THE ROLE OF INDIGENOUS TECHNOLOGIES AND INNOVATIONS IN SOCIO-ECONOMIC AND HUMANISTIC DEVELOPMENT IN NIGERIA

Mark David Otarigho
&
John Ichipi
Department of General Studies, College of Education, Warri

Introduction

According to Manabete (2014), technology can be better understood and defined if we see the concept from Foucault's (1988) perspective of four types of technology which always function together but are not irreducible to one. These four types of technologies are technologies of production, sign systems, technologies of power and the self. Technologies of production allow us to produce, transform or manipulate things; technologies of sign systems permit us to use symbols, signs or meaning and technologies of power determine individual behavior. In the words of Peters (2003), technologies of the self are approaches adopted to study the ethics of the individual. Technology, in its widest form, can be taken as the application of human intellectual ability to the task of harnessing nature in its entirety for humankind's development and sustenance (Manabete, 2014).

Technology refers both to artifacts created by humans, such as machines, and the methods used in creating those artifacts. However, the word is also used to describe the extent to which a society can manipulate its environment. That is, the motivating factor behind all technological activity is the desire to fulfill a need. Technology is therefore, thinking about the best way to do things while drawing inspiration from the cultural mindset within a social praxis. This is probably why Ali (2003); defines it from the perspective of culture thus:

> *Technology is a term that captures man's scientific attempt to transform the natural world in which he finds himself. It entails the ability to create devices, tools and machines through which the threats of the society can be subdued and brought under control.*

Indeed, the conglomeration of technological devices available at man's disposal is best represented by the artifacts and edifices available within a given cultural terrain. In this case, the culture of a people is symbolically the totality of both the material and non-material innovative ideas and techniques.

At the beginning of the 20th century, the public meaning of technology was associated with achievement, progress and purpose (Pacey, 2001). Abdulkareem (1992) sees technology as the art and science of applying man's knowledge in human endeavours so as to satisfy man's needs. Burkitt (2002:224) defines technology to mean "a form of practical action accompanied by practical reason which aims to in still in the body certain habitual actions – either moral virtues...or technical skills." Burkitt added that technology is a means by which human beings produce products and works. The International Technology Education Association (2002:2) defines technology as the way "people modify the natural world to suit their own purposes...it refers to the diverse collection of processes and knowledge that people use to extend human abilities to satisfy human needs and wants." The South African Department of Education (2002:4) defines technology as the "use of knowledge, skills and resources to meet people's needs and wants by developing practical solutions to problems, taking social and environmental factors into consideration."

Consequently, Keirl (2006) views that all technologies are created by a manufacturing process resulting from human intention and design. In other words, it is not possible for technology to be in any functional sense without a rational human engagement.

Daniele & Carlo (2002) define technology as the application of knowledge towards the design and fabrication of devices, tools and appliances to better the condition of man. They also said that technology is the art of using knowledge appropriately to create something that alters the condition of living of a people. It refers to the application of knowledge, skills and resources to meet people's needs and wants. It can be accepted that technology is the tool that keeps going the socio-economic life of a people. It can as well be accepted that technology refers to the science and art of putting to use man's knowledge, skills and experiences in human endeavours so as to meet the needs and wants of people.

Effective technology strategies are based on a clear understanding of the basic unit of technological activity, the industrial firm, which imports, masters, uses and improves technology. It also subsequently stimulates the demand for innovative technologies. For the process to thrive, it needs active, supportive and dynamic government policies and institutions. Efficient technology use goes beyond importing machinery. It entails building capabilities, technical understanding and an informational base; acquiring new technical skills and managerial practices; and forging linkages with other firms and institutions. It requires the ability to understand and master new technology; to adapt it to local factors and conditions; and to upgrade it as technologies improve and new products appear (UNCTAD, 2003).

Indigenous

Originally, "indigenous" was equivalent to "local" or "folk" or, when applied to knowledge,

"informal knowledge". In the 1960s to late 1970s, the word then took on a more overtly populist flavor of "grass-roots politics" and "folk culture" in the sense of "indigenous" as opposed to state or "high" culture. In view of the marginalization and destruction of the eco-zones inhabited by ethnic groups, the meaning of the term "indigenous", at least as applied to knowledge, has today come to be used in a context in which "non-western" or "anti-western" knowledge, or the knowledge of minorities, as compared and contrasted with knowledge at the level of the nation state (Antweiler, 1998).

Rai and Shrestha (2006) opine that the term indigenous innovation has the same meaning as the following terms: traditional innovation, rural people's innovation, farmers' innovation, local innovation and community innovation, and indeed other related terms. Generally, the term innovation refers to an idea that is new or perceived to be new or altered. If this new idea or improvement of the resources is accomplished through traditional methods or knowledge systems, then it is called an indigenous innovation. It is often the case that, indigenous innovations are environmentally friendly and sustainable when compared with scientific innovations (Sopazi and Andrew 2005). It has been viewed and understood that while local or indigenous technology or practice is recognized as a common practice already adapted and widely used, Innovation is considered more of something new that may have emerged from traditional practices but not necessarily the same (Rai and Shrestha 2006).

According to Shashank & Ravi (2003) the term 'indigenous' also has political connotations. Today it has come to be associated with the terms like 'rural', 'grassroots', 'anti-western' and the one based with minority. However, the dictionary meanings of the term are fairly broad based and include 'native', 'original' and 'homegrown' among others, and are lot more appropriate in the context of innovation and its implications on economic and social development.

Exploring Aspects of African Culture for Technological Development

SekouToure (1974) asserts that:

> By culture we mean all the material and immaterial works of arts and science, plus knowledge, manners, education, a mode of thought, behaviour and attitudes accumulated by the people both through and by virtue of their struggle for freedom from the hold and domination of nature.

Without doubt, culture creates an enabling environment necessary for human growth and adaptation within society. It is a phenomenon that plays an important role in the humanistic quest for scientific and technological development through the shaping and reshaping of the scope of research. Since culture is a dynamic phenomenon, it encourages progress in research in the sense that it is quick to render certain forms of technical knowledge moribund and give way for the emergence of new mental culture that would be used in the production of innovative technologies. Worthy of note here, is the fact that every technological product is produced in the hope that it will suffice in combating a social problem or aid an aspect of human existence (Adebayo, 2011).

There are notable aspects of the African culture that can be exploited for technological advancement. Prior to the oil boom and industrialization of the early 1970s, Africa was prospering on the gains from agriculture – agriculture at this time occupied the central part of economies of African nations but today, the reverse is the case, because now agriculture plays a secondary role.

Despite the effects of this historical condition, there is still hope for Africa in the exploration of agricultural technology in the 21st century. It is important to note that the agricultural culture of most African societies which includes the regulation and management of farm and animal produce for consumption, the understanding of soil chemistry necessary for good farm yield and income earnings, is being explored to achieve measurable and sustainable developments in AgroSciences. This is probably why the Economic Commission for Africa (1998), observes that African agriculture has witnessed considerable transformation in several respects. Crops that were formally alien to the continent such as wheat, barley, rice, maize, tomatoes and apples have been successfully introduced and adopted to different nations in Africa.

Biotechnology is an aspect of technology that that can be richly explored within African culture for development. Literally, biotechnology entails the use of living organisms or their products to modify human health and human environment; such knowledge is made possible by culture which embodies the totality of human experience and the tendency for survival within asocial environment. In this respect, knowledge is the means by which human beings master and control their environment (Oladipo, 2009) and the process of seeking to understand the conditions and meanings of existence.

More so, in manufacturing of textiles, African countries have discovered, developed and displayed a rich cultural knowledge that can be gainfully explored for both technological advancement and socio- economic impact. In spite of this fact, most technological capabilities in Africa (especially south of the Sahara) are constrained by bad government policies and poor conditions of infrastructure. But beyond this constraint, noticeable progress is being made in the textile industry which makes it viable for the development of technology. For instance, among the Yoruba of Nigeria, *Adire* is a locally made hand-dyed cloth, and batik is made with indigenous material, with hundreds of different identifiable patterns. In fact, *Adire* is an integral part of the Yoruba culture which expresses the intricacies and dynamics of culture, hence an art mastered by Yoruba women and used for expressing cultural identity. Undeniably, *Adire* is also a well-known fabric around the world today, a thriving technological export of the Yoruba, with respect to textile manufacturing. In Ghana, the *Kente* is another culturally developed textile that has gained universal recognition; other countries like Kenya and Mauritius have also built their capacities in terms of manufacturing, to reach a level of relative technical efficiency. Mauritius deserves a special mentioning because it is described as probably the most impressive newly industrialized country in Africa which has continued to record remarkable growth in its manufacturing industry with rising indices from those of previous years.

The point then is that although Africa may not be able to produce technological machines like speed moving cars, gigantic ships, intimidating bulldozers, microchips, and hyper-technical equipment, it is still capable of evolving its own technology as far as its cultural understanding and intellectual horizon permits. The African focusing on the battle for survival will have to be dogged on this singular issue (Alozie, 2008). We have thus argued that technology is a product of culture, and in so far as Africans have their own unique culture, they are capable of producing their own technology which would help to solve the immediate problems of social existence and the challenges of survival. This by no means suggests that Africa is capable of producing all the technology it needs for human flourishing; no nation can be that autonomous, but not all the technology that is imported is actually needed, when some of it can be developed in Africa, given the enabling conditions.

According to the Native American Academy Silver Buffalo (2013), there are certain characteristics that are peculiar and distinct to Indigenous Technology (IT), which include the following:

1. ITs emerge from the implicit order to reflect the art of skillful living. It is pragmatic, responsive and responsible to the ecology in which it lives.

2. IT attracts the learning spirit; it provides a learning ecology that supports the revitalization and transformation of awareness and knowledge.

3. Through meaningful interactions, IT seeks to engage and evoke significant knowledge and experiences reflective of the indigenous world.

4. ITs have the obligation to come into existence, to be used and to transform within an ethical space that is responsible to life in all its forms.

5. IT is coherent with the natural order. In other words, the ability or capacity to make something does not constitute a valid reason for its existence.

6. ITs have intrinsic value because we know their ancestry where they came from, what their place is in our world. We know they will transform and pass from this place to return to the realms of energies.

So far, from our definitions of technology, it is important to note that two basic tendencies are discernible; one is almost exclusively concerned with the technical aspect of the subject matter, while the other emphasizes the socio-economic and cultural dimensions. The first school of thought (technical aspect) regards technology as the systematic knowledge for the manufacture of a product, for the application of a process or for rendering of services which may include managerial marketing technologies.

In contrast, the second school (socio-economic and cultural), conceives of technology as allelements of productive knowledge needed for transformation of inputs into products; in the development and rendering of services, as well as in generational shift to further the tentacles of productive knowledge. In addition to this view, technology also includes the social and economic atmosphere in which the application takes place as well as the ways of

fulfilling particular needs deriving satisfaction.

Examples of Indigenous Technology in Nigeria

Some of the indigenous technology in Nigeria include tools and implements, weapons, boomerangs, nets, baskets and bags, watercraft and canoes, bush food implements and shelters, the manufacturing of batik, Adire, Aso-Oke, and other indigenous clothing which are peculiar products of Nigeria people's cultural experience. There is also a special type of clay soil (kaolin) in Otedo, Ughelli south LGA in Delta state of Nigeria which the humble local dwellers use in manufacturing all kinds of clay pots with special designs and varieties.

Several years before the advent of colonialism in Africa, a number of indigenous technologies existed in many communities. These ITs included iron smelting in the Old Oyo kingdom in Nigeria, tin smelting around Jos in North-Central Nigeria, artistic bronze works in Benin Empire and Ife in Southern Nigeria.

There was also the local manufacture of Dane guns, cutlasses, hoes and axes by local blacksmiths (Aliyu, 2003). In many communities in Adamawa State, North- Eastern Nigeria, notably the Chamba, Longuda and Higgi peoples' tools and implements such as knives, spears, axe- heads, hoes, bows and arrows, drinking vessels and catapults were made (L'kama, Manabete, Kamaunji and Ahmed, 2008).

The work of Amuda, Amuda and Waziri (2012) show that very many years ago, indigenous technologies and science practices were common among women in Borno State, North-Eastern Nigeria. The practices included using glass mirrors, washing plates and clothes, splitting of firewood using the axe-head, treating fever, diarrhoea and cough by steaming leaves and other herbs, and applying natural products like ash, ground pepper and animal dung to protect crops against pests and diseases.

Thus, the critical point is the acquisition and strengthening of domestic technological capability to produce indigenous goods and services for employment generation and poverty alleviation. The point being made here is that indigenous technological capability is quite weak in Nigeria presently. Often times, the rejection of the idea of technology within Africa stems from the comparative analysis of Western

technological accomplishments and the industrialization of European nations with the arbitrary efforts of Africans to solve human problems through the application of fundamental knowledge derived through the process of subduing nature. But this basis of comparison is asymmetrical and causes more harm than good to the African predicament on the practical use of technical methods and systematic knowledge in an appreciable manner.

Technological capabilities in developing nations commonly differ from those in the developed world because technologies are frequently imported, and local firms must be able to master adapt and improve upon them for maximum impact. In-house efforts also need to compensate for insufficient supplies of human capital, advanced machinery and technological knowledge often found in developing nations (Pietrobelli, 2006).

Factors Militating Against Technological Development in Nigeria

Ezeah (2012) listed the following as factors militating against technological development in Nigeria:

Inconsistent policies

Since independence, Nigeria's policy makers have tended to think of technology erroneously in the context of finished products, rather than as a set of ideas rooted in the local culture with the set purpose of serving the basic needs of the people. This perception of technology focuses attention on the importance of finished products. Again, the problem of technological development in Nigeria reveals factors such as poor funding for science and technology education, inadequate infrastructure for research and development (R & D), poor staffing and lack of linkage between (R & D), and industries [Usman, 2008].

According to Usman (2008), Nigerian universities limit their roles to teaching and manpower production at the total exclusion of research in order to advance and improve society.

Other identifiable problems hindering the launch of Nigeria's technical progress is the failure to correctly exploit the naturally endowed talents in Nigeria. Thus, there is the underutilization of talent in Nigeria. This is due to the tendency to confuse academic intelligence with technological potentials. Thus, while the industrially advanced economics of North America, and Western Europe or the rapidly developing Asian countries respect the utilization of natural talents in everyday endeavour, especially science and technology, and tend to attract talents from other countries, African countries including Nigeria only utilize talents from other countries. African countries, including Nigeria, only utilize talents in sports and entertainments. That is why they are mostly successful in those areas.

Belief in paper qualification

Nigeria recognizes only paper qualifications. This is a problem because existing educational training systems are designed to usher in technical progress in Nigeria, but academic credentials are inaccurate indicators of the technological potentials of Nigeria. In fact, even in developed countries, there is no clear correlation between academic intelligence and inventive talents. For instance, while there are some individuals who are good in both theory and practice of technology; there are many others who are academically sound but have problems using tools; just as there are many who are inventive geniuses even though they do not have high credentials [Usman, 2008]. Inventors such as Thomas Edison,

Gutenberg, the Wright Brothers and Bill Gates etc. are people that have changed the course of human history, but they do not even have a University degree. Using academic performance only, to anchor technological development is faulty and can only produce poor quality and quantity technology output that cannot compete favourably with the high tech goods produced by inventive geniuses in the advanced economics.

Global competition

Given the high level of today's global competition in the technological sector, it is inappropriate to anchor all our programme of technological development solely on academic performance, hence the need to adopt the talent-based approach to correctly select those who have the right aptitude. In Nigeria today, there are several universities, polytechnics and

colleges of technologies duplicating research efforts. Most oftentimes, the researchers' efforts are not mindful of the end users' needs when the research output do not meet the yearnings of the people, the whole effort ends in colossal waste of the little resources available to us.

According to Peter (2012), other problems militating against technological breakthrough in Nigeria include:

(1) Inconsistent, uncoordinated and inappropriate policies.

(2) Fragmented and overlapping institutions.
(3) Low productivity.

(4) Private sector under investment.

(5) Unfavourable business climate.

(6) Infrastructural deficiencies.

(7) Limited access and use of long-term business credit.

(8) High risk of investment.

(10) Insecurity of lives and properties.

(11) Inflationary trends.

(12) Presence of sub-standard materials.

(13) Paucity of funds for research.

Characteristics of Indigenous Technology

- First, indigenous technologies are recognized as animate, imbued with the breath of life, they live in form and function having emerged from the realms of the invisible
- Indigenous technologies emerge from the implicate order to reflect the art of skilful living. Indigenous technology is pragmatic. It is responsive and responsible to the ecology in which it lives.
- Indigenous technologies attract the learning spirit(s) they provide a learning ecology that supports the revitalization and transformation of awareness and knowledge.
- Indigenous technology is intended to enhance the ability to maintain and renew balance and harmony within a multi-dimensional environment.
- Indigenous Technology is created within a sensory environment that builds on our sense of relationship, meaning, balance, feeling, memory and place as well as sight, sound, smell, taste and touch.
- Through meaningful interactions Indigenous technology seeks to engage and evoke significant knowledge and experiences reflective of the Indigenous world.
- Indigenous technologies have the obligation to come into existence, to be used and to transform within an ethical space that is responsible to life in all its forms.
- The ability or capacity to make something does not constitute a valid reason for its existence. Indigenous technology is coherent with the natural order.
- Indigenous technology has a different life trajectory than a fax machine.

  The Pukea (A carved Polynesian trumpet) will not find itself in a landfill replaced with something sleeker and

faster. Its efficacy has not diminished over thousands of
years of use. The Pukea is an authentic example of technological design coherent with the natural order

- Indigenous technologies have intrinsic value because we know their ancestry where they came from, what their place is in our world. We know they will transform and pass from this place to return to the realms of energies.

Characteristics of Indigenous Innovation

Indigenous knowledge is ingrained into the culture and exists largely in tacit form. Unlike the western knowledge system
(scientific knowledge system) that is easier to communicate and articulate through formal language including grammatical statements, mathematical expressions and specifications, indigenous knowledge is difficult to explain through formal language. Though it is probably the oldest system of knowledge and has evolved with the evolution of mankind, it is not properly documented. It has therefore generally remained constrained within the community/region. By the very nature of its evolution, indigenous knowledge will be different at different locations and with different people (Nakata, 2002).

Technological advancement without the skilful exploration of a people's culture is impossible, because culture is the driving force that fuels and inspires technological accomplishments in human society (Adebayo (2011). And unarguably, every technology within a social praxis is a product of culture, since culture is a phenomenon which encompasses all the material and non-material expressions of a people; it affects the way people interact with nature and therefore varies with the environment. To take advantage of science and technology for development, therefore, African societies must reconcile their traditional cultural environment with the different circumstances of the modern international environment which has so far been largely shaped by science and technology (Adegbola, 2003:124). Also, it is important to note that technology is not just a catalogue of tools and the expert demonstration of its usage. It is forthrightly, a culture mindset that ensures the acquisition and usage of techniques, methods and skills acquired as an integral part of the society. In order to grapple with this issue efficiently, it is important that we pursue a conceptual clarification of key notions forthwith. Let us begin by defining culture. In a most anthropological sense, culture is regarded as that complex whole and a compound phenomenon that includes all aspects of life that give definition to human membership in society.

Since culture is values and norms people have which make them live in a particular way, it is therefore the sum total of all things that refer to religion, the origins of people, symbols, languages, songs, stories, celebrations, clothing, building and dressing, and all expressions of life. It thus encompasses food productions, technology, architecture, kinship, the interpersonal relationships, political and economic systems and all social relationships (Obioha, 2010). From this definition, it follows that culture is fundamental to any form of human creativity. That is, human beings must exist first in a cultural setting as a culturally- enclosed being before they can begin to explore the possibilities within the environment and the productivity of human mental capabilities.

> This is perhaps why culture is regarded as the *ground norm* of technological and scientific development. Similarly, culture can be regarded as the pattern of behaviour that allows people to live in social groups and therefore learn, create and share. Hence, culture is a distinguishing factor that distinguishes one human group from another It entails the unique mode of expression of a people and embraces all aspects of human life, past and present (Williams, 2006). This emphasis on social group, here, reveals the importance of socialization as a cultural process of learning and exchange of ideas that could give birth to creative innovations. Meanwhile, the allusion to 'past' and 'present' shows that culture is not static but dynamic – an expression not only of a people's past but also of the struggle of the present and aspirations of the future (Fadahunsi, 2004).

In the most technological sense, one can characterize culture as the totality of the way of life evolved by a people in their attempt to meet the challenges of living in their environment (Mabogunje, 1991).

The imported technologies did not take into cognizance the indigenous knowledge systems of African peoples. Consequently, four fundamental problems present themselves, namely, problem of adequately articulating the foreign language of the technologies; problem of adequately articulating the design principles of the technologies, lack of adequate knowledge of repair fundamentals, and the problem of spare parts availability. The question is, Can't Africa teach her peoples to develop and harness her indigenous technologies, since the technologies are of their very local environments? Must an old man in an African village who is a master craftsman and who possesses indigenous knowledge necessarily articulate a foreign language before his product can be considered viable? It is a known fact that countries in Europe which spearheaded the industrial revolution up to the present developments in science and technology employed their indigenous languages in communication and instruction. Britain, Germany, Russia, France and countries in the Balkans in South-east Europe, among others, all used their indigenous languages for communication and instructional purposes to develop their technologies to a world class status.

Conclusion

One basic issue which West Africa and indeed Africa as a whole need to deal with is how to make indigenous technology (IT) relevant to people, especially in the present era. Technologies imported into Africa from Europe and Asia have faced severe limitations especially in areas of training, spare parts and maintenance and repairs. The indigenous tools, devices, articles and items which the continent has in abundance can be harnessed to meet global standards. Indigenous knowledge and technologies need to be preserved, respected and propagated. In this connection, article 8 of the Rio Conference (Eionet Gemet Thesaurus, 2012) mandated the parties to "respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional life styles...and promote their wider application with the approval and involvement of holders of such knowledge, innovations and practices.

Recommendations

In view of the numerous threats to the survival of indigenous technologies in West Africa, the following recommendations are made.

1. Provide for sustained and focusing technology efforts and initiate steps for brand enrichment and product marketing.

2. Be committed to purchasing the indigenously developed products which are at par with the overseas products. The indigenously developed products are however, losing grounds due to lack of such commitments.

3. Go through the trade practices, especially the buying trends of common wealth nations and promote the indigenously developed products in such a way that they make in- roads into the markets in common wealth nations.

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