usually characterised as vocational and technical education. It provides students with practical skills and competence to practice a vocation in the trades and crafts of production, repair and maintenance of artifacts and utilities in society. Included in "education for earning a living" are sciences, engineering and technology courses, which are taught in our polytechnics, which build the capacity of students to create and innovate techniques and technologies of production. This is the first vital construct through which we understand a polytechnic's pivotal role in the development of a nation. Similarly, looking at polytechnics education, programmes like electrical engineering, mechanical engineering, civil engineering, agricultural engineering, building, and architecture are examples of programmes in technical education that provide "education for a living".

At this point, it is important to state that whereas acquiring technical education is a necessary condition for economic development, it is not a sufficient condition. Technical education should lead to innovation. The second construct, innovation, refers to the capacity to create new concepts and bring into existence new inventions. Innovation stems from science and technical education. Innovation simply refers to the invention of new ways of doing things just as some students in the US invented facebook and twitter. Finding new ways of making soap, of processing salt, of preserving tomatoes, of using local content to create new means of transportation (e.g. solar powered vehicles) are all examples of innovation. Entrepreneurship, obviously then, thrives on innovation.

More so, evidences shows tha students of Nigerian polytechnics are making discoveries and innovation. At a recent convocation ceremony of the Nasarawa State Polytechnic, the Rector reported that students of the polytechnic have invented a salt processing machine, soap making machine, and an essential oil plant (Oraetoka, 2013). Now, these important innovations are the direct result of technical education in Nigerian polytechnics. The more innovations made by Nigerian polytechnics, the more entrepreneurship opportunities they are able to create. Thus, polytechnics provide technical education which can lead to innovation and subsequently entrepreneurship development.

Thus, the third construct, is entrepreneurship. It refers to any attempt to create a business venture or expand an existing one, leading to self-employment. It could be on the basis of an existing idea or because there is a new innovation that desires to be harnessed and exploited. Thus, an entrepreneur identifies opportunity, assemble required resources, implement a practical action plan and harvest the rewards in a timely, flexible manner. Fortunately, business and business-related programmes taught in Nigerian polytechnics enable their students to develop entrepreneurship skills and take advantage of their innovations to start their own businesses.

Provided Nigerian polytechnics are able to make achievements in the "three constructs" as postulated above, the outcomes of such a combination have been carefully articulated and explained in economic theory. The bottom part of the illustrations shows the multiplier effects once entrepreneurship development is achieved: self-employment, income generation, growth in microenterprise output and gross domestic product. These are all indicators of economic development and economic prosperity in any given macroeconomic environment.

The question is, have Nigerian polytechnics recorded these achievements so far, and if no, why? This question leads to the section four on the challenges of polytechnic education in Nigeria.

Challenges of Polytechnic Education in Nigeria

A critical problem facing Nigerian polytechnics and other tertiary institutions in Nigeria is underfunding. Total budgetary allocation to education sector was only 7% of the total in 2009 and 6.45% of the total in 2010. Nigerian polytechnics receive only a small proportion

compared to Nigerian universities. Underfunding translates to inadequate and under-equipped (sometimes obsolete) laboratories and workshops making much of the practical aspect of learning in Nigerian polytechnics impossible. These underfunded polytechnics cannot provide the technical education that will lead to innovation and entrepreneurship development.

Certainly, Nigerian polytechnics lack adequate and qualified academic staff. The discrimination experienced by academic staff in polytechnics compared to their counterparts in Nigerian universities in promotion and financial remuneration partly explains this shortage of academic staff. The problem is also partly explained by the systemic problem of brain drain and decline in the quality of education. In a 2007 staff audit of Nigerian tertiary institutions, Nigerian monotechnics and polytechnics require 30, 016 academic staff in view of their student population but had only 12, 938 recording a shortfall of 17, 078 academic staff representing 56.9% of academic staff required (Shu'ara, 2010). It means that Nigerian monotechnics and polytechnics are working with less than half the number of academic staff required. Certainly, this will adversely affect the quality of teaching and instruction rendering polytechnics incapable of achieving their aspirations.

Despite the clear emphasis on science and technical education as indicated in relevant laws establishing Nigerian polytechnics which stipulates 70:30 ratio between science/technology and business courses, many polytechnics fail to comply with the provision. Enrolment data obtained for 2000/2001 session, for example, show that 30.9% of students admitted by Nigerian polytechnics are in accounting/financial studies/banking and finance, 18.7% in business administration and management studies, 6.3% into marketing/purchasing, and 5.0% into secretarial studies while only 6.3% were admitted into electrical engineering, 3.8% into mechanical engineering, 2.6% into civil engineering, 0.6% into agricultural engineering, and 0.5% into chemical engineering. On the whole, business related programmes got 60.9% of total admissions in that session while science/technical programmes got only 13.8% of total enrolment (Onjewu, undated). This lack of emphasis will not promote technical education and innovation in Nigerian polytechnics.

Also, poor implementation of poverty allevation and employment creation programmes is a major hindrance to the actualisation of Nigerian polytechnics to propel economic development. Even when polytechnic graduates have acquired technical education and are ready to venture into their own businesses, relevant government agencies that are expected to fund their new innovations and entrepreneurship ventures do not target and give adequate funding to polytechnic graduates.

Another challenging issue, is the discrimination faced by graduates and lecturers of Nigerian polytechnics. Polytechnic graduates are not accorded same recognition and privileges as their counterparts from Nigerian universities in recruitment and practice in the Nigerian public service. Polytechnic lecturers are not promoted beyond level 14, except that has been addressed in a recent reform. These discriminatory practices have the direct effect of discouraging youths from aspiring for polytechnic education in Nigeria. In 2008/2009 academic session, total enrolment in Nigerian universities was one million, fourteen thousand, three hundred and thirty seven (1, 014, 337) while total enrolment in Nigerian monotechnics and polytechnics for the same academic session was three hundred and eleven thousand, five hundred and eighty one (311, 581) representing only 30.7% of total university enrolments (Shu'ara, 2010). Unless this trend is reversed, polytechnic education will continue to nosedive and the aspiration of having polytechnics become catalysts to economic development will remain a myth.

However, polytechnics have contributed a lot in giving credence to this problem of discrimination. It is when a polytechnic graduate fails to innovate and invest in his talent that the issue of paper qualification becomes relevant. Nobody asked Bill Gates what was his highest qualification before listing him as the richest man in the world. No one

cares that the man is actually a university dropout when he is repeatedly listed among the 10 most influential people in the world.

When Jelani Aliyu, a 1988 graduate of Diploma in Architecture from Waziri Umaru Federal Polytechnic (then The Polytechnic Birnin Kebbi) pursued his dreams, and became the chief designer for General Motors USA, and the inventor and designer of the Volt Electric Car, the first comprehensive and viable electric car ever designed in the world, when he became one of the most highly paid personnel in the whole of the USA, no one lamented that he was first and foremost a holder of a Diploma in Architecture from The Polytechnic, Birnin Kebbi.

That bickering between graduates of Nigerian universities on the one hand and Nigerian polytechnics on the other, and the resultant discrimination of the latter by the former is simply a manifestation of our systemic inadequacies particularly the corruption syndrome which has attracted every graduate and potential graduate of our tertiary institutions to the public sector. In the more advanced countries, like the US and UK, where accountability and transparency in governance are the norm, such bickering between graduates of these tertiary institutions is hardly experienced, and evidence suggest that graduates will prefer to start their own enterprises or join some private firms because economic opportunities are better in the private sector where remuneration is higher compared to public service. Their public service is zero-tolerant of corruption and pay less than private firms. Thus, job seekers will apply to the public service only as a matter of last resort and such bickering automatically becomes unnecessary, irrelevant and unwarranted.

Conclusion

This paper, established that technical education is broad based and could be relevant to people by training them to be skilled in a way that enables them to have a very important choice: to be in government or be self-employed. It also teaches the technological skills which would transform national economy. On the whole, the benefits of technical education are limitless including the lowering of unemployment and enhancing national development. The prevailing circumstance in which polytechnic graduates join the bandwagon of unemployed is uncommon, out-of-place, unnecessary and unwarranted.

With the right teaching environment, with the right proportion of staff and equipment, supported by a complete set of revised curricula and sufficient private sector and government funding, Nigerian polytechnics have the capacity to invent, innovate, create jobs, income and output as well as propel economic transformation in Nigeria.

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APPENDIX 1: FEDERAL POLYTECHNICS IN NIGERIA

	INSTITUTIONS
1.	Akanu Ibiam Federal Polytechnic, Unwana-Afikpo, Ebonyi State.
2.	Auchi Polytechnic, Auchi Edo State
3.	Federal Polytechnic, Ado-Ekiti.
4.	Federal Polytechnic, Bauchi, Bauchi.
5.	Federal Polytechnic, Bida, Niger State.
6.	Federal Polytechnic, Damaturu, Yobe State.
7.	Federal Polytechnic, Ede, Osun State.
8.	Federal Polytechnic, Idah, Kogi State.
9.	Federal Polytechnic, Ilaro, Ogun State.
10.	Federal Polytechnic, Kaura Namoda, Zamfara State.
11.	Federal Polytechnic, Mubi, Adamawa State.
12.	Federal Polytechnic, Nasarawa, Nassarawa.
13.	Federal Polytechnic, Nekede-Owerri, Imo State.
14.	Federal Polytechnic, Offa, Kwara State.
15.	Federal Polytechnic, Oko, Anambra State.
16.	Hussaini Adamu Federal Polytechnic, Kazaure, Jigawa State.
17.	Kaduna Polytechnic, Kaduna.
18.	Waziri Umaru Federal Polytechnic, B/Kebbi, Kebbi State.
19.	Yaba College of Technology, Yaba, Lagos.
20.	Federal Polytechnic, Bali, Taraba State
21.	Federal Polytechnic, Ekowe, Bayelsa State

APPENDIX 2: STATE POLYTECHNICS IN NIGERIA

S/N	INSTITUTIONS	S/N	INSTITUTIONS
1.	Abdu Gusau Polytechnic, Talata-Mafara, Zamfara State.	25.	Niger State Polytechnic, Zungeru.
2.	Abia State Polytechnic, Aba, Abia State.	26.	Nuhu Bamalli Polytechnic, Zaria, Kaduna State.
3.	Abubakar Tatari Ali Polytechnic, Bauchi.	27.	Osun State College of Technology, Esa-Oke.
4.	Adamawa State Polytechnic, Yola.	28.	Osun State Polytechnic, Iree.
5.	Akwa-Ibom State College of Art and Science, Numkum	29.	Plateau State Polytechnic, Barkin Ladi.
6.	Akwa-Ibom State Polytechnic, Ikot-Osurua	30.	Ramat Polytechnic, Maiduguri, Borno State.
7.	Benue State Polytechnic, Ugbokolo	31.	Rivers State Polytechnic, Bori.
8.	Delta State Polytechnic, Ogharra	32.	Rivers State College of Arts and Science, Rumola, Port Harcourt.
9.	Delta State Polytechnic, Ozoro	33.	Rufus Giwa Polytechnic, Owo, Ondo State.
10.	Delta State Polytechnic, Ugwashi-Uku	34.	Sokoto State Polytechnic, Sokoto.
11.	Edo State Institute of Management and Technology, Usen	35.	Taraba State Polytechnic, Jalingo.
12.	Gateway ICT Institute, Itori, Ewekoro, Ogun State.	36.	The Polytechnic, Ibadan, Oyo State.
13.	Gateway ICT Polytechnic, Igbesa, Ogun State.	37.	The Polytechnic, Ijebu Igbo
14.	Gateway ICT Polytechnic, Saapade, Ogun State.	38.	Yobe State Polytechnic, Geidam.
15.	Hassan Usman Katsina Polytechnic, Katsina.		
16.	Imo State Polytechnic, Umuagwo		
17.	Institute of Management. & Technology, Enugu.		
18.	Jigawa State Polytechnic, Dutse		
19.	Kano State Polytechnic, Kano.		
20.	Kogi State Polytechnic, Lokoja.		
21.	Kwara State Polytechnic, Ilorin.		
22.	Lagos State Polytechnic, Ikorodu.		
23.	Moshood Abiola Polytechnic, Abeokuta, Ogun State.		
24.	Nasarawa State Polytechnic, Lafia.		

APPENDIX 3: PRIVATE POLYTECHNICS IN NIGERIA

S/NO	NAME OF INSTITUTION
1	Allover Central Polytechnic, Sango-Ota, Ogun State.
2	Covenant Polytechnic, Aba, Abia State
3	Crown Polytechnic, Ado-Ekiti
4	Dorben Polytechnic, Bwari, FCT.
5	Fidei Polytechnic, Gboko, Benue State.
6	Grace Polytechnic, Surulere, Lagos State.
7	Heritage Polytechnic, Ikot Udota, Eket, Akwa Ibom State.
8	Igbajo Polytechnic, Igbajo
9	Interlink Polytechnic, IJebu-Jesa, Osun State.
10	Kings Polytechnic Ubiaja
11	Lagos City Polytechnic, Ikeja.
12	Lighthouse Polytechnic, Evbuobanosa
13	Nacabs Polytechnic Akwanga, Nasarawa state
14	Nogak Polytechnic, Ikom, Cross River State.
15	Our Saviour Institute of Science Agric and Technology (OSISATECH), Enugu.
16	Ronik Polytechnic, Lagos.
17	Shaka Polytechnic Benin City
18	Temple Gate Polytechnic Aba, Abia State
19	The Polytechnic Ile-Ife, Osun State.
20	The Polytechnic Imesi-Ile
21	Tower Polytechnic Ibadan, Oyo State
22	Wolex Polytechnic, Ikeja, Lagos State.