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Migration of Science, Technology and Engineering Development by Globalization of Higher Education Opportunities: Contemporary Evaluation of Africa Experience

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Abstract: *Science, Technology and Engineering are global contemporary basis for societal economic development and sustainability. This implies that when science provides solutions to human needs, financial income and prosperity is inevitably attracted. Armed with this fact, Western research institutions and universities supported by their Governments, position themselves for advance research activities in science, technology and engineering related areas. In addition to active collaborations with the industry, the research findings from these institutions are converted into finished products and consumables under well-defined production or manufacturing processes. In order to sustain and expand this economic prosperity and opportunity, there is the need for regular high caliber manpower recruitment of specialized professionals who have received part or all of the education and training required. The resultant effect of this need is that the West turns to Africa and in response, some of Africa's best hands in the sciences, technology and engineering arena are attracted by incentives that their home countries cannot afford or sustain. In this paper, this bane of Africa's development is further dissected to show that African nations' science, technology and engineering resources have maintained a steady migration with African trained personnel as they relocate to the West, dating back to the era of the colonialists. This resource migration is partly the reason for Africa's under development.*

Keywords: *interconnectedness, commodification, globalization, Africanization, indigenous technology, industrialization*

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I. Introduction

Science, Technology and Engineering Education in modern times have taken different crucial developmental dimensions. In this regard, globalization of education within the context of national science and technology development have progressed from serving of primordial colonial interests as it was in the pre-independence situation of most African nation states, to indirect underdevelopment and under-industrialization of African nations by means of subtle and surreptitious engagement of African nation states higher education policies, by the introduction of various forms of educational benefits ranging from full scholarships, sports scholarships, medical scholarships, military engagement incentives, regional agencies educational grants, etc. This development have been significantly occasioned by the *"widening, deepening, and speeding up of interconnectedness in all aspects of contemporary life, from the cultural…."* [1]. Thus, interconnectedness in all aspects as was observed by Evans *et al* is the foundational structure for the sustenance of continuous exploitation and depletion of African human resources and by extension one of the cardinal reasons for underdevelopment of science, technology and engineering framework in Africa.

Thus, the foregoing observation is eminently all encompassing as it appeals to the interdependent relativity of the connectedness of corporate and public interests and concerns in the administration of higher education. Within the framework of the forgoing postulation, suffice to say that these corporate and public concerns have directly influenced the choice and location of where higher educational opportunities can be acquired for their individual organization's corporate assimilation and utilization. Conservatively, it has therefore been suggested that "global higher education can be referred to as the 'widening, deepening and speeding up of *interconnectedness of universities within the global world'* [2].

Although the foregoing view cannot be strictly divorced from the earlier assertion of Evans *et al*, it is important to note that it addresses the paramount issues of resource unavailability and knowledge linkage

platforms within the context of higher education administration in tertiary and allied institutions in Africa. In this regard, this paper shall posit that educational capital resource unavailability, low or no investment into modern higher educational priorities in science and technology, lack of governmental will power to implement science and technology policy blueprints, all supported by the global drive for appropriate knowledge acquisition and application are some of the basis for the drain on Africa human resources, resulting under development and underutilization of scientific findings and their applications in terms of development of appropriate technologies blueprint peculiar to the African continent.

The implication of this finding is that most higher education institutions in Africa anchoring programs in science, technology and engineering appears to operate in isolation since they lack the basic parameters required to attract foreign academics with technical linkage possibilities and globally interconnected facilities for higher human development. In view of this drawback, higher education institutions in Africa are often bedeviled by the lack of initiatives for necessary policy frameworks geared towards global competiveness in science, technology and engineering concerns. In this regard, these institutions are relatedly disconnected from a global web of knowledge and allied resources. Interestingly, this position is incidental to university autonomy and limitless cross-border skilled manpower mobility.

In view of the foregoing, migration of Africa knowledge economy in the garb of globalization has become a critical issue in academic dialogs and this has increasingly brought about critical changes in national policies on higher education in Africa, as observed by Mwesigye and Muhangi (2005); and flowing from the definition above, John (2005) in Evans, described globalization as;

> *"what happens when the movement of people, goods, or ideas among countries and regions accelerates"*

A succinct observation in this regard draws inference from the fact that under the idea educational globalization, people, goods and services 'accelerates across regions', and this mass movement of intellectual capacity from Africa's citadel of learning to American, Asia and European countries is intended to bring about modernization with accelerated conditions of changes in the transformation of those other continents.

Although it has been observed that the advent of globalization has brought about resources that has resulted great socio-economic progress to Africa[3], suffice to say that such progress is insignificant when compared to the full benefit the African continent stands to have gained had most or all of her university graduate in science, technology and engineering remained to develop their various African nations along the lines of the competitive resources at their nation's disposal. For instance Nigeria and Angola are rich in oil, gas and other forms of fossil fuels. Imagine that their university graduates in science, technology and engineering remain behind or returned after their foreign training, then the economic resources of these nations would have witnessed an upward surge.

II. Scientific Research Findings as Basis for National Development

As could be observed, Okoli's views were predicated on the earlier conditions of education under colonial administration, where African students undertook university education in Europe and elsewhere in other to serve colonial administrative interests. These diaspora education was intended to enhance Europe's grip on African civilization and development and the worst hit being the learning of science, technology and engineering. Further, another crucial issue that bothered on Okoli's submission is the fact that it failed to conclusively define the nature of diaspora education given to African students who took undergraduate degrees. The implication of this inadvertence of intellectual thought is the lack of adequate assessment parameters for determination of the impact of diaspora education on African socio-infrastructural development.

Thus, the weakness of that model of learning when compared to the technologically advanced society that the United States bequeathed to Japan after World War II [4] is not only conspicuous but instructive to conclude that while colonial European method of early African education was self-serving and exploitative, the United States model for Japan, which was known to be science and technology based was more fruitful as could be seen in the advancement of technology in modern time Japan. This lag is re-echoed in the infrastructural lopsidedness of African societies, when compared to other more industrialized nations of the world like Japan. Accordingly, Jumbo (at p. 233) submitted as follows:

> *".....For instance after World War II, part of the reconstruction effort of the occupying forces and the United States in particular was to open up Japan to possibilities of the gains of democratization which later progressed to anti-communist ideologies for which educational aculturisation in all areas*

> *including technical educational was crucial. Interestingly, the Japanese technical education curriculum after World War II relied on the American model patterned after John Dewey's propositions. Under this reconstruction agreement the occupying forces were required to enhance foreign scholarships for Japanese students to other parts of the world in order to acquire among others, technological knowledge and experience….. The result of this technological acquisition was very remarkable for Japan's economic growth and central to this developmental strides in Japan….."*

The forgoing therefore implies that pre-independence diaspora higher educational training for African students in Europe was not only exploitative but retrogressive in the sense that the application of scientific findings did not form core curriculum concerns. This implies that even when African students undertake scientific and technologically based training in western institutions, well thought out research designs from these students' efforts do not translate into commercialsable ventures in Africa and as such, are of little or no value. This significantly account for under development of African societies.

Although, John (2005) in Evans[1] identified four cardinal change indicators realizable from cross-cultural educational pursuits, these positive change indicators of education globalization in a sense also constitute a *negative change process* for Africa's science and technology development. Thus, the four unified indicators are as follows:

i) post-national forms of production and distribution of goods and services that are practically enhanced by enormous volumes of cross-border trade conditions,
ii) foreign direct investments and capital flows between African countries,
iii) information acquisitions and applications,
iv) communications and advance mass media technologies.

It is therefore important to posit that these four indicators are mostly the basis for Africa's underdevelopment in science, technology and engineering. For instance, on the issue of production and distribution of goods, it is unarguable that most of Africa's science and technology based consumptions are imported from either Europe, United States or Asia. The reason being the dependence of African states on foreign production or manufacturing entities and these exporting countries are able to achieve this feat partly because of Africans who proceeded abroad for advanced degrees in science, technology and engineering; and upon completion of their programs could not return to Africa to contribute to the continent's development but stayed back to sustain the industrial growth of their hosts.

In support of the foregoing argument, the U.S. Department of State in a 2003 report [5a] observed that:

> *There are now roughly 35 million citizens of African descent in the U.S. with a collective purchasing power of about $450 billion per annum -- a sum that if represented by a single country would make it one of the 15 largest economies in the world.*
>
> *African immigrants to this country, an increasingly important part of the Diaspora, **boast some of the highest educational attainments of any immigrant group and there are now more than 250,000 scientists and physicians of African descent in the United States**. (underline and bold are mine for sake of emphases)*
>
> *As a country, our human, economic, moral and strategic ties to Africa are strong and growing. In 2002, U.S.-African trade totaled approximately $24 billion, and the United States is Africa's largest single market. The United States is both the leading foreign investor and the largest bilateral aid donor to Africa, providing more than $2 billion in overall development, humanitarian and security assistance this past year.*
>
> *A large proportion of the over $3 billion in remittances that Africa receives from the Diaspora each year originates in this country.*

> ***Most important for the future, over 30,000 Africans are studying in the United States today.***

Although the report under discussion was for year 2002-2003 period, the fundamental facts remain the same in 2018 but with higher population ratio of Africans and their contributions. As observed in the report, "*there are now more than 250,000 scientists and physicians of African descent in the United States".* This figure is abysmally too low to represent the population of African scientists, engineers and technology related disciplines resident in the United States alone. A large number of these millions of African population went for higher education after graduation from African universities.

Thus, according to the report while 35 million Africans contributed to an annual consumption of $450 billion in 2002, remittances to Africa from these African citizens was placed at a paltry $3 billion and United States Government intervention for the same year is about $2 billion. This imply that in 2002 alone, while the African continent received a combined amount of about $5 billion from the United States Government and African citizens in the United States, the same Africans resident in the United States contributed over $450 billion to the United States economy. Herein lies Africa underdevelopment in terms of science, technology and engineering. This fact also holds same for other western countries where Africans are engaged to produce goods that are later exported to Africa for African consumption at very exorbitant costs.

Under the foregoing disposition, the report further observed that;

> *While the second wave of the Diaspora represents the fulfillment of many individuals' dreams for greater prosperity and freedom, the magnitude of the exodus of Africa's best from the continent in many ways marks a failure of governance on the African continent.*
>
> *At a time when African governments are desperately seeking technical skills from agronomy to economics to health care, we estimate that more than 20,000 African professionals leave Africa every year to settle in the West. More than 40,000 Africans with a Ph.D. work out of Africa, and for every 100 professionals sent overseas for training from Africa between 1982 and 1997, only 65 returned to Africa. At the same time, one estimate suggests that more than 100,000 expatriates are employed in Africa at a cost of $4 billion each year to offset the annual migration from Africa by its own skilled professionals.*
>
> *This situation marks a significant roadblock to sustainable economic growth and development in Africa. At a time when Africa desperately needs human as well as financial capital, too many of Africa's best and brightest are leaving.*

In addition to the foregoing, the report drew the attention of African governments to the fact that they ought to initiate deliberate capacity building frameworks to utilize Africa's pool of developmental resources hanging outside the shores of Africa. Succinctly stated, the report averred that,

> *For their part, African governments need to realize that their expatriate communities and the African Diaspora at large is a strategic asset for their development, one that holds enormous stores of know-how, capital and good will.*

Consequent on the submissions above, should the lack of scientific and technological development of Africa be blamed only on African leadership alone? Stated differently, does the West not have a fair share of the same blame? In response to this poser, a careful study of the yearly diversity emigration visa programs of the United States and Canada remarkably shows that they mostly target highly qualified Africans. Thus, application processing for these entry level situation is limited to persons whose presence and engagements in the United States constitute a significant loss to African development. An example in point is the *naturalization law* of the United States Government where Section 329. [8 U.S.C. 1440] of the Immigration and Nationality Act stipulates that:

> *(a) Any person who, while an alien or a noncitizen national of the United States, has served honorably as a member of the Selected Reserve of the Ready Reserve or……No period of service in the Armed Forces shall be made the basis of a application for naturalization under this section if the applicant has previously been naturalized on the basis of the same period of service.*
> *(b) A person filing an application under subsection (a) of this section shall comply in all other respects with the requirements of this title, except that-*
> *(1) he may be naturalized regardless of age, and notwithstanding the provisions of section 318 as they relate to deportability and the provisions of section 331;*
> *(2) no period of residence or specified period of physical presence within the United States or any State or district of the Service in the United States shall be required;* [5b]

In line with the reasoning of this paper, the foregoing is indicative of the fact that the United States Government makes deliberate national policies for permanent residency of aliens and non-citizens; and these policies are restricted to professionals from other nations of the world especially Africa.

The foregoing argument is predicated on the fact that while a university graduate who is a citizen of Germany or France may not take up this United States incentive because of commensurate living standards applicable in their countries, at least eight out of every ten graduates of African universities would not hesitate to accept the offer of naturalization by military service or other United States government approved measures.

III. Exportation of African Technological Revolution

In furtherance of the foregoing discussion, it has been observed that a lot of modern civilization sprang from Africa. Thus, records [6] show that during the slave trade era a lot of Africans who found themselves in new lands brought with them indigenous technology only invented and applied in Africa. Some of these African inventions were further redesigned to suit their new environment and later formed the basis for modern western civilization. Accordingly, Demoiselle opined that:

> *From 1793 until 1836, both slaves and freedmen could obtain patents for their inventions. In 1836 the law was changed to prevent slaves and masters from obtaining a patent for the slave's inventions. The United States Patent office refused to grant slaves patents for their inventions because slaves were not considered as citizens. The slave owners were also prevented from receiving a patent (A Brief History of Patent Laws of the United States). The first African American to obtain a patent was Thomas Jennings, on March 8, 1826, for a dry cleaning process called ―dry scouring.*

From the foregoing, question arising therefore is, where did the slave boys and girls get their idea or impetus for invention from? The answer lies in the fact that those inventions were primordial engineering activities practiced in Africa and exported with the Africans when the Europeans forcefully took them or bought them as slaves. In this regard, Thomas Jennings, an African who received a United States patent for inventing the dry-scouring process for dry cleaning of fabrics must have lifted one of Africa's many prehistoric technological inventions. No doubt, the said process is currently a high flying dry-cleaning machine whose logic of operation may also have been used to invent many other modern machines and processes.

Secondly, many of these African exported inventions were not patented to the slaves and were forcefully taken and patented to their masters since for a long period of time the slaves were not considered to be humans and when the West changed that orientation, they said the slaves were not citizens of the United States as to be patented.

In addition to the foregoing, Demoiselle reiterated an avalanche of African based inventions as reproduced below;

> *Henry Boyd, a slave living in Cincinnati, Ohio, invented a bed where the wooden rail screwed into both the headboard and the*

> *footboard. He used his skills as a carpenter and his invention to buy his freedom in 1826. Within ten years, he opened his own company. Boyd stamped his name on all the beds he made.*
>
> *Benjamin Bradley, a slave working in the Annapolis Naval Academy, developed a steam engine for warships in the 1840's. Because he was unable to receive a patent for his invention, he sold it. He brought his freedom with the money he made from the sale of the steam engine. He spent the first money he made on legal fees to buy his family's freedom.*
>
> *Oscar J. E. Stuart, a white Mississippi planter, wanted to receive a patent for his slave Ned's invention of the cotton scraper. After being denied the patent, he wrote a letter to Secretary of Interior Jacob Thompson, on August 25, 1858, telling him that the invention was his because it was the product of Ned's labor, both intellectual and manual. The federal government did not change the ruling and made it a written official policy in 1858.*
> *In the case of Benjamin Montgomery, a slave of Joseph Davis, brother of Jefferson Davis, he invented an angled blade propeller that allowed steamboats to move in shallow water around the plantation. Joseph Davis tried to obtain a patent for Montgomery's invention, and he was denied a patent as well. When Jefferson Davis became President 5 of the Confederate States of America, he had the confederate congress pass a law permitting slave owners to obtain a patent for the inventions of their slaves…..*

The abovementioned also apply to the rest of western civilization. Interestingly, had these technological feats been allowed to develop in Africa, then Africa's rise in science, technology and engineering would have been limitless. While it is important to note that these inventions are not only crucial to western industrialization, they are representative of Africa's initial dominance of global technology space.

The foregoing views are better understood when a close observation is made to the findings of Turner in his work on 'African-American Technological Contributions' [7]; he observed that:

> *To understand our present—from the perspective of African-American scientists and engineers and, indeed, from the perspective our nation as whole—we must reckon with the trials and triumphs of black innovators since the days of slavery. This understanding, this appreciation of our hard-won progress, is necessary to chart our future in an ever-more diverse and increasingly competitive global science and technology community.*
>
> *Our collective future, as U.S. citizens and as inhabitants of this finite planet, depends mightily on progress in science and technology. The stakes have never been higher. It is incumbent on our nation to leverage our diversity and to make African Americans (now 13 percent of the population)……*
>
> *Evidence of advanced methods of metal making suggest that African peoples may have been the first to enter the Iron Age. The first true steel was made in Africa. (underline and bold are mine for emphasis)*

He further opined that African contribution have overwhelmingly shaped the development of American societies. He drew attention to the following findings:

> *In 1893 at a Chicago Hospital, Daniel Hale Williams, a black physician performed the first open heart surgery. His patient was*

> *James Cornish, a young man who had been stabbed in the chest. Cornish's wound had been treated, but he was bleeding internally and would have soon died if not for Williams' decision to perform surgery. In so doing, Dr. Williams pioneered the use of antiseptic techniques. The patient made a full recovery and, reportedly, lived a long life.*
>
> *Granville Woods is credited with developing the concept of the third rail. The additional rail allows a train to receive more electricity while reducing friction. This concept is still used on subway train platforms in major cities in the United States. Woods was called the "Black Edison." He patented more than 50 inventions including an automatic brake and improvements to other inventions, such as safety circuits, telegraphs, telephones, and phonographs.*
> *Born in Dutch Guiana, Jan Matzeliger developed and perfected the technology that made shoes affordable for the common person. His shoe lasting machine automated the process of sewing the tops of shoes to the soles, and is credited with making shoes affordable for the average American.*

Having argued and established the obvious reasons for Africa backwardness in the development of appropriate technology based on home grown scientific ideologies, suffice to posit that the same slave-master mentality that forcefully took Africa's bests to Europe and America to help them industrialize and develop their cities, still hold sway in our modern age; but under the guise of pursuit of higher education and good life in foreign lands. Thus, the new slave master is the Dollar, Pounds Sterling, Dutch Mark, French Franc, etc. In additional support of this argument, the U.S. Department of State in the 2003 report already referred to, pointed that about 35% of Africans who came to the United States for study stay back to pursue their careers in the United States. Although this figure is unimaginably low, suffice to posit that such admission lays credence to the assertions of this paper.

Further, the view of this paper is that such data may not have revealed the real percentage of Africans who stay back in the United States after acquisition of higher education and training as the real value could be astronomically very high, should the same survey be conducted today. This view is based on the fact that the United States Government and other national governments in the western bloc have deliberately provided in subtle manners many social, educational and career incentives to the brightest of these students. These offers are sometimes too difficult to be rejected or ignored and as such, the African students after their academic training accept to stay back while Africa, their continent remains in an obscured and absurd scientific and technological reality.

IV. Declassification of Early African Education and the Growth of Scientific Knowledge

Further, as reiterated by Okoli, the earlier African view towards education was a quantitative and fee paying approach of education handed down by the colonial masters. This form of colonial heritage was directed towards administrative survival of the colonializing imperialists. Thus, Africans studying in Europe were limited to such administration oriented courses of study within the humanities such as, law, history, philosophy, sociology, anthropology, literature, etc.

Clandestinely or surreptitiously these African students were not allowed to take courses in applied sciences, technology or engineering. They were only allowed to study theoretical oriented science courses such as chemistry, biology agricultural sciences, physics for the purpose of teaching and managing of colonial scientific concerns in Africa.

As was observed at page 70 of the said work, Okoli noted that:

> *Africans learnt from their interactions with the colonial masters, especially. After the world wars that the only advantage their masters had over them was their education. The Africans see education as instrument for meaningful development, modernization and for preparation of the individual for the*

> *contemporary society. Unfortunately, colonial education was fee paying all through and so many Africans could not afford it.*

Pursuant to the view canvassed above, it should be emphasized that as more African states gained political independence, the challenge of industrialization started becoming a reality since the colonial masters made no attempt to industrialize the region but were only interested in converting their own slums back home into cities on the backs and sweats of Africans. Thus, as observed by Okoli, these challenge of modernization brought to fore the need for scientific and technology based education.

Consequent on the foregoing, the initial basic non-professional education that was embarked on by post-colonial African administrations was found to be fraught with necessities that were anachronistic in view of modern developmental challenges. Thus, it was opined that Africa needed more beneficial forms of education that do not only serve Africa industrialization interest but also a global resource center for sustainable and rewarding investment in the direction of implementation of scientific findings.[8] Hence, drawing inference from the work of Meyer et al [9] it was observed that,

> *At the outset, it is important to point out that the universities as part of society cannot immune themselves against the global forces that prevail in society. While the effect of globalization on HE remains polemic, advocates of globalization argue that due to technological globalisation, world nations have become highly interconnected to the extent of becoming a boundary-less global village. This has the critical implication that universities will cease to operate as isolated institutions in particular cities, or countries but rather as global higher education institutions connected to the global world that transcend their countries of origin.*

The foregoing notwithstanding, the U.S. Census Bureau Report, October 2014 [10] indicated that African foreign-born possessed a higher level of educational attainment and achievements than the total number of those born overseas. Thus, the report pointed that 41% percent of African-born had a bachelor's degree or higher qualifications within the period of 2008-12 under review compared to 28% of the overall number. The implication of these figures is that the deliberate policies, working and living incentives of foreign governments make it possible for African students to live and work in foreign states after attainment of higher educational qualifications in those countries thereby denying Africa the benefits derivable from their education and training in science, technology and engineering.

The report further pointed that: "High levels of educational attainment among the African-born are in part due to the large number of ***educated Africans*** who have chosen to migrate and to many who come to the United States to ***pursue academic studies***". What more testimonial evidence in this regard can be greater than the United States Government Census Report?

Further, as could be seen in a reproduced section of the report in Fig. 1 below, Egypt, Nigeria and South Africa top the list of African countries with the highest number of scientifically oriented manpower domiciled in the United States alone. A lot of these resource persons are academics holding senior teaching and research positions in United States universities including the Ivy League institutions. This bulk of African brain resource have been so assimilated into the American or western culture and lifestyle that they seldom remember Africa; and statistics averred in this paper show that only less than 1% of their entire efforts in terms of income gets back to Africa. If this is not the bane of scientific development and industrialization of Africa, what else is the bane?

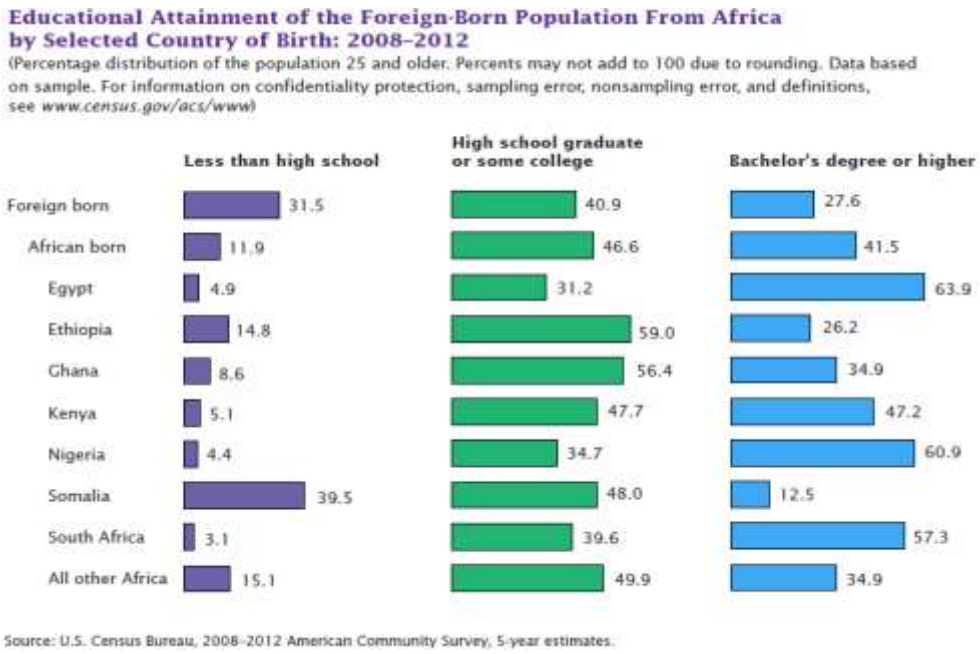

Fig 1 Educational Attainment of the Foreign-Born Population from Africa by Selected Country of Birth: 2008–2012.

It should be noted that Somalia is high in ***less than high school qualification*** because of asylum seekers who were allowed to enter the United States without academic qualifications but possess some level of work experience and technical knowledge. The Report further indicate that the rest of African emigrants are allowed entry into the United States if the emigrant can show proof of prior educational attainment at bachelors or higher degrees mostly.

The Report further revealed that within the foreign born population from the African continent, 64% of such persons are from Egypt, 61% from Nigeria, 57% from South Africa, 47% from Kenya and 35% from Ghana. Other African countries are also indicated in the report. Instructively, the Report showed that these are countries with higher population of persons with bachelors and higher degrees. Some of whom came to the United States for advanced studies.

In addition to the foregoing, the Report pointed:

> *That the difference in educational attainment among the populations from different African countries in part reflects how they immigrated to the United States". A relatively high proportion of immigrants from Africa entered the United States on diversity visas (24 percent as compared with 5 percent of the overall foreign born), which require a high school diploma or equivalent work experience.*

To further support the assertion of this paper that the West seeks for any or every opportunity to deny Africa the benefit of industrialization, a report was filed in 2015 by Sophia Shaw[11] where in the opening remark of the report the author asserted that:

> *As demand grows for workers trained in science, technology, engineering and math, minorities are the untapped resource we must nurture*

This view is directed at science, technology and engineering development measures implemented by national governments of technologically advanced nations for their national economic and security interests. These governments are capitalistic in nature and careless about the impact of their economic dependent decisions on the African continent. This implies a categorical attempt to keep the African continent perpetually dependent on foreign manufactured goods and services. In the said 2015 report, Shaw opined that:

> *Nearly 75% of US scientists and engineers are white. And, despite comprising 26% of the workforce, African Americans and Hispanics represent only 11% of all Stem employees. Addressing this lack of diversity is key if the US wants to be a leader in Stem fields.*
>
> *Everyone benefits when we produce talented Stem employees and many of the United States' best opportunities for economic growth come from jobs that require Stem skills. Recognizing this need, the White House launched Educate to Innovate to "provide students at every level with the skills they need to excel in the high-paid, highly-rewarding fields of science, technology, engineering and math." Faced with the effects of climate change, we will need even more Stem graduates to protect the environment and address the detrimental impact of increased greenhouse gases on the planet.*

In view of this obvious policy, shouldn't African governments and institutions initiate continent wide collaborations to keep African human resources within Africa? The United States government's initiative of "educate to innovate" is made in furtherance of its 'Stem Policy' (science, technology, engineering and math policy) and the target manpower are the intelligent and knowledgeable young African men and women who have received under graduate education in Africa and seeking to advance their knowledge of the subject matter.

V. Globalization of Education by Domestication of African Educational Resources

In the foregoing regard, globalization as applicable to Africa educational development is defined in terms of the status, purpose, structure and the content of the programs that African universities must offer to remain competitive.[12] This assertion was further reinvented by the submission that some areas of study would attract more attention and investment due to foreseeable 'economic usefulness and technological values and applications'. [13] This argument is further fortified by the submission that:

> *It is therefore not surprising that market-related knowledge disciplines such as techno-sciences and business tend to be given more privilege than others such as social sciences and humanities.* [8]

The consensus here, draws inference from the ideology of domestication of African nurtured appropriate technologies for purposes of improvement and exportation. A reverse case in point is the invention of yam pounding machines by the Chinese. Relatedly, yam is a staple food to Africans; however, Chinese inventors (who do not eat African grown yams) understudied African yam cultivation and processing activities and produced machines that can pound or produce yam floors. These machines are produced in China for export to Africa.

The socio-economic implication of these Chinese inventions is that while Africans purchase these machines, demand for workers and increased capacity utilization is created for the Chinese populace; this characteristically means more jobs and incomes for Chinese citizens in an area of comparative advantage to African inventors most of whom are in foreign lands, in search of greener pastures.

Further, Machingambi in support of Greaves et al (2007)[14] introduced a new dimension to the discussion which was encapsulated as follows:

> *…….in a global capitalist society, education acquires a particular, distinctive economic and business orientation which does not necessarily provide a holistic educational experience that enriches the learner. Thus, disciplines or forms of knowledge that help develop national culture or other forms of cultural heritage may be marginalized as the focus will be on those learning areas that tend to promote cosmopolitan values.*

From the foregoing argument, the idea, '*to promote cosmopolitan values'* in the quote above is based on the understanding that it is a means of solving some related social problems which significantly rely on

defined proficiencies that are fundamental to Africa's economic development. Thus, these defined cosmopolitan values are incidental stepping stones and aggregated opportunities for investments in commercially relevant scientific findings that can well be suitable for Africa's educational resource base.

In other to optimize the gains and advantages of these African based techno-educational resources, the crucial inputs in forms of engineering procedures and processes are therefore intended to codify the research findings and application areas within the African context. In this vein, higher education in Africa should establish and maintain a link between the industry, academia and the consuming public. Thus, the idea of globalization of technology using African universities as centers of research excellence could well imply Africanization of appropriate technology by linkages and sharing of individual resources to create a regional socio-scientific and socio-technological balance.

VI. Recommendations

Solutions to the identified problems above is dependent on African states *inclusiveness policy framework* that would remove national boundaries and barriers just as the European Union (EU) did to Europe. This position is more fortified by the assertion that the "rise of a global society, driven by technology and communication is supportive to nurture students into global citizens with a broad range of ideas, skills and capacity to apply to a competitive and information driven society'.[15] This view is relevant if consideration is given to the fact that educational development should target the nurturing and mobility of knowledge and skills across nation states in Africa without any national boundaries or state limits.

Secondly, individual state's higher education policies should maintain the same agreed continental approach and standards. This view is a huge necessity in the sense that modern industrialization policies of developed economies are dependent on their abilities to favorably compete in a global market. It is therefore instructive to state that industrial-based economies are gradually winding up thereby leaving the stage for knowledge based businesses initiatives.[13]

Thirdly, communication and knowledge dependent economic development is currently the driving force for modern time higher education development. The benefit derivable from this initiative portend great impetus for Africa and as such calls for advancement of applicable methodology for which relevant technology and communication-driven education becomes a lifelong training process, where transferable skills and knowledge becomes the basis for national socio-economic order of investment. [16] Examples in this direction are Germany and Japan, who rely on the development of the scientific and technological knowledge and skill of their citizens to advance on their various competitive products. This attempt attract foreign incomes to boost their local economies and social stability.

Fourthly, it has been suggested that current universities management method should be redefined by African universities administrators in the crucial areas of quality staffing and students recruitment in addition to deliberate policies that are geared towards encouraging the universities to constantly initiate and sustain the industrialization of Africa.[17]

Fifthly, the paper has also drawn attention to the lack of foresightedness and political willpower from the Governments of African states in realizing and utilizing the diaspora human resources at their disposal. A lot of the persons in political leadership position see these foreign based professionals as potential political threats to their hegemonic hold on political power and as such would not encourage any developmental advances from them. In view of this lag, it is recommended that Africans should engage their Governments and specifically their legislators in this regard. This imply that an important issue as this, should be a key campaign thrust for national elective offices.

Sixthly, it is hereby recommended that African leaders should through regional organs such AU, ECOWAS, etc, initiate incentive measures towards forming of networks for African professionals in the diaspora. This platform could be the basis of interaction of this professionals with their home Governments. A legislation in this regard could be useful to safe guide diaspora investments where they chose to invest in Africa science, technology and engineering development.

Finally, since industrialization is all about actualization of capitalistic ventures, African universities as centers of excellence are to evolve beyond cultural primordialism and inculcate beneficial technology commercialization ideologies in order to sustain the funding paths for growth in scientific researches and their technological responses. This view is referred to as commodification of educational policies for global competitiveness and Africa is well positioned with all required resources to actualize this feat.

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