Fostering Egalitarianism Through Globalisation of Africa's Indigenous Knowledge and Technology (IK&T) for Enhanced Industrial Development and Global Competitiveness

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Abstract Globalisation is defined as the process of strengthening economic, political, social and cultural relations across the globe aimed at inspiring homogenisation of political and socio-economic principle worldwide. The belief is that it impacts significantly on Africa through methodical rearrangement of collaboration among its nations, by removing, among several others, cultural, commercial and communication barriers. The problem that arises is the assumption that these African states are equal in status, strength and resources even with industrialised countries in Asia, Europe and America. The answer is affirmatively 'no'. How then do we make the unequal states of Africa equal in the arrangement, in order to benefit from globalisation and ensure stimulation of Africa's industrial development for global competitiveness? This is the focus of this chapter. Relying on secondary and historical data, the chapter employs human factor (HF) theory and posits that capacity and capability building in indigenous technology development is a facilitator for nationwide advancement, in the midst of other factors, its propensity to provide the required backing for growth in the key areas of the economy, mainly in farming and manufacturing. The main argument thus is that development of Africa's indigenous technology, an important and neglected African resource, its innovations and adaptation are unequivocally mandatory for refining production techniques required to drive progress, African empowerment and global competitiveness. This is so in that technology invented based on people's culture, tradition and needs and which is adopted for use in their environment can be easily understood, adopted and adapted for increased productivity and industrial development. This will bring the countries in the continent to be equal participants/partners and beneficiary in the globalisation process.

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1 Introduction

When globalisation is defined as the process of strengthening economic, political, social and cultural relations across the globe, which aims at inspiring homogenisation of political and socio-economic principle worldwide, the belief is that it impacts significantly on African states through methodical rearrangement of collaboration among nations, by removing, among several others, cultural, commercial and communication barriers. The question can be posed: Are these states equal in status, strength and resources with industrialised countries of Asia, Europe and America? The answer is affirmatively 'no'.

Available evidence shows that in sub-Saharan Africa, 38 countries are categorised as low-income countries, 11 are middle-income countries and only 1 is a high-income country; GNP per capita measured in terms of PPP is $1440 in the continent when compared to the world average of $6300; 33 of the 48 countries in Africa are labelled as least developed by the UN; and 34 of the 42 countries covered by the HIPC initiative are African (Hagen 2002). According to Maddison (1995), when per capita income level in the main regions of the world is examined, the average income in Africa has always been below the world average between 1820 and 1992 and specifically below the average income in other regions, Western Europe, Western Offshoots (Canada, the USA, Australia and New Zealand), Southern Europe, Eastern Europe, Latin America and Asia, in every year except 1950. All these obviously illustrate the marginal and unequal position of Africa in the world economy. There is no doubt that there has been a plethora of academic literature containing several excellent reviews by political economists, public policymakers, policy analysts and administrators, academic researchers as well as other social scientists regarding the causes and way out of Africa's economic quagmire for increased industrialisation and global competitiveness. In spite of all these, the situation is getting worse in the continent. This suggests that there is something fundamental to the African condition, which impedes and thwarts all efforts at economic development. In fact, as argued by Hagen (2002), a lot of experimental and pragmatic studies of economic growth have established that after regulating several descriptive variables a replica variable for African countries is undesirable, adverse and statistically substantial and weighty. With all these, can countries of Africa be said to have equal industrial and economic muscles to compete globally with the industrialised countries in the globalisation process? How do we make the unequal states of Africa equal in the arrangement in order to benefit from globalisation and ensure stimulation of Africa's industrial development for global competitiveness, as well as what commodities can Africa offer? These and more are the focus of this chapter.

It has been variously argued that the major determinant of a nation's economic success is not the availability of resource endowment but the use to which such nation can put the resources to advance its development through appropriate technology (Prusak 1996, 1997). However, African countries are lagging behind in the area of the utilisation of their resources and technology. One fundamental challenge

to technological backwardness of most African countries is the adherence to contemporary religions and values to the total neglect of their indigenous/traditional religion, culture and values coupled with the lackadaisical attitude of governments, stakeholders and peoples of the continent to explore indigenous viable options for industrialisation and development. Building capacity and capability in indigenous technology development is a facilitator for nationwide advancement, in the midst of other factors, its propensity to provide the necessary support for growth in the major sectors of the economy, especially in agricultural and industrial sectors (Mathooko 2000; UNESCO 2010). The development of Africa's indigenous technology, an important and neglected African resource, its innovations and adaptation are unequivocally mandatory for refining production techniques required to drive progress, development, African empowerment and global competitiveness. This is so in that technology invented based on people's culture, tradition and needs and which is adopted for use in their environment will prevent their extinction, increase their loyalty and sense of nationalism and ensure their communal continued existence, uniqueness and distinctiveness. Such technology can be easily understood, adopted and adapted for increased productivity and industrial development. This will bring the countries in the continent to be equal participants/partners and beneficiaries in the globalisation process. Against this backdrop, the chapter therefore looks at the concepts of indigenous knowledge and indigenous technologies in Africa and the developmental opportunities they offer for industrialisation. While outlining the challenges, it discusses various ways of enhancing their promotion, utilisation, development and globalisation for Africa's industrial growth for global competitiveness.

2 Theoretical Framework

Against the backdrop of the nature of the postcolonial African states and with respect to the various legacies of colonialism which have distorted African indigenous knowledge, tradition, culture and values and its implication on the promotion and utilisation of these knowledge as it concerns and affects indigenous technology with its accompanying implication on production processes and practices, this paper adopts a tripartite theories of human factor (HF), dependency and cultural revivalism in its explanation of how African continents and their indigenous knowledge and technology were rendered impotent to positively contribute to the people's productive capabilities, production process and economic growth as was experienced before colonialism.

According to Adjibolosoo (1995), the human factor refers to the range of individual's behaviour, character and disposition as well as other aspects of human idiosyncrasy, peculiarity and habit that permit and support social, economic and political institutions to function consistently over time. These human factor characteristics, as listed by Muranda (2005), involve such values as commitment, responsibility, honesty, integrity and accountability in the conduct of activities in the work

place. Integrity means an exhibition of a high degree of adherence and commitment to sound moral principles (Adjibolosoo 2003).

The advocates of the dependency theory are of the opinion that the experienced sociocultural, economic and political challenges facing the continent of Africa can be traced to the Western world's attitude and approach in enforcing Africa's integration and incorporation into participating at the periphery of global capitalist system. The approach, given its parasitic, exploitative and disproportionate nature, did not make or allow the countries in the continent to play equal and partnership role with those of the Western or developed economies in the arrangement. This argument is well espoused by some leading African scholars including Andre Gunder Frank, Frantz Fanon, Claude Ake and Walter Rodney, among others, to explain the reasons for Africa's underdevelopment (Uthman 2016). In fact, Ake's argument becomes relevant when he posited that Africa's present poor state as seen in its lack of modern industries and/or advanced technology is better explained within the agenda of the Western countries to perpetually dominate Africa. This is entrenched in their approach to make African economies a mono-product nation that will continue to provide raw materials needed by foreign industries.

The cultural revivalism on the other hand assigns very substantial and critical influential responsibilities to African traditions and cultural heritage. Specifically, as posited by one of the major proponents of the theory, the major solution to Africa's contemporary challenges is 'to cut-off and detach from Western ideas of doing things and revert to African ways of solving problems through rebirth, reawakening, promoting and utilising African indigenous traditions, knowledge and technical know-how which have remained untapped and unexplored due the colonialists' campaign of calumny' (Gyekye 1997: 233).

Without doubt, what African continent requires now is the technology of self, in the light of growing unemployment, poverty and underdevelopment, explainable in low industrialisation in the African region. It is obvious that colonialism distorted African growth. Many African states have not been able to achieve technological development and independence because colonialism has reshaped the whole structure of the African way of life economically, socially, technologically, philosophically and politically and its legacies are the bane of Africa's industrial backwardness of today. The continent is failing to contend with its realities because the system was designed by the colonial authorities to carpet the black man for the white settler's elevation (Nyoni 2015). Africans have been brainwashed and branded, particularly through Christianity which Pathisa Nyathi (cited in Nyoni 2015) referred to as a proselytising religion, to the extent that they speak unpleasant of their fellows' abilities and most times denied their identity, ancestry and heritage. The situation has made it to be absolutely difficult for African nations to develop and harness their indigenous technologies given the unconducive atmosphere that has subjugated her traditional and indigenous values to the Western values. All these are not to argue that there are no endogenous factors in Africa that play complementary roles of entrenching foreign rule, sociocultural, political and economic domination of Africa. These factors include leadership imperfections, weaknesses and errors demonstrated by African political elites and leaders in institutionalising colonial legacies, which

have resulted in the overwhelming suffocation of Africa's indigenous knowledge system by Western indigenous system with its accompanying warp and negative stories of Africa's development (see Alemazung 2010). This explains the desperate need for the technologies of 'self' by Africans.

3 Africa's Indigenous Knowledge System and Western Indigenous System Compared

The indigenous system and methodology of knowing are built on locally, environmentally and periodically contextualised truths (Hammersmith 2007). Thus, these methods compared to the objectives of many Western scientific traditions for universal truths are explainable in the level of their attachment to natural communities described by Ermine as characterised by complex kinship systems of relationships among people, animals, the earth, the cosmos, etc. from which knowing originates. Given this therefore, indigenous knowledge systems (IKS) will refer to both the content and context of intricate knowledge systems acquired over generations by indigenous communities as they interact with their environment (Hammersmith 2007; Chikaire et al. 2012). To its promoters, IKS goes beyond handicrafts, taboos or folklores, oral histories and oral traditions (Augustine 2008; Howden 2001). It includes indigenous technological knowledge in agriculture, fishing, animal husbandry and ethnic veterinary medicine, forest resource exploitation, atmospheric management techniques, knowledge transmission systems, architecture, medicine, pharmacology, law, spirituality, orientation and navigation on land and sea as well as management of natural resources, among others (Abah et al. 2015).

Western Knowledge Systems, Western culture and Western civilisation, whichever way it is construed, are terms used to refer to the cultures of the people of European origin and their descendants (Hammersmith 2007). By implication, it encompasses the comprehensive and wide-ranging inheritance and legacies exemplified in social norms, ethical values, traditional beliefs and customs including detailed and particular artefacts and technologies which are generally identified with and within the Western world or its sphere of influence. In simple terms, Western Knowledge Systems refer to the framework of knowledge systems driven by the idiosyncrasies and characteristics of Western values, traditions, cultural beliefs and civilisations.

Notwithstanding, as posited by Abah et al. (2015), the two systems consist of multifaceted networks of propositions and interpretations drawn and agreed to be useful by groups of researchers. Specifically, both require some sort of beliefs, trust, convictions or acceptance of a specific model or image of the world, and both are socially negotiated pictures of the universe which inform the ongoing life of the society (Abah et al. 2015). It is also instructive to note that each of the knowledge system has their relative significance, challenges and limitations which make them

complementary rather than seeing one to be barbaric, primitive and inferior (see Kaino 2013).

4 Indigenous Knowledge and Technology (IK&T) in Africa: Its Importance

Indigenous knowledge (IK) suffers from having an all-embracing meaning. This is so in that the concept is an ascribed meaning in relation to the diverse culture and the identity of a people. In other words, the concept is sometimes variously referred to as traditional knowledge and/or local knowledge. For instance, Warren (1991) while explaining IK refers to it as the local knowledge that is peculiar, exclusive and distinctive to a given culture or society. He (Warren) further added that IK is 'the basis for local-level decision making in agriculture, health care, food preparation, education, natural-resource management, and a host of other activities in rural communities' (Warren 1991: 3). To the World Bank Group (n.d.), IK incorporates and embraces the know-how, expertise, practices and intuitions of people that are utilised or made use of in order to manage, sustain or advance their welfare and comfort. This definition is in line with that of Grenier (1998) which described IK as the unique, traditional, local knowledge existing within and developed around specific conditions of men and women indigenous to a particular geographical area. This could be the reason why Siyanbola et al. (2012) argued that the concept is concerned with the developed ancient traditional beliefs and cultural practices of specific regional indigenous and local communities which encompass their knowledge, wisdom and teachings. This is corroborated by Nakata and Langton (2005, cited in Adigun, 2014; Emeagwali and Sefa Dei 2014), when they opined that indigenous knowledge is owned collectively by the community and exists as folklores, stories, proverbs, songs, cultural values, norms, beliefs, rituals, local languages, health care and agricultural practices such as animal husbandry, animal breeds, development of plant species, land cultivation practices and crop propagation methods. It should be noted that although these massive quantity of knowledge cannot be found in a written form or compendium, they form a significant and cherished source of research activities, especially on indigenous technologies of African peoples anywhere in the world.

It should be equally noted that for proper discussion and effective understanding of indigenous technology (IT), the discussion on indigenous knowledge is very germane. This is so in that IT operations are grounded and established on essential indigenous knowledge systems. It is on this note that the discussion of the concept of technology is considered to be essential.

5 What Is Technology?

The question 'what is technology' has remained a puzzle among science and technology experts and researchers over time. The concept has not succeeded at acquiring any specifically limited and practical meaning that is universally acceptable for all times. Understandably, scholars and writers have begun to question the wisdom of dripping so much ink and expending so much time and dissipating energy on arid definitional exercise and exploration of meaning for the concept of technology. This could be the basis for Bijker et al. (1987) conclusion that it is needless dissipating and expending treasured and valued time struggling to reach a universally acceptable definition as it is difficult to ascribe a single meaning to the concept. In fact, it is as a result of this that Lawson (2008) argued that all previous attempts at achieving all-encompassing and all-embracing definition and meaning have over the years been unsuccessful. This notwithstanding, a short definition of the subject under discussion is of essence and crucial.

Scholars, Adams (1991) and Pacey (2001), for instance, have linked the general meaning of technology with achievement, progress and purpose, while Abdulkareem (1992) refers to technology as the practice and application of man's knowledge in his struggle and activities to solve his daily challenges and satisfy his needs. Relatedly, Burkitt (2002: 224) defined technology to mean 'a form of practical action accompanied by practical reason which aims to instil in the body certain habitual actions—either moral virtues...or technical skills'. He (Burkitt) further posited that technology is an avenue through which human beings engage in productive activities. The International Technology Education Association (2002: 2 as quoted by Manabete 2014) defined 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'. This definition is in line with that of the South African Department of Education (2002: 4) which defined 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'.

Importantly, in order to have a better understanding of the term technology, it is imperative, according to Keirl (2006), to consider the attributes of technology as these are central to people's life and culture (Manabete 2014). On this note, Keirl (2006) posited that all technologies are product of a manufacturing process occasioned by human intention and design. That is, no technology can be well-designed, purposeful and operational in the absence of a reasonable human commitment and involvement. In fact, this is brought into perspectives by the Greek's word 'techne' which refers to 'technology' to mean belonging to the arts, crafts or skill (Vandeleur 2010). From the foregoing, technology can be defined as the application of knowledge, skills and resources to meet and satisfy people's needs and wants.

Consequently and in relation to the focus of this chapter, Foucault's (1988) perspective of four types of technology presents a better understanding of the meaning of technology. According to Foucault (1988 as presented in Manabete

2014), there are four types of technology which are different but must harmoniously function and relate for enhanced system sustainability. These four types of technologies, as maintained by Manabete (2014), are technologies of production, technologies of sign systems, technologies of power and technologies of the self. While technologies of production ensure production, transformation or manipulation of materials and resources, technologies of sign systems allow the use of symbols, signs or meaning and technologies of power to determine individual attitude and conduct (Manabete 2014). Given the objective of this chapter, the discussion centres on the technologies of production which deal with production, transformation and manipulation of human and material resources rooted in the technologies of self for increased industrialisation.

Consequent on the above, how do we refer to indigenous technology (IT)? Like IK and the concept of technology, IT has been variously explained. The concept, in the view of Aliyu (2003), refers to a harmonised system of technologies developed by indigenes for their use based on available raw materials and designed to meet local needs and conditions. Given this, IT can be regarded as any technology invented, developed, embraced and utilised in a society in order to better or improve the life of the people in that society. Indigenous technology is a product of IK at its discovery, founded and grounded on valuable societal IK. Thus, IT exists or comes about when societal traditional/indigenous knowledge of simple instrument, devices, skills, knowledge and know-how are put to use in a way that they ease or enhance the resolution of societal challenges or problems. To identify IT, certain features which are distinctively unique can be deciphered. These include the facts that IT:

1. Is practical, realistic, receptive and accountable to the environmental and ecosystem in which it exists.
2. Appeals and entices the motivation for knowledge acquisition; it offers and ensures a learning environment that guarantees the renewal and change of consciousness and understanding.
3. Strives or endeavours to employ and induce substantial understanding, know-how, skills and practices reminiscent of the indigenous world as a result of significant interface and networking.
4. Has the responsibility to exist, to survive, to be utilised and to change within a morally principled environment that is accountable to forms of human existence.
5. Is logical, rational and intelligible with the natural order. In other words, the ability or capacity to make something does not constitute a valid reason for its existence.
6. Has inherent worth in that its history and ancestral origin are known as well as its global position (Native American Academy Silver Buffalo n.d.; Thesaurus 2012).

Although IK was regarded before as ‘backward, uncivilized, not scientific, and anti-development’ (World Bank 1993: 4), the opinion is significantly transformed in the recent time. For instance, many stakeholders, as observed by the World Bank, have begun greater focus on the functions of IK and its accompanying IT in supporting sustainable development (World Bank 1993: 4). Importantly, one of the attentions, as argued by Alayasa (2012), arose from the acknowledged

significance of culture in growth process and vice versa as affirmed by related global treaties as well as the necessity to consider the underprivileged in growth decision-making (Cooper and Vargas 2004 cited in Alayasa 2012). To corroborate this, the United Nations Development Program Arab Human Development Report (2002) posited that:

> Culture and values are the soul of development. They provide its impetus, facilitate the means needed to further it, and substantially define people's vision of its purposes and ends. Culture and values are instrumental in the sense that they help to shape people's daily hopes, fears, ambitions, attitudes and actions, but they are also formative because they mould people's ideals and inspire their dreams for a fulfilling life for themselves and future generations. There is some debate in Arab countries about whether culture and values promote or retard development. Ultimately, however, values are not the servants of development; they are its wellspring. (United Nations Development Program and the Arab Fund for Economic and Social Development 2002: 8).

The World Bank Forum about native skill and intelligence, and enduring growth in (1993) emphasised native/local skills as critical to the process of institutionalising successful sustainable development outcomes. This is identifiable in wealth creation and employment generation which guarantee increased industrialisation. In spite of this, IK and particularly IT are yet to be sufficiently considered in the sustainable development even in spite of the acknowledgement of its critical utility in this regard by a plethora of literature (World Bank 1993) as few researches have really been conducted with respect to IT's propensity and integration to stimulate industrial development for competitiveness in Africa. This is in spite of the core concern that sustainable development is much better facilitated by the support and creativity of the local and indigenous people. However, some efforts in the collected writings (World Commission on Environment and Development 1983; United Nations 1995, 2002, 2010) underscored the incorporation process. This is still not enough and necessitates further and additional intervention (United Nations 2011: 5, 2012).

Another major worry about the extant writings concerns the penchant to address decision/programme execution or disappointments regarding IK and IT against or instead of their capabilities and accomplishments. Understanding decision failures and/or disappointments is a germane discourse on successful efforts and lessons that could be learned from focusing on the society's cultural and indigenous knowledge's strengths for sustainable development which is equally critically essential (see Alayasa 2012). The next section is dedicated to this discussion.

6 Indigenous Knowledge and Technology (IK&T) Across Africa: Selected Success Stories and Propensity for Industrialisation and Global Competitiveness

The continent of Africa is blessed with varieties of enormous indigenous technologies (ITs). These indigenous technologies, as opined by Ibeanu and Okonkwo (2014), form the significant part of people's culture. They signify the means, through

which African people respond, cope and endure with the environmental challenges confronting them.

If technology and its development involve any activity designed to mobilise the society's traditional wealth, sociocultural and cooperative combination of contemporary and old-fashioned technologies structured and tailored towards viable tasks intended to achieve a particular goal, it then means that in Africa and elsewhere, indigenous people have used indigenous tools and implements, weapons and some others to make life easy for themselves. One of these indigenous technologies, as pointed out by Abdulkareem (1992), was the scratching of stones against each other to produce fire which was used for cooking, lighting and keeping houses warm and comfortable. There is also the use of stone as a tool to do many things, including making other tools, tilling the ground to get food, preparing food, chopping wood, preparing animals, using spears as weapons for hunting, fishing and fighting (Manabete 2014).

Before the colonial occupation in Africa, a number of indigenous technologies existed in many communities. In precolonial Africa, several studies have been conducted on African traditional skills with proof of their progressive inputs mainly to the growth and development of different groups of people. Some of which have assisted in wealth creation and employment generation. What is crucial is the need to develop and globalise them for enhancing global competition.

In Nigeria, for instance, there are many technological breakthroughs and discoveries earlier recorded which preceded European and Asian civilisations. Typical of these was the iron technology of the Nok culture around Jos, Bauchi, Daima, Kano and Zaria which existed around 500 BC (Olaoye 1992). In fact, archaeologists have exhumed iron spears and axes at Nok ever since the Ajaokuta Steel Rolling Milling was established in Nigeria and iron smelting furnaces had been discovered in Taruga. Besides, other communities in Nigeria where traditional iron was discovered include Benin's famous wax casting, Ife art and Igbo-Ukwu's iron smelting and metal casting centre as shown by archaeological evidences (Inuwa 1995). There has also been sufficient proof of evidence of iron utilisation around Kainji Dam in Niger State of Nigeria around the second century BC and its role in the construction of canoe and other farm tools around the area (Obayemi 1980).

In 1904, it was recorded that there were specialised iron mining and smelting villages containing about 100–120 people in the Old Oyo kingdom. Affirming the contribution of these manufacturing talents to the growth of Old Oyo Empire, Stride and Ifeka (1975) asserted that:

> the growth of Oyo's prosperity and power were the industrial skills of the people. Their early knowledge of iron working and the existence of iron ore locally meant early possession of efficient tools and weapon, their skill and dexterity in weaving and dyeing in carving and decorative arts.

Tin smelting can also be found 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 some societies in Adamawa State, North-Eastern Nigeria, notably

the Chamba, Longuda and Higgi peoples, just like the Aboriginal people of Australia, there exist similar tools and implements such as knives, spears, head-axe(s) hoes, bows and arrows, drinking vessels and catapults (L'kama et al. 2008).

As revealed by the work of Amuda et al. (2012), very many years ago, indigenous technologies and science practices were common among women in Borno State, North-Eastern Nigeria. The practices encompassed using glass mirrors; washing plates and clothes; splitting of firewood using the head-axe; 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.

Indigenous capacity for management of natural resources was equally noticed in other empires at different locations such as Songhai, Oyo, Benin, Dahomey and Zulu (Folke et al. 2011, cited Akinwale 2012; Olaopa et al. 2014, 2016). These capabilities have been utilised in the existing indigenous industries in several parts of West Africa. These IT industries include the production of pots from clay, especially the wonder clay pot and stove from Sierra Leone (shown on Gotel TV in Adamawa State, Nigeria) (Manabete 2014). Others are textile making, cloth weaving/dyeing, gold/blacksmithing, wood/calabash carving, traditional medicine, traditional soap making, fishing, subsistence agriculture, leather tanning, brewing/distilling, glass and bead, pottery production of aluminium metal scraps and pots, leather tanning and bronze casting (Essien 2011). The methods of knowledge acquisition of these technologies are mostly through apprenticeship, oral transmission and observation (Siyanbola et al. 2012).

In 2500 BC, Egyptians discovered papyrus and ink for writing and built the first libraries (Essien 2011). They also used irrigation to control Nile floods, spoke wheel invented in ancient Near East and horse used to pull vehicles, while in Babylon mathematicians had already understood cube and square root (Bruce 1988 as cited by Essien 2011). In agricultural practice, in Columbia and Rwanda, the knowledge of indigenous women farmers in bean cultivation assisted in the process of adaptation of modern cultivation techniques (Olaopa et al. 2016).

In science, engineering and technology, indigenous people have distinguished themselves by using simple technological knowledge to make life easy and comfortable in their environment. For example, in Sudan it was suggested by Gibbons (1999) that reliance on local informants and drawing on their technical knowledge have assisted in undertaking a perfectly satisfactory soil survey and mapping in a very short period compared to a formal scientific approach. In the same vein, pastoralists in Mali have equally help in the research that led to the discovery of the cause of nervousness and irritation in the country (Domfeh 2007; Chambers 1983), while in Ghana, the Ghanaian farmers are able to identify antecedents of climatic and weather conditions (Olaopa et al. 2016).

Currently, there are lots of fast and indigenous technical developments evolving and receiving wider currency in contemporary Africa which are capable of awakening and bringing the continent to a level where her products can withstand and compete with those of the advanced industrialised economies of the world. The route of these unparalleled and speedy technological transformations can easily be deciphered from the African youths' enthusiasm about technology and the rapidity

at which training and knowledge centres for developing technological initiatives capable of propelling the continent's technological growth are springing up (Kizza 2013). All these have resulted in the development of many Africa's indigenous technological products capable of global competition (see FORBES 2011, 2012a, b as cited in Kizza 2013).[1] In medicine, indigenous African people have made use of significant portions of plant species for preparing medicines for health benefits (Melchias 2001). For instance, in Central Africa, the richly endowed Mount Cameroon with varieties of medicinal plant species has been found, even by the World Health Organization, to be as efficient as the imported 'Western' prescription medicine (Nkuinkeu 1999). Interestingly, efforts at protecting, managing and conserving these natural resources have been in existence many centuries before the intrusion of the colonialists in the African continent. Specific efforts in this regard can be traced to the village of Zaïpobly in La Côte d'Ivoire, Ile-Ife and some other communities in Yorubaland of Southwest, Nigeria and Ghana where the ancient tradition of community forest management seems to hold the ancient keys for a meaningful model of forest conservation (Domfeh 2007). Also, in East and Central Africa, there are also the community forests (CF) in Cameroon, rangelands in Kenya and Tanzania, village forests of Tanzania and Busaga and Buhanga forests in Rwanda which encompass a very rich biological population, thus offering an opportunity for local people to engage in the participatory management of natural resources by acquiring a CF (Olaopa et al. 2016).

In Swaziland, the application and use of indigenous knowledge for disaster management are used to predict occurrence of floods through the sign shown from the height of birds' nests near the rivers (Olaopa et al. 2016). The position of the sun and the cry of a specific bird on trees near the rivers may predict onset of the rainy season for farming (Domfeh 2007). It should be noted at this juncture that there exist the theoretical and empirical studies that validate IK and IT in Africa. These have been well documented (see Warren 1992; Warren et al. 1995; Forsyth 1996; Khor 2002; Leveque and Mounolou 2003; Ogundiran 2016).

The above notwithstanding, regrettably none of these prehistoric breakthroughs in technical knowledge and institutions in African countries is immortalised. Their developments were stultified and retarded with the advent of colonialism and the introduction of capitalism. This led to the monetisation of African states' economies caused by alterations in African people's old style of living with the replacement of simple and family-based production arrangement with export commodities/crops. This is worsened by the slave trade that had originally taken away from African states their productive human resource and capital expected to dominate the continent's major work force as critical and essential tool and catalyst of industrial revolution. These situations, however, have delayed the renewal and transformation of various forms of IT in Africa. This is so in that rather than improving the local

[1]FORBES in different works listed in detail different Africa's indigenous technological products developed across various countries of Africa which have contributed significantly to economic development.

skills of production, they were complacently substituted by foreign trade in goods like palm oil, ivory, guns and pepper, cocoa, coffee, groundnuts and rubber without any strong financial muscle to contribute to national product and global competition. This made African economies suppliers of raw materials without industrial base, while at the same time human resources were reduced as a result of slave trade. The implication of this is that foreign rule provided the basis of Africa's industrial underdevelopment, while Westernisation and globalisation are capable of sending to extinction Africa's distinctive and multifarious societal cultural norms that function as the basis for various indigenous and local practices and further weaken the ability of the states of Africa (Li 2000; Sundar 2000; Baviskar 2000). If efforts are not directed at radically transforming the continent through the development of the indigenous technology, the aim of improving its production capacity and capability for industrial growth and global competitiveness for enhanced equal participation in the globalisation process may be an ordinary dream.

The above is against the fact that European and Asian countries have leveraged on their indigenous technology to build modern nations. The United States of America has established a development founded on the state-of-the-art innovative improvement in science and information technology and unequalled development in all areas of human activities. China and Japan's ability to capture modern technology especially in the electronics industry was founded on the adoption of their society's local tools based on their indigenous know-how. Chinese accomplishments are a testimony that the basics of an industrial foundation were erected on unaltered principles, beliefs and old engagements which opportunities are still being made use of. In fact, China in 1200 BC invented the first Chinese dictionary and in 1250 BC produced silk fabric. The importance of IK and culture and their potential to fast-track industrial development can be found in the former USSR. The country, as argued by Essien (2011), had established a contemporary nation in two generations by engaging peoples with a wandering and rural/local experience to operate an industrialised economy based on developed machines.

7 Indigenous Knowledge and Technology (IK&T) for Africa's Industrial Development and Global Competition: Strengths and Opportunities

The weaknesses and threats of IK&T have been variously analysed and documented elsewhere (see Eyong n.d.; World Bank Group n.d., cited in Mabete 2014 the African Ministerial Council on Science and Technology, AMCST n.d. in Mabete 2014; Adelaga 1997; Manabete et al. 2006; Gakuru 2006; John et al. 2009; Zambwa et al. 2009; Abioye et al. 2011; Innomantra Consulting Private Limited 2011; Kizza 2013; Olaopa et al. 2016). The attempt and major concern in this chapter is to examine and analyse the strengths of IK&T and the opportunities it offers for

stimulating wealth creation and employment generation for industrial development and global competition.

Indigenous technologies empower the local people, thereby enhancing local economy. In Africa, local industries/technologies create wealth and generate employment through which the indigenous people generate revenue. This therefore encourages community and regional interactions as well as economic development. The improvement in the local technologies and industries enhances the people's welfare and social life and ability to pay tax/other levies which at the same time act as a facilitator to other investments. These enhance industrialisation and catalyse industrial development, domestic capacity building (Innomantra Consulting Private Limited 2011) and intergroup relations within the country, the region and the entire continent.

Indigenous technologies and industries encourage the sustainable use of natural resources and the preservation of cultural values of the indigenous people. In fact, some of their products, if properly harnessed and developed, serve other purposes such as fertiliser or as source of food, which can be exported and used to reduce balance of payment problem. For instance, through the use of indigenous technology, the ashes produced from the indigenous cashew processing industry are used as manure in the farms, and the burnt shells serve as firewood, while the nut itself is a source of food which can be packaged and sold abroad (Ibeanu and Okonkwo 2014). Besides, the use of IT provides both the people and government numerous opportunities for innovation, modernisation and technological competitiveness, thereby reducing costs and implications associated with importation and transfer of technology. For instance, the application of indigenous technology in the palm wine processing to local gins and products of black/goldsmiths local industries, their proceeds and further development are capable of sustaining those engaging in the business and increase industrialisation, foreign exchange and earnings. This further creates awareness and demand for indigenous processing methods in the global market (Innomantra Consulting Private Limited 2011).

The IT used in the local industries has continued to leave archaeological imprints in the cultural landscape of many communities in the African continent. These technologies and materials remain as such communities' valuable archaeological information useful for the explanation, understanding, rebuilding and restoration of the past activities of the ancestors in the area. Besides, archaeologists can make meaningful interpretations about these material remains through their physical examination, description and/or classification in addition to the attraction that such places/communities will serve for cultural tourism if given proper attention. There are two benefits to be derived here. First, the development of the tourism industry will improve the economic activities of the indigenous people since their local and other products are sold not only to tourists as souvenir but also to the general public in popular local markets. Second, such places provide an avenue for employment and revenue-generating outlets for the government. This is capable of enhancing the countries of Africa's ability to effectively participate in the globalisation process.

Indeed, the development of cultural tourism in Africa will stimulate improvement in local infrastructures, motivate local and international investors and bring further

benefits to the host community. It will improve intercultural understanding and encourage the production of cultural products for local consumption and exportation if well harnessed.

Thus, IT, when pursued enthusiastically and dedicatedly, helps a nation to attain self-reliance in technological development which increases its opportunities to grow and develop every segment of its economy, specifically the agrarian sector where a preponderant majority of African population engages (Corpor 2013), for global competitiveness. Not only this, as argued in the African Ministerial Council on Science and Technology (AMCOST) document and as supported by the World Bank (cited in Manabete 2014), indigenous knowledge and technologies play vital roles in biodiversity, conservation and sustainable development, contributing to increased food production, fighting against the dreaded disease HIV/AIDS and related diseases as well as considerably stemming environmental degradation.

8 Globalising Africa's Indigenous Knowledge and Technology (IK&T) to Stimulate Industrial Development for Enhanced Global Competitiveness: Policy Issues and Facts

It is true that globalisation is the new language which refers to the process of amplification of economic, political, social and cultural relations across international boundaries (Shaka 2013). With the trend of thing, globalisation has gripped Africa and the rest of the world. Specifically, its effects have been seen in the rise in democracy through multiparty elections in various countries like Kenya, Ghana and South Africa as their citizens now had the power to elect the people of their choice through the ballot without the fear of being punished or suffering act of vengeance as experienced in Liberia, Nigeria and Sudan. In the area of economy, integration of African economies into the world capitalist system has been argued to produce insightful effects on African societies. This include improved quality of life and high standard of living, close and better networking/collaboration among countries, improved information accessibility and world culture observation enhanced by the development of Internet. All these, as argued, have resulted in improvements in information and transportation know-how and free market beliefs in relation to availability of goods, services and unparalleled capital mobility, among other benefits (Ohiorhenuan 1998; Mowlana 1998; Oyejide 1998; Grieco and Holmes 1999).

The above notwithstanding, the propositions of globalisation can be seen to assume a phoney equality for countries of Africa compared to the developed world. In this sense, globalisation affects developmental philosophy, strategies and policy actions of these countries; reduces the values of equity, justice and fairness regarding market consideration, financial muscles, resource development and technical know-how; and decreases the self-sufficiency of African sovereign states (Akindele et al. 2002). By implication, it affects innovativeness of states and

encourages "decreasing national control and increasing control over the (Internal) economy (of the state) by outside players" (Tandon 1998: 2). The manifestation of this is obvious in the collapsed industrial sector of most African countries.

Specifically, the globalisation of politics of free mobility of factors of production and reduced tariffs have made production cost and commodity prices exorbitant in Africa due to labour emigration, enhanced by lack of incentives and motivation, and to development of economies which can now produce and sell at cheaper prices. The legacies of colonialism explainable in the attitude of African political elites to disparage and describe local goods as being inferior and of low quality have resorted to government's lackadaisical attitude towards the development, promotion and improvement of IK&T to encourage local production. The end result is therefore the sabotage of local products through high importation, currency devaluation and its impacts on foreign reserves (Akindele et al. 2002). This clearly raises the need for African countries to design and implement a new development paradigm to free the continent from the storming threat and danger of cultural imperialism and socio-economic and political dominations entrenched in the politics of globalisation in order to solve all its developmental challenges. If this is not done, Africa may remain in perpetual, cultural and intellectual slavery, thereby becoming the continent of a cultureless or culturally disoriented people (Akindele et al. 2002). This will be so in that, as argued by Nsibambi (2001), as cultures interrelate, some cultures are being adulterated, weakened and/or destroyed at the expense of others and destructive values are being spread globally with relative ease.

There is no doubt that Africa has significantly rich technological heritage spread across different communities and which is obvious in different areas of their lives. Notwithstanding, the continent should not just be overwhelmed by these naturally endowed resources but rather make maximum use of them. Siyanbola et al. (2012) buttressed this fact when they argued that for any nation to survive competition in this era of globalisation, it is imperative for such nation to identify its areas of competence and comparative advantage and then build on it using scientific approaches and techniques towards harnessing, improving and utilising its indigenous technologies. In this regard, research and development (R&D) become very critical. It will be a worthwhile endeavour to commit time and resources to R&D by all stakeholders coupled with the building of network, collaboration and strategic alliance between government and technology developers, rewards for innovation and invention and well-structured intellectual property regime and laws. This will ensure higher economic value of IK&T; mutual technological, managerial and financial strengths; and reduction in time for development, production and induction of products that meet the service requirements and provide encouragement for exportation of indigenous products which would create a pull for those products in the domestic market (Innomantra Consulting Private Limited 2011).

History has never shown that Africa's productive practices have been wasteful but conducted with due regard to the inhabitants' environmental dictates, beliefs, culture and values (Akpomuvie 2013). Nevertheless, African idea of development was thwarted, and local industries and practices were condemned. The situation reduced the confidence of local technologists, craftsmen and experts steadily.

European styles and ways of life became the societal ethics and moral standard. As asserted by Akpomuvie (2013), the situation became worsened by the attitude of European industrialists and government agencies in robbing the locals of their patents and designs. It is interesting to note that, in the face of humiliating efforts at discouraging native ingenuities, inventiveness and resourcefulness in the areas of science and technology, native innovation, inventions and customs endured the persecution.

For appropriate utilisation of Africa's indigenous skills and technologies in the development of their ability to be equal partner in the globalisation process, lots of efforts are essential. A number of countries in Africa through their ministries of science and technology, international organisations, non-governmental organisations, universities and individuals with other stakeholders need to take stock of existing indigenous skills and technologies and properly document them. It is when these are known the implication of the skills and techniques on individuals and their accessibility, the effect of contemporary societal changes on the indigenous value systems and the influence of ethnicity on maintenance, survival and the stability or transformation of these systems that effective quantification and proper action for industrialisation can be taken for enhanced development. To ensure and prevent the loss of this knowledge, Africa can adapt the system of the Indian Digital Library of Traditional Knowledge by establishing the digital libraries—library that contains databases of indigenous knowledge, in various fields, and follow the guidelines of the World Intellectual Property Organization (Adigun 2014; Emeagwali and Sefa Dei 2014).

Also germane and critical is the need to overhaul courses and disciplines by way of curriculum reorganisation in African universities (Vandeleur 2010). This will ensure effective integration of the constructive rudimentary and essential components of African indigenous skills and technical practices. To further institutionalise this, engineering and medical students as well as students in many other related fields of applied science and art should be required to undergo direct internship/traineeship of 1 or 2 years in related local sectors in the rural communities. This will improve their knowledge by learning the general basics and fundamental challenges of local professionals and where possible enthusiastically engaging them to achieve an enhanced acknowledgment and advancement of these systems (Akpomuvie 2013). In the circumstance where African traditional values and knowledge, especially in medicine, are not recognised, in spite of its significant contribution, in the curriculum will do no good to Africa's health-care system.

The Centres of African Studies and other related agencies, the Nigeria Natural Medicine Development Agency (NNMDA) and the Centre for Black African Arts and Culture (CBAAC) in Nigeria, for instance, should take a lead in this effort. They should provide enabling environment and opportunities in terms of motivation and the amenities to scientifically train and learn African cultures and traditions. All African universities and specialised institutions of science and technology should include courses in African studies to motivate and encourage the students to develop interests in the study of their society's traditions and culture. Encouragement in terms of scholarship, aids, grants and tuition free study should be given to interested

students who prefer to study in the Institutes of African Studies, Centres of African Studies and Departments of Sociology, Anthropology, Archaeology, History, Agriculture, Theatre Arts, Creative Arts, Linguistics and Geography which deal directly with the problems of knowledge in Africa but now on the verge of extinction.

Closely related to the above is the necessity to make the body of knowledge gained in the research available to the public and practising contemporary scientists by these universities and Centres of African Studies in collaboration with the appropriate ministries, departments and agencies in Africa in order to ensure their better effectiveness and acceptability. Such platform will guarantee public loyalty and acceptability of the traditional African skills and technologies for the development of industrialisation required for global competitiveness. This will be better facilitated and achieved if the policymakers and professional administrators support local inventors and innovators through policies that help in the institutionalisation of Africa's traditional practices. This will make a change in paradigm from unrepentant wanton importation of foreign technologies and the accompanying feelings of inferiority associated with indigenous ideas and technologies to encourage the growth of local industries, using traditional skills and technologies.

Indigenous technology will be indispensable in the process of industrialisation in a society in which most of the rural inhabitants are involved and engaged in decision-making and execution. Specifically, in the continent, this process of a policy plan for honest community-oriented and people-centred technology is fundamental to the development of indigenous skill and technology that will catalyse industrialisation.

9 Conclusion

Indigenous knowledge, skills and technologies are great resources and possessions of a nation. Their appreciation, growth, promotion and utilisation, according to Emovon (1989, cited in Akpomuvie 2013), provide the major foundation for technological specialisation, development and superiority of many countries in the area of production of industrial goods and services. What remains for Africa is how to make indigenous technology (IT) relevant to people, especially in this era of globalisation. This is against the limitation of imported technologies to adequately meet the dictates of African environment which then call for the emergent need for harnessing and developing the indigenous tools, devices, articles and items which the continent has in abundance to meet global standards. Researchers and other technical experts in Africa must therefore strive to develop research proposals that seek to upgrade African indigenous knowledge and technical skills. This will encourage interest and stimulate growth in these area, increasing industrialisation and global competitiveness.

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