
TECHNOLOGY EDUCATION: AN INDISPENSABLE REQUIREMENT FOR AFRICA'S WEALTH CREATION AND SUSTAINABLE DEVELOPMENT

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Abstract

Africa has remained within the poverty regions of the world not because of lack of endowment but essentially for the inability of the constituent states to effectively harness and process their natural resources in exchange for hard currencies. Many of the states still rely on primary produce for export making their economies vulnerable to the vagaries of prices of these produce. On the average, manufacturing is low in the region and the overall effect is slow pace of development as reflected in poor infrastructure and other indicators for development. The present situation imposes on the African states the imperative of giving more attention to technology education which is now the defining factor for development globally. This paper examines this subject with particular reference to Nigeria whose economy is currently in recession. The research method adopted is qualitative.

Nigeria's economy has again proved its vulnerability as a mono economy. For upward of ten years and till 2015, the country recorded high GDP. and became the largest economy in Africa (Nduka, 2014). The annual average GDP growth rate was about 5 percent even when the world economy was on the decline (World Bank, 2013). But today the GDP has crashed putting the economy in recession all because of the fall in the price of crude oil in the international market. The experience is of course not new to Nigeria because she had to abandon the Fourth Mid Term Development Plan (1981-85 plan) due to fall in price of crude oil. The Third Development Plan (1975-1980 Plan) had recorded successes with a growth rate of 5 percent following which the 1981-85 growth was projected at 7.2percent. Unfortunately, the plan achieved only 0.2 percent (Iyayi, 2014).

No lesson seemed to have been learnt from that experience of over thirty years ago. The economy has, as it was then, remained undiversified relying on crude oil export, while infrastructures like electricity, roads, and railway which are to power the economy are still not in place. Similarly manufactures form very small proportion of

the country's exports (World Bank, 2012). The country is within the Sub Saharan Africa region whose income per capita averages below \$1.25a day (Chijioke, 2013) and second only to the Middle East and North Africa region for reliance on commodity exports.

The present state of the economy is understandably taking its toll on the standard of living of the citizens. The features are high inflation which is presently put at between 17 and 19 percent, low utilization capacities by industries due to limited access to foreign exchange and the depressed state of the naira against the dollar and other foreign currencies, for importation of raw materials for the industries, mounting unemployment and resultant high crime rate etc.

The hardship imposed on the citizens by the poor economy daily elicits comments, suggestions and criticism from persons of different backgrounds and occupational leanings. Opinions on the matter are diverse but interestingly there are common areas of agreement primarily that the economy should be diversified and the manufacturing sector developed. While the country's leadership seeks options to properly articulate the various views and achieve the desired solutions, education remains one viable tool for achieving the seeming elusive development. In the contemporary world, education has not only served its traditional role as a change agent for countries, it has through technology, redefined the positions of many such countries. For Nigeria to join the group of developed countries, she must embrace technology education to enhance her production base and transform from primary producer to manufacturing giant.

Conceptual Discourse Technologies

MC Graw Hill Encyclopedia of Science and Technology defines Technology, as an "assembly of equipment which is often of a complex nature, which discharges a certain function, such as a combine harvester; or a number of discrete assemblers which may be located far from one another but are interlinked so that when working together, they discharge the desired function; such as a satellite communication system; an electricity generating, transmission and distribution network; or a machining center. In this definition, technology consists of discrete items of equipment (building blocks) which are produced by Engineering and assembled together in a scientifically logical whole by designer technology"

However technology is beyond this as it includes "knowledge and skills" which are applied to solve problems for comfort of man. It is for achieving endless improvement of state of things for man and has affected man's ability, position, and substantially his environment. . In this latter context, technology is acquired from an aspect of education- Technical Education. Dyson (1989) refers to it as "a byproduct of Technical Education". What is often termed technology education is therefore, technical education.

Technical Education

Technical education is here discussed as that aspect of learning that equips its recipient with practical skills and knowledge leading to effective application of scientific ideas for development. It is “the training of technically oriented personnel who are to be the initiators, facilitators and implementers of technological development of a nation by adequately training its citizens on the need to be technologically literate leading to self sufficiency and sustainability” (Uwaifo,2010). The National Policy on Education (1981) defines education as that “ which leads to acquisition of practical and applied skills as well as basic scientific knowledge” (cited from Okolie, 1989). The policy listed five types of technical education institutions outside the Universities: the pre-vocational and vocational schools at post primary level, the Technical Colleges, the Polytechnics and the Colleges of Technical Teacher Education at post secondary level.

Experts are not agreeable on this classification with particular reference to inclusion of vocational education as part of technical education. Vocational education takes place at lower level than technical education and does not impose or demand any formal or academic knowledge. It refers to all activities and experiences by which one prepares for one’s primary work in life, and equips one mentally, morally and physically (Oriaifo,1981). Technical education “is that education which vitalizes technology in its totality. It requires not only knowledge and attitude at higher level than vocational education, but needs knowledge, skills and attitudes in science, scientific designs and different branches of engineering, art, commerce and even some vocational elements. Technical education is oriented towards problem-solving, so as to improve the quality of human life”. However, technical and vocational education combined is “essential for building technological foundation and the creation of the requisite socio-political, cultural and economic structures and systems as it is instrumental to the generation of wealth on a sustainable basis. Products of such education can readily handle job on planning, research, control, maintenance and productivity” (Ujamhan, 1998).

Table 1: Showing the Number of Technical Institutions in Nigeria

	Proprietor	Polytechnics	Monotechnics	Post Primary Tech Colleges
1	Federal Government	23	5	19
2	State	40	5	110

Sources: Polytechnics: JAMB Tertiary Admissions Brochure for 2012/2013 Session. Post Primary Technical Colleges: www.theinfostrides.com

Sustainable Development

The concept of Sustainable Development was developed by the Brundtland Commission in its report titled “Our common future” in 1987. The concept was to make development enduring, taking it beyond the present to provide for future generations, defining sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The report emphasized environment as a critical component of development and ties together the concern for the capacity of natural systems with the social, political, and economic challenges faced by humanity (Wikipedia.org/wiki/sustainabledevelopment). Its central theme is development of human capital while keeping the natural and man created resources at a continuous productive state.

The two key concepts of the report are ‘needs’, the essential needs of the world’s poor, to which overriding priority should be given: and the idea of limitations imposed by the state of technology and social organization on the environment’s ability to meet present and future needs. The UN has broadly viewed sustainable development as a system approach to growth and development and to manage natural, produced and social capital for the welfare of their own and future generation. The term as used by the UN incorporates both issues associated with land development and broader issues of human development such as education, public health, and standard of living.

In 1992, the United Nations produced the Agenda 21 which outlined the building of a just, sustainable and global security. The action plan Agenda 21, identified and emphasized information, integration and participation as major elements to help countries achieve development. Information is for achieving cross sectoral integration in the new recommended way of doing business while public participation in decision-making is a fundamental prerequisite for achieving sustainable development. Under the principles of the UN Charter, the Millennium Declaration identified principles and treaties on sustainable development, including economic development, social development and environmental protection (Iyayi, 2014).

Technology Education, Wealth Creation and Sustainable Development: The Nexus

The link between technology education and sustainable development is in its use as a tool for innovation for transforming natural resources for the social, economic and political development of the society. It helps to invent a culture of creativity through acquired skills and knowledge converting available resources within the environment for the benefits of the present and future generations. Technology education in this context helps to harness the potentials of entrepreneurs at various levels significantly the Small and Medium Scale (SME) Enterprises for wealth creation

Technology has provided considerable assistance to SMEs in countries, especially in Asia, and Latin America to achieve efficiency and competitiveness. Technological competence is an especially important determinant of small manufacturers’ ability to

hold their own in context of liberalization and increasing integration of developing countries' manufacturing activities into global network. Many of their markets, even traditional ones, are undergoing fast changes. In this situation, firms try to avoid defeat on inability to meet deadline for supply, poor quality products and design and achieve improvement in products, processes and production and thus able to take advantage of new opportunities and have an edge over competition (Henny, 2000). Technology assistance initially adopted a "supply-push" approach (UNDP et al, 1988). It was aimed at providing a variety of services to help small businesses overcome small producers' resource constraints and help strengthen their competitiveness. However the failure of this approach resulted in the development of technologies in close collaboration with the prospective users through a process in which these users can adequately take charge of the course or processes of their designed projects and ultimately the technologies. This accounted for successes in East Asian countries of Japan and China (Henny, 2000)

So, the old belief that small enterprises could enhance their competitiveness by dependence on the technical advancement designed elsewhere has been gradually replaced by a more dynamic notion of competitiveness, which depends on small producers' own independent and unique contribution to local technical progress on an on-going process. This has happened in Asia and Latin America where there is emphasis on the need for small local suppliers that can supply products and services downstream in the "value chain", react quickly and flexibly to their changing requirement, and begin to play a role in the design and implementation of technological improvements. Thus, competitiveness of small companies has become increasingly conceived in terms of their internal capacities to choose, use, adapt and develop technology. Such capabilities are a must in order to become, and retain competitiveness in the fast evolving environment which continuously places new demands upon large and small firms alike (Meyanathan, 1994; UNIDO, pp 53-56)

This is however, without prejudice to the benefits of technology transfer which SMEs can attract from foreign countries. In South Korea, SMEs have served as effective channels for technology transfer to that country. Foreign recipient firms of the SME's exports have backward and forward linkages with the SMEs thus strengthening the competitiveness of the domestic economy (Obadan et al, 2002). Apart from the benefits of technology development realized from growth of SMEs, they have boosted the economies of many countries in several other ways.

Countries with successful story regarding SMEs have numerous benefits including employment generation, increase in GDP, enduring social and economic development and consequent improvement in the peoples' standard of living etc bequeathed to them by the enterprises. Small and Medium Enterprises (SMEs) have played catalytic role in the socio-economic development of Malaysia, Japan, South Korea, Zambia and India. They have made enormous contributions to the Gross Domestic Product (GDP), export earnings and employment in these countries (Osoimehin, et al, 2012)) The roles of the SMEs manifest in terms of job creation, use

of local raw materials, fostering Inter-industry linkages and serving as incubators for technological innovation (Obadan et al, 2002). One major claim for focus of SMEs is that they are large employers of labour and this makes them vital in coping with the problems of unemployment and poverty (Fabayo, 1989).

The following represents the experiences of some of the countries:

- Share of firms in Employment Generation: E.g. Ecuador in 1980, SMEs accounted for 99% of firms and 55% of employment. Also in 1986, in Bangladesh, enterprises with fewer than 100 workers accounted for 99% of enterprises and 58% of employment.
- Labour Intensive: Little et al (1987) and Snodgrass and Biggs (1996) have indicated that SMEs tend to be more labour intensive as their operations are more labour demanding than large firms.
- Job Creation: SMEs are more important for employment growth and job creation.
- Innovativeness: SMEs are said to be more innovative than large firms. In developed countries for instance, Snodgrass and Biggs (1996), Hallberg (2000) have noted that SMEs often follow “niche strategies”, using high product quality, feasibility and responsiveness to customer needs and mass producers.
- Wages and Benefits: Though large firms pay higher wages and fringe benefits, etc in LDCs SMEs have lower productivity and hence pay lower wages and non-wage benefits, compared to large firms. However as industrialization proceeds, the divergence in labour productivity and wage rates between SMES and large firms narrow. The USA is cited as a place where the development has taken place.
- Social, Political and Equity contributions: SMEs contribute to transformation of traditional or indigenous industry; stimulation of indigenous entrepreneurship and technology, and redistribution of income and wealth, more equitably. On the political front, promotion of SMEs could be geared towards addressing the needs of some political constituencies.
- Source: Obadan, M. et al

During the period captured by the above documentation, ie 1980s to the close of that century, many countries formulated policies and set up agencies to boost SMEs and increased their manufactures and employment. The United States of America (USA)’s standards in 1988 set enterprises with not more than 100 employees as SMEs and such enterprises accounted for 34% non-farm employment, 32% of the total sales, more than 50% of jobs in construction and commerce and just less than 50% of jobs in the manufacturing of the of the country’s economy.

“In Japan, small scale enterprises, by 1978 accounted for more than 75% of total employment in non-farm private sector and created about 60% of jobs in manufacturing.

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In UK, in 1983, about 56% of total jobs in manufacturing were from small and medium scale enterprises

In Brazil, about 44% of total employment and 30% of country's manufacturing output in 1998, came from small scale enterprises.

In Egypt, a little less than 59% of total manufacturing employment was from small scale enterprises in 1990.

In Ethiopia, Ghana and Sierra Leone 88% of the total manufacturing employment was from small scale enterprises.

In Botswana and Burundi, small scale enterprises were found to have contributed more than 50% of the industrial output.

In Tanzania and Kenya, small scale enterprises accounted for 25% of the industrial output.

The manpower for all these SME came from Technical and Vocational Education" (Ujamhan, 1998)

For Nigeria, technology is expected to help to re-order her systems, processes and attitudes for productivity. It should create a new labour force from among the indigenous people and infuse in them competences, relevant skills and knowledge. It should take the form of a cultural revolution bringing new ideas, initiative and orientation. The technology is, taking queue from Asian countries, not necessarily to be sourced only by transfer or adaptation but from formal education based on our peculiar needs and circumstances having regard to what we have as resources and our vision as a nation.

For now, the country's high technology exports have remained very low averaging 3% of the total exports and comparable only to the Middle East/North Africa and the South Asia regions with 3 % and 7 % respectively (World Bank, 2012). Use of obsolete equipment and methods of production have been identified as among the problems confronting SMEs in Nigeria because of owners' inability to access new technology (Chukwemeka, 2006). There is consensus of opinion by (Meyanathan, 1994), (Ukpabio,2004) and the (World Bank,2001) that SMEs have played the intermediate role in the development of large scale enterprises (Osotimehin, 2012).

Table 2: Nigeria's Current Performance in Technology Exports

Country	High Technology Exports (% of Manufactured Exports) *
Brazil	11
Indonesia	11
Malaysia	45
Nigeria	1
Korea Rep	29
South Africa	4

Source: World Bank (2012)

Improved Technology will enhance Nigeria's performance in manufacturing and enable her to realize more revenue from processed goods, create employment and wealth for the people. It will in addition boost the local content of our manufacturing industries.

It is an acknowledged fact that the few Nigerian manufacturing industries, including the oil those in the oil sector lack local technical input or content. Nigeria has tried to redress the situation through legislation leading to the passage of the much talked about Nigerian Local Content Law. The obvious explanation for the rather sorry situation is the absence of technology and the failure of our educational system to fill the gap.

A case to recall is the recruitment test organized by the Nigerian National Petroleum Corporation in 2001, which featured First Class and Second Class (Upper Division) university graduates and the best of the Polytechnic graduates. The test produced a result in which 80% of the candidates scored below 20%. The final outcome of the test according to the report is that "the key sectors of the economy are lamenting the dearth of qualified manpower to man the production lines. For now, the aviation and oil and gas are in dire need of qualified manpower that can no longer be sourced locally. This development frustrates the local content policy drive of government". The report added that for the NNPC to function optimally, it would have to look beyond the shores of Nigeria to recruit manpower. Said Oniwon, the Group Managing Director of the NNPC, "the abysmal record has not only heightened our apprehension about lack of functionality of our education format but goes a long way to underscore the need to shift away from paper qualification"(Onyekakeyah,2011)

Following this Elder Ogunde, Oluwole, Chief Executive Officer, Hope Petroleum and Chemical Limited lent his voice to the need to emphasize technical education. He said "except government at all levels give technical education its rightful place and remove the disparity between the university and technical graduates, there may be dearth of technical manpower in the near future". Technical education, he recalled, is a tool for technological development of any meaningful society and therefore cannot be neglected, "as as nation that is not production oriented will continually be dependent on other nations-, hence the need to re-equip all technical schools in the country--". He "advised government to make technical education attractive by way of encouraging the youths to enroll in the schools; pay the same attention like that of the university,--". To him, "the persistent lack of proper motivation to the technical graduates is discouraging the youths and at the same time, the society is not helping the matter as result of the bad perception about technical graduates in spite of their ability to cope with various challenges and transform the country technologically", (Ujunwa,201 cited in Iyayi, S,12)

Conclusion

The current economic situation of Nigeria forms the basis for this work. The inability of Nigeria to exploit and process the resources available to her is responsible

for her poor state. The paper accordingly posits that technology can serve as a viable tool to truly transform our economy from primary products exporter to manufacturing and achieve socio-economic growth. The overall outcome will be sustainable development. Technology education will open up the country to this through wealth creation and boost to local content of our manufacturing industries

Technology creates wealth and provides services through manufacturing, production and effective distribution strategies. Generally, education has a direct economic impact on the quantity and quality of occupational skills of the nation. Indeed, education increases the level of initiative and inventiveness of the recipients (Philips, 1964). Through inventions and imitations, local technologies have been used to increase services, boost industries especially the SMEs and enhance earnings of individuals and countries from manufacturing. Literature has revealed that the SMEs accounts for about 41% of total income of South Korea. Kenya is another country that has fared well in the SMEs. The enterprises accounted for 12-14% of her GDP in year 1982, 1989, 1992 and 1994 (Osotimehin, 2012)

The paper argues for development of technology based on our local needs, circumstances, the resources available and our vision. While the paper does not rule out the benefits derivable from technology transfer from outside, it notes the complexities in this. The paper therefore opines a paradigm shift in our educational system to develop the technical aspect. Education should be tailored toward meeting our technological requirements for achieving the objectives of social and economic development.

Recommendations

1. Technology Education should be given all the attention it deserves in Nigeria for sustainable development. Government and other stake holders in the education industry should move from mere rhetoric to practice and ensure adequate funding of technical colleges to upgrade their facilities.
2. Government agencies and departments responsible for designing and implementing government development plans should synergize with the technical institutions for their inputs to achieve the planned targets. The essence of this is to make the institutions share in the nation's visions and help to provide training for the required skills and knowledge as well as the right attitude and orientation.

There is need for strong co-operation between research institutions, universities and industries, including the SMEs sub-sector (Meneghel Mello, Gomes and Brisella, 2004). These three bodies should be strongly involved in the process of seeking partnership in the productive sectors.

3. To enhance the development of technology from within for eventual global relevance, government, its agencies, private organizations and individuals should encourage technical institutions in their local inventions and fabrications. Government should take the lead in the patronage of locally produced items and assist to patent and mass produce all such items.

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