

APPROPRIATE AFRICAN TECHNOLOGY DEVELOPMENT IN NIGERIA: CHALLENGES AND THE WAY FORWARD

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Abstract

Nigeria, like any other developing country, requires technological development for economic stability and self-reliance. Since it is a well-established fact that technology can hardly be transferred particularly from the developed countries to the developing countries, the crucial role of appropriate technology becomes very inevitable if we want to attain technological advancement. This paper examines the concept of technology and technological development, the actual meaning of appropriate technology, its developmental challenges and the way forward towards actualizing appropriate technologies in relevant areas.

Introduction

The material wealth of any nation and its rating in the scheme of development depends on the production of goods and services through the coordinated use of available human skills, land and natural resources. It is now generally acceptable that science and technology contribute immensely to this process. So many developed countries such as Brazil, Taiwan, Malaysia, Mexico, Indonesia, Japan etc had received tremendous results in their manufacturing sector through utilization and development of appropriate indigenous technologies already existing in their Countries.

In Nigeria and in Africa, technology is not a new thing. What is new is perhaps modern technology. Indigenous technology has been a thing of the old. It has been a part and parcel of African culture, no matter how crude. Salihu (1991), quotes historical reports that iron smelting was carried out in Taruga (Nigeria) as far back as 400BC; producers were craftsmen working in small homes, open spaces, markets etc but in modern types of industrial factories. Southgatu (1957), confirms that production activities in England were along this line before the industrial revolution. Hopkins (1977), reaffirm that pre-colonial West Africa had a range of manufacturing industries which closely resembled those of pre-industrial society in other parts of the world producing clothing, metal works, ceramics, construction and food processing. He Identified Kano and Oyo areas of Nigeria as centuries old renowned locations of professional black smiths.

In Igbo land, certain crude technologies exist. This include the production of palm oil from palm fruits, the production of dane guns, spears, arrows etc. They made clothes from plant cotton, extracted oil from vegetables, dyes from plants; (Nkokeleonye 1991). CESAC (1985), described the African technology as indigenous. It was also described as 'subsistence technology" for it involved extraction from nature for our use.

This paper will not delve into indigenous technology but will highlight appropriate African technologies, their development challenges-and the way forward.

The Concept of Technology and Technological Development

Technology refers to all the ways people use their inventions and discoveries to satisfy their needs and desires. Fagbemi (1988:2), sees technology as "a positive and practical application of science in the service of man. That is the development of scientific concepts, skills, devices, tools and implements for application by labour in the production of material needs of society.

Kenneth and Yakubu (1997:154), conceived technology as:

The application of skills and knowledge for the purpose of transforming scientific analysis and discoveries into functional machines and equipment and tools through planning, design fabrication and manufacturing processes and indeed for the subsequent repairs and maintenance of the machines equipment and tools for the benefit of mankind.

Mayerson (1990), describes technology as the things of our modern society. An interaction of knowledge, skills and social organization. A way of achieving things of inventing and planning to

overcome specific problems. Jones (1971) observed that technological knowledge is surrounded by industrial secrecy and property rights, embodied in experience and therefore more difficult to transfer. Going by the latest description of technology, we can see that technology does not necessarily involve machines. That means that before the advent of the colonialist, our progenitors had built a large reservoir of experience in the rational utilization of energy in several processes, which had enabled them to satisfy their needs and sustain life.

Now that we have a better conception of technology, let us look closely at technological development. Ikoku (1981:2), defined technological development as that which:

connotes the ability of the nation to locate its recourse, to transform such raw materials into more useful products; to substitute for scarce (usually imported) resources with local land more abundant ones and generally to ensure the most economical and productive use of what the country has.

This means that apart from locating its resources, such a nation should be able to produce the raw materials and as well conserve them while transforming some quantity into "more useful products" as the need arises. Moreover to be able to achieve technological development or advancement, there must be "an army" trained in the relevant technologies to do a battle with a technological and economic backwardness.

Nigeria is still technologically under developed, backward and dependent. This is primarily due to lack of focus and vision. Nigeria cannot be said to lack sufficient resources in actual sense. There is abundance of data to show that Nigeria is abundantly endowed by nature with resources both human and material. Our backwardness can be traced to the fact that we have not been able to transform this raw human and material resources into more useful forms. We sell our material resources completely raw at give away prizes, dictated by the foreign buyers. Our human resources are wasted away due to our inability to give our young ones relevant technological education. This lack or limited technology education is responsible for our inability to transform our raw materials into more useful forms. Thus, leaving Nigeria to be technologically dependent on the advanced countries.

What is Appropriate African Technology

Appropriate African technology refers to the type of technology which can be developed to suit our cultural, environmental and social milieu. That means that such a technology should take its bearing from what is readily and abundantly available. Indigenous technology is regarded as the appropriate technology for developing countries. This brand of technology has been variously referred to as "labour intensive", "relevant" and environmentally sound (Baron 1978). This definition has been popularized in the publication of relevant agencies of the United Nations as "appropriate technology"

(Marsden 1970, Ilo 1971). Ali (1998), noted that the actual technological break through has to come essentially from within. That means that the skills and knowledge required for technological breakthrough can be more functional when it is hatched from within. There could be adaptation based on interaction with foreign technology, but its origin must be within the African environment. Mayerson (1990), collaborated this position when he observed that technology is best developed when it is appropriate and compatible with the already existing cultural, historical, environmental and economic conditions of the people with the skills and proficiencies gotten from within.

A technology therefore, is more appropriate and more functional when it is emanating from indigenous technology. This emanation may not be wholistic, it could be improved or re-packaged based on new ideas or knowledge which could be as a result of creative ingenuity or experiences from external interactions, or adapted to suit the modern requirement. The skills required can be improved upon by sending the already crude manpower for further training and exposure outside the country.

Appropriate Technology Development: The Nigerian Experience

The Nigerian Government and some private individuals have in the past made some frantic efforts to develop an appropriate technology. The country has witnessed the blossoming of native inventive skills in the likes of the Damian Anyanwu and the sylvanus Chima's native (Presumably radioactive) herb radio and electronic technology fame. We have seen Mike Henderson (Abuwa) from Obioma Ngwa experiment successfully on indigenous air craft technology. There are

the "Egbufors" of solar energy fame from old Orlu division. On a higher plane the endeavours of Professor Ezekwe and his colleagues in project development Agency (PRODA) and the technology of yam-seed multiplication are timely reminder that if we "dip the bucket where we are, we shall get the sweet water of indigenous technology. (Wigwe. 1988).

We have also witnessed various programmes aimed at industrialization and technology transfer. The setting up of vehicle assembly plant, iron and steel companies, machine tool industries and the establishment of research bodies such as the defunct National science and technology Development Agency (NSTDA), the Nigerian institute for social and Economic research, the Raw Project Development Agency (PRODA) and the National Agency for science and Engineering infrastructure are efforts of government towards technology development and transfer. Nigeria has also, commissioned a turn-key Petroleum industry in March 1988. The industry was expected to produce Linear Alkyl Bensene (LAB) in Kaduna and a carbon black/Poly Propylene in Ekpan Warn. Between 1975-1978, the Nigerian government commissioned many automobile assembly plants. These include: Volkswagen of Nigeria Limited, (VWON), Lagos; Peugeot Automobile Nigeria Limited, (PAN), Kaduna; Anambra motor manufacturing company (ANAMCO), Enugu, Nigerian truck manufacturing company (NTMC), Kano, steyr motors, Banchi; and Leyland Nigeria Limited, Ibadan.

After operating for well over ten years, these plants are yet to meet the aspirations of the government and people of Nigeria with respect to: transfer of technology and linkage effects to the rest of the economy; checking capital flight and improving upon foreign exchange earnings; providing cheaper and better means of transport; and job creation and securing of employment.

The reasons for the poor performance of the automobile industry has been dealt with in sufficient details as topical issues in Nigeria's contemporary economic history and requires no further elaboration here. (Ossai and Ayoola 1987; Akinrinade, 1987). One of the reasons offered by the motor companies for the low proportion of local content in their production process was that there was not enough local suppliers to supply the automobile plants with high quality components needed in the manufacture of vehicles (Omotunde 1987). The implication is that several years after the commissioning of the companies, there were poor efforts of backward integration in the automobile industry which would have stimulated local technology for the production of local content required by the assembly plants. This means that there cannot be any sound technological innovation and development, especially in situation where the necessary raw materials and some traces of indigenous technology are non-existent.

In most cases, it is the presence of the raw materials that initiates the indigenous technology. This author has identified some areas of appropriate technology based on the presence of the major raw materials required for the technology and some traces of local technologies.

Some Areas of Appropriate Technology and their Relevance

Coal: Nigeria has abundant coal in Enugu. Before the discovery of oil, coal was the main source of power all over the world. Coal can supply most of the chemicals supplied by oil. It is simply a more difficult task to get the chemicals out. This is why oil is preferred as a source of chemicals. Scientists are projecting that the Nigerian oil will finish in the next twenty years. In which case, the nation will return to coal as a source of power. Lee (1988) observed that it is quite possible that new, easier methods may be developed for obtaining chemicals from coal. In Britain, there is an effort to turn coal into petrol. They have had some success at their research laboratories in Cheltenham. Coal has been made into petrol, diesel, fuel, jet fuel and chemicals. They have set up a pilot plant at Ayr in North Wales. The plant started in 1987 and converts 2.5 tonnes of coal a day. The process relies on solvents dissolving the coal. British coal hopes to convert 10 million tones of coal into petrol every year in this century. Modern coal-powered cars are already being produced in Britain (Lee 1988). Nigeria can also borrow a leaf from Britain and develop its coal industry. Since the country has abundant coal and even the personnel, appropriate technological development in this area will advance the country. By the time the country begins to convert, coal to liquid fuel as is the case in Britain the dependence on petroleum will reduce.

Oil: Abundant oil mineral exist in Nigeria and many other African countries. Petroleum is the source of many other chemicals. From it a variety of hydrocarbons are produced. There is no industry that does not need petroleum products. In Nigeria, most of the products got from Petroleum are exported

to the West because they cannot be put into adequate use locally. Even ordinary carbon black which can be used to make printing ink, black paint, carbon papers, typewriter ribbons etc. are either wasted or exported at a give away prize because the country lacks the appropriate technological expertise to put the material into adequate, utility. Nigeria with her abundant human resources still relies on foreign experts for the drilling and refining of petroleum; and for maintenance of the machinery. When these machines breakdown, the country imports fuel for domestic use. Appropriate technology in this area, which will include trained personnel and provision of the required machinery will save the country from this embarrassment.

Cement: Cement is made by heating a mixture of limestone, clay and water. The end product is cement powder, which is sold for making mortar, bricklaying or concrete. Limestone is very abundant in various parts of the country. It is the major raw material required for cement production. Cement technology is very relevant in Nigeria. With appropriate and adequate technology, cement can be improved upon to replace the non-degradable plastics and metals. Cement can be designed to have the features of plastic or metals. This can easily be done by

- a. Increasing the power of the missing machine.
- b. Reducing air in contact with cement.
- c. Adding a chemical that stops the particles from clinging.

By this process, it is possible to design a cement that will even have better qualities than plastics and metals (Lee 1988)

Plastics: Ethene (a monomer of polyethene used in making plastic) is got from coal and Petroleum. Since the nation has abundant-petroleum and coal; which when broken down yield ethane as one of the products, the nation can flourish in plastic technology if the industry can be appropriately develop.

Soap/Cosmetics: Nigeria has abundant vegetable oil. Palm oil is very common in the Eastern and Western Nigeria. Groundnut oil and animal fat are common in the northern part of the country. These animals are good sources of animal fat. Their fats can be melted down and used for soap manufacture.

Fat or Oil + NaOH _____ Soap + Glycerol.

Sodium hydroxide is a readily available industrial raw material and with the abundant oil resources, high quality soap/cosmetic technology can be attained. The glycerol (glycerol) which is a waste product of the saponification process can be extensively used in the manufacture of body lotion and creams. Our country is still importing high quality soap. She still relies on foreign countries for cosmetic creams and lotions. An appropriate soap cosmetic technology can save the country from this problem.

Synthetic Detergents: One of the simplest ways of making detergents comprise of two stages;

1. The diesel oil and kerosene fraction from crude oil are further distilled. The hydrocarbon with roughly twelve carbon atoms per molecule are collected.
2. Sulphur dioxide and Oxygen are allowed to react with the hydrocarbons. Ultraviolet light is used to help the reaction. An alkane sulphonate detergent is formed.

Alkanes (12 carbon atoms) + Oxygen + SO₂ _____ Alkane Sulphonates

These processes can be put into practice even locally in this country. Sulphur is predominant in petroleum as sulphides. It is one of the wasted products during petroleum refining. These sulphides can be roasted to obtain sulphur dioxide which is useful for making detergents. The sulphide can also be used in the production of sulphuric acid and other industrial chemicals using appropriate conversion processes.

These are many other areas where the country needs appropriate technology. Such areas as Agricultural improvement, refuse management, drug production, fruit preservation, etc need appropriate technology.

Challenges

The challenge to develop appropriate technologies in Nigeria is to carefully examine various technological options along some important factors. According to Sesan (1984). some of these important factors to be considered are resources in terms of technical experience, man power,

availability of raw materials, parts, components, machines, facilities, local organizational structure, market acceptance, competition, productive life, availability of funds, support, provision for innovation linkages with local resources, and climate condition.

The national policy on education (2004 revised), clearly explained that through technical education many Nigerian graduates will acquire skills leading to production of craftsmen, technicians and other skilled personnel who will be enterprising, self-reliant, enabling other young men and women to have intelligent understanding of the increasing complexity of technology.

To achieve this objective, the supply of machines, tools, equipment and other basic facilities must be adequate. The common practice of importing foreign goods in place of locally made goods should be discouraged. In as much as we do not condemn importation, we only advocate for the use of local materials in some cases as a way of encouraging local manufacturers. It is only in a country like Nigeria that certain simple material like tooth pick, matches etc are imported when they could simply be produced locally.

The Way Forward

1. There is need to identify relevant indigenous and emerging technology which could be made appropriate to suit this modern age and need.
2. There is need to identify important equipment that are in working condition and that can be modified or copied using local design and fabrication facilities.
3. There should be innovative ways for technologies, parts requirements for the conversion of resources into indigenous and agricultural input.
4. There is need to identify ways to design equipment, manufacture and assemble machines to compete with modern technologies.
5. Government should organize seminars, conference, workshops and exhibitions among the local indigenous engineers to educate themselves on knowledge and skills of transfer of technology through recommending ways of up-grading the already existing technology into an appropriate one.
6. Government should establish board which would determine the appropriate technologies, their level of development stages (e.g. Laboratory, workshops, prototype, manufacture) in all states of the federation. The board should serve as an advisory center to be responsible for recommending ways and means of up-grading the identified indigenous technologies.
7. There is need for government to enact an edict empowering local practitioners to identify and import machineries/equipment for processing local raw materials.
8. There should be raw materials display centers of the federation and Abuja to create awareness on local materials.
9. Government should carry out an intensive research, develop new processes, technologies and products in the execution of new emerging project designs or fabricated parts. More research should be carried out on various innovations that are possible for different technologies.
10. There should be government and private sector large-scale research into what technical experiences (in terms of indigenous technology) that are still practiced or which can be got from relics. Such abandoned technologies have to be recreated and integrated into presently functional indigenous experiences. The use of modern machines installed by foreign experts should also be sustained until we develop ours.
11. Non-governmental organization should be made to strengthen the cooperation with government in creating awareness about the importance of production and use of locally made materials to the national economy.
12. Alongside the already existing conventional institutions, there should be institutes of indigenous technology which are to be fundamentally research based. This should not be research into books or literature but research into archives for technical experiences. Such researchers should be properly remunerated if we want to get results.
13. The existing technical institutions should be totally restructured to make them achieve the objectives for which they were established. These institutions should get down to the basics and actually train people to make things happen. Emphasis should shift from techniques of providing services to techniques of producing goods no matter how primordial or crude such

goods may be. When such goods are produced, research can be carried out on how they can be improved.

14. The dependence on paper qualification for technical graduates should be discouraged. What should rather be on paper should be the ability of the technical graduate in terms of a detailed description of what he can do or things he can produce. Technical institutions should gradually phase out the use of grades such as A, B, C and the like. Such grades serve no useful purpose in telling us in measurable terms what the graduate can do.

Conclusion

It is hoped that with the emerging abundant raw materials and man power in Nigeria, serious efforts should be made by the government, individuals, professionals as well as local indigenous technologists to see that our indigenous raw materials are fully harnessed, developed and utilized as industrially finished materials through appropriate technological breakthrough in the areas of agriculture, industrial, mineral and other sectors of the nations economy. This is the only way the country can ensure self reliance and technological advancement.

Technological growth cannot be by transfer or importation. That is why all government efforts to ensure transfer failed. Most countries such as India Pakistan, Columbia which were tagged developing before, have now become developed primarily because they were able to utilize the available resources in their country through appropriate technological practices.

References

- Akinrinade S. (1988). Oiling the Rig. Newswatch April 4, 14-18.
- Ali, A (1998). *Strategic issues and trends in science education in Africa*. Owerri: Cape Publishers international Limited.
- Baron, C (1978). Appropriate technology comes of age. A review of some recent literature and aid policy statement International labour review 117 (5) 624-634.
- CESAC (1985). *Introductory Technology for Junior Secondary schools*. Longman Nigeria Ltd.
- Fagbemi (1988). Technological education in Nigeria. An overview of its Historical development, right and functions. *Nigeria Journal of Technical Education*. Vol 5 No 1&2.
- Federal Republic of Nigeria (2004). *National Policy on Education*. Abuja: NERDC Press. Hopkins, A.
- G (1977). *An Economic History of West Africa*. 3rd Ed. London: Longman group Ltd.
- Ikoku, C. (1981) Building the New Africa: The role of science and technology; Public Lecture delivered at the Federal Polytechnics Idah.
- International labour Organization (ILO) (1971). Appropriate technology, employment and income growth: Geneva. 30.
- Jones, G (1971). *The role of science and technology in developing countries* London: Oxford University Press.
- Kenneth, U. N and Yakubu, L. B (1997). Science, technology and the economics of revitalizations of our national economy. Technology education in Nigeria. *Proceedings of the conference on "Production approach to the teaching of concepts in technology education and challenges of technology for national development 153-156*.
- Lee R. E. (1988). *The Chemical Industry: Illustrations*. Cheltenham: Stanley Thomes (Publishers) Limited.

- Mayerson, J (1990). *Technology: A system approach*. Leckhampton England: Stanley Thomes (Publishers) Limited.
- Nkokeleonye, C. U (1991). Factors affecting the growth of Iron industry for Educational use in Anambra State. An unpublished thesis.
- Omotunde (1987). Crash of a dream: Nigeria's auto factories still move. News watch 5(6) Feb 9, 14-20.
- Ossai A. and Ayoola E. (1987) .The J45 billion steel: So much for so little. This week 5(3) July 6 PP 8-18.
- Salihu (1999). Technological education for national development. A paper presented at the 3rd convocation lecture at the College of Education (Tech) Bichi, Kano PP 2-4.
- Sesan, A (1984). Adapting traditional technologies for use and the development of Nigeria economy. *NBTE Press 2* (\), 7-8.
- Sowthgate, G. W (1957). *English Economic History*. New Edition. London: J. M Dent and sons Ltd.
- Wigwe, G. (1988). Education for self-reliance searchlight. Publicity Bureau of NUT Imo State.