

# Utilizing Federalism, Science and Technology for Economically Viable United States of Africa

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## ABSTRACT

Colonialism brought about an unviable federal system of government where it is practiced in many African states, which impacts directly on socio-economic development of the continent. African states are a byproduct of the Industrial Revolution in Europe; thus, its political formations were fashioned according to the interest of the metropolises as well as the neo-colonial elites at the expense of the poor local indigenes. As a result of these, the continent is characterized by policy failures; authoritarianism; inappropriate state structures and other vices. Consequently, this paper intends to provide answers to: why has development challenges persistent in Africa when the continent prides itself with differently endowed resources and series of development strategies adopted; how can Africa be salvaged from this development quandary and policy failures; and what roles can Science, Technology and Innovation (STI) play, in this circumstance, to excuse the continent from these doldrums? The paper embraces qualitative and historical research methodology and adopts content analysis of secondary sources of data. This method involves the in-depth review of literature and scientific papers on the subject matter, and making judgemental inference therefrom. Evidence from the review indicates that real federation and sustainable economic development for global competitiveness can only be achieved through sincerity, trust and political dedication on the part of the leaders, people and respective states. It also requires all stakeholders' readiness to redirect all the regions' resources leveraging on effective channelization of indigenous knowledge (IK) towards the development of STI driven by effective policy formulation and implementation.

**Keywords:** Content analysis, Federalism, IKS, Metropole, Neocolonial, STI.

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## INTRODUCTION

Across the world, the various societal challenges that have limited the enjoyment of the dividends of democratic governance and the need and how to safeguard humanity from further dangers portend by hunger and starvation, insecurity, declining and/or insufficient resources, diseconomies of scale, lack of competitiveness have dominated many political, economic and academic fora.

Consequently, stakeholders have found reason and solution in the formation of different types of groupings at different levels of political system. It is against this background that some great African leaders muted the laudable idea on creation of a United States of Africa amidst several impediments to the realisation of this dream.<sup>[1]</sup>

Specifically, this notion of African unity came up and is predicated on the need to properly focus and direct the attention of the newly independent states towards the critical

need to pursue unity and ensure solidarity across the continent. Also, it is an attempt to implement a transformation agenda that will make Africa a place of pride in the global community.

No doubt, the continent has witnessed various laudable and commendable institutional transformation and transition, and programmes. Yet, the yearning for a new suitable body which will adequately meet demands of societal dynamics and the dictates of globalisation, as a consequent of the apparent insufficiencies of the existing initiatives, has been persistently on the increase.<sup>[2]</sup> This paper is aware of the fact that a lot of initial issues entail critical consideration. Participating in the debate and thinking on what requires to foster a central and economically competitive unified government, this paper focuses on two issues: one, to highlight the opportunities and prospects inherent in the principle and practice of federalism to the notion of a United States of Africa, and two, to make proposals based on the critical roles of Science, Technology and Innovation (STI) in facilitating the achievement of a viable United States of Africa. That is, what improvements will be required in transforming STI and essential associated governance structure that will facilitate the achievement.

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## Research Questions

1. Does the principle and practice of federalism offer any opportunities and prospects for creating viable United States of Africa.
2. What are the essential roles of Science, Technology and Innovation (STI) in facilitating the achievement of a viable United States of Africa.

## METHODOLOGY

The understanding of the nature of post-colonial African state, the attitudes and perception of African policy makers towards indigenous knowledge (IK), and STI in this paper require a combination of qualitative and historical methodology. The qualitative research will offer data analysis on the nature of African state, federalism, the attitudes and perception of African policy makers towards STI without the use of statistics and other forms of quantification. Historical research encompasses developing an understanding of the past through interrogation and analysis of facts which may be available in the form of texts or collected from secondary sources. This includes government records, reports of international organisations and internet on the subject matter of the research, and making judgemental inference therefrom.

*Exploring extant literature on African Post-colonial States, Federalism and Science, Technology and Innovation (STI)*

### *Description of African States*

Precisely, Adejumo<sup>[3]</sup> described the political economy of African state as the one dominated by struggle for primitive amassing of wealth and power among leading political elites with its accompanying inevitable impacts on political and socio-economic development. This situation allowed for the production of old elites, maintenance of existing leadership structures and their policies. In this circumstance, business as usual is encouraged, reform attempts are obstructed, initiative is discouraged, and peoples' confidence and trust in government is lost while development is impeded. It is in the light of this relationship that the nature of the African state and its connection with different society's challenges, as the consequences of its defect will be explained.

The evolution and character of the African state provide a very critical foundation in an understanding of the propensity or otherwise to attain the dream of economically viable United States of Africa. The process of emergence of African state, most especially during the period of colonialism moulded the structure and defines the nature of the economy.<sup>[4]</sup>

In Africa, the urgency to serve commercial interests and economic imperialism was the major reason for the British colonial occupation in Africa. In the process, Africa was balkanised and diverse peoples, with varied backgrounds and

cultures were merged into a single political entity called states.<sup>[5]</sup> This created division and historic and cultural allegiances within and among the states which always impedes national integration across the continent. In addition, the colonial politics of divide and rule further instituted and strengthened ethnic bigotry, regional political parties, and narrow-minded as well as divided native political elite. The colonial state with the introduction of indirect rule recruited and strengthened the rulership of the dominant in order to promote and safeguard the wrath of changing the existing class structure.<sup>[3]</sup> In fact, the nature of administrative system and political relations that existed were one of authoritarian, arbitrary rule and display of power, strict regulation and reliance, characterised by patron-client relationship.<sup>[6]</sup> The indigenous Africans were able to maintain their position based on the goodwill of, faithfulness to and reliance on the colonial masters or associates.<sup>[7,8]</sup>

With regard to economy, the continent's resources were taken against the will of the people, and a single product and an unorganised economy that supports reliance and exploitation in the global capitalist system was set up and institutionalised.<sup>[7,9,10,11]</sup> In terms of institutions, after independence African state took over and reared an administrative system which guarantees a master-slave relationship the leaders and the led, a system that encourages all socio-political and economic vices.<sup>[12]</sup> Thus, at independence, as succinctly puts by Ogunsanwo,<sup>[13]</sup> the Nigerian state, as indeed the whole Africa, was a distorted, malformed and mutilated, underdeveloped and conflict-ridden state in many ramifications. According to Ogunsanwo,<sup>[13]</sup> these distortions which has incapacitated African growth and development can be found in its political economy arrangement, leadership attitudinal behaviour and beliefs. Number one infirmity of the African state is in the area of the economy as identified by Ogunsanwo.<sup>[13]</sup> The states in the continent inherited a totally marginal and economy whose survival is at the mercy of Europe. The economy is not in any way interdependent and as such deprived and disrupted and consequently incapacitated to meet the demands of its citizens.

The second distortion is in the area of the mind-set, experience and attitude of the produced indigenous elites and citizens. These sets of individuals are British in their orientation and thinking, unpatriotic and less loyal to African development agenda. Their main concern is to protect and preserve the colonial institutions and interests in the newly independent states and in the entire Africa.

The third abnormality of the African state is in the double values. On this, Ekeh<sup>[14]</sup> argued that the aftermath of colonial rule is the production of what he described as 'the two publics'. These are the socially moral public and that which detests morality. It is however disheartening that, the public which is unprincipled and unethical dominates governance institutions

and other activities in Africa. As such, the proclivity and tendency for apolitical behaviour exemplified by poor attitude to public property, assets, or resources, fiscal recklessness of the political class, corruption, lack of recognition for transparency and accountability, looting,<sup>[15]</sup> poor policy making and implementation, among other unethical behaviour remained unabated and with impunity across all states in the continent.

The last distortion which is structural imbalance of the African states can be deciphered in some countries, Nigeria for instance, where a region in terms of geographical spread is so large than double or more of other states combined. This made it to be a general belief and subscription to the view that the structural pattern has the consequence of making the practice of fiscal and cooperative federalism challenging. This notwithstanding, the concern of this aspect of the paper is the opportunity offered by federalism in the area of resources endowment and indigenous knowledge of the federating units.

The apolitical attitude and behaviour of African leaders and their followers are erected on this faulty nature of independent state including their economic system.<sup>[16]</sup> The prevalent phobia to transformative development agenda and appropriate strategies coupled with the concerns for power struggle, politics of existence and personal security within the political elites and the citizen combined, find explanation in this paradigm. Without mincing words, foreign rule evidently produced menaces of structural imbalances, low level of independence, scientific and technological delay, and impoverishment of African majority.

#### *The Concept of Federalism in Africa and its relevance to the formation of a Unified Government.*

In the plethora of existing works on federalism, it is largely acknowledged that federalism, is used to refer to acknowledgement of variances and multiplicities as the motivating factor for alliance. The unified state is the physical organisational manifestation of the notion.<sup>[17]</sup> Undeniably, there can be federalism without formal federation in that many alliances or unification often failed to attain complete association, and in its place can have extremely dispersed units with preference for significant devolution of powers and responsibilities or local independence.

The unique characteristic of alliance is the statutory provision of independence of decision making and guaranteed participation in the process of administrative policies at the federal level. The major disparity concerning a federation and a confederation is found in the way governmental actions and inactions directly affect and influence the lives of individual citizens in the federal arrangement unlike in the confederation where the states are directly impacted.<sup>[17]</sup> Interestingly, the concept of United States of Africa enjoys both advantages.

Many believed that federalism in Africa have not produced any positive change, its success rate is very low, inconsistent and sparse while its disappointments seem apparent.<sup>[18,19]</sup> This judgement is based on the existing of only three, Nigeria, Ethiopia and South Africa, institutionalised and enduring federal states in the continent.

The overall impacts of various factors such as culture, democracy and development, ethnicity and religious conflicts, one party system and totalitarianism, top-bottom governance system, high fiscal centralism, among others on federal practices and trials provided the reason for flexibility and the susceptibility of Africa's federal notion.<sup>[18-21]</sup> In addition, they represent the hindrances to federal accomplishments and inability of representative government to expedite the federal practice.

It should be noted that, the evident dearth of successful contemporary federal systems must not be allowed to give the impression that federalism in Africa is inactive.<sup>[22,23]</sup> Divergently, federal practice still remains an important topic when it comes to the discourse about some failed states, such as Somalia, Sudan and the Democratic Republic of the Congo. Not only this, there is bequeathed heritage of societal order, different forms of traditional governance for example, related to political authority in Africa on which colonial indirect rule was erected even though distorted and disrupted by colonial rule.<sup>[17,23]</sup> This is critically important all over the continent. Its neglect in any meaningful discourse on the African federal experience will have a great consequence.

Of equal importance is the fact that the identified hindrances to successful federal idea does not remove the fact that each region or countries in Africa are naturally and differently endowed with natural resources and indigenous knowledge which they harness to solve their societies challenges, not minding the political violence, corruption and criminality associated with these resources. With leadership commitment (which is one of the major features of African traditional societies) to federal values, the problem of inequality and other challenges can be easily surmounted. The significance of leadership commitment was empirically confirmed in Thomas Franck's outstanding research enquiry into the 'Why Federations Fail: an inquiry into the requisites for successful federalism', published in 1968. It was established that the main reason for disappointment or inability of most alliance to perform include dearth of fiscal information or indicators, list of range of societal differences and most importantly, absence of a political-ideological commitment to the recognition of federal ideas specifically.<sup>[18]</sup> This, with commitment to other strategies, STI in particular, in facilitating the process of nation-building and economic development is missing in Africa.

## Analysis of Issues and Discussion of Findings

### Institutionalising United States of Africa: A case for Economic Viability/Structure

For many decades amidst various developments including coups and conflict, scholars and leaders in Africa have been interrogating the appropriate framework and strategies to strengthen and intensifying regional peace and cooperation across the continent to the level that the whole continent would form an outstanding sovereign territorial state, a continental African political arrangement that is similar to the United States of America.<sup>[24]</sup>

Notwithstanding, the fact remains that both colonial and precolonial state of Africa cannot provide the environment where development can thrive. This has dashed and thwarted the many hopes of strong political union and better economic performance in Africa's poor societies. This becomes worrisome in spite of the continent's abundant human and natural resources endowment. Africa, as a continent, produces 46 per cent of the world's chromium, 48 per cent of its diamonds, 29 per cent of its gold and 48 per cent of its platinum.<sup>[25]</sup> In fact, as posited by Aljazeera.com (2016), the continent possessed about one-third of the world mineral deposits. These are presented in the Table 1.

In the area of agriculture, due to the increase potentials of Africa's agricultural production exemplified by the continent's unexploited arable land, the continent accounts for 75 percent of cocoa with insignificant revenue accrued to it from chocolate.<sup>[26]</sup> The agriculture sector is still characterised with low level of production as a result of some challenges.<sup>[27-30]</sup>

In view of the steadily increasing prices for most of these resources, one can conclude that there is hope of expectation for a significant improvement of the economic situation on the continent and the propensity to institutionalise an economically viable United States of Africa. However, the opposite is the case given many factors already highlighted above. The most critical of these factors are inability of the regions to effectively utilise the endowed natural resource and the poor level of STI as exemplified by STI indicators in Africa.

To be specific, most African states are mono-producers and appear to over-rely on these resources in its subsistence manner and crude forms without any value addition.<sup>[26,31]</sup> As a result, the African economies became tremendously reliant and susceptible to the development of the global market prices for natural resources in the extractive industries with little revenue generated from finished products due to lack of value addition which STI offers opportunity.

Surprisingly, the dream and idea of Africa's transformation from a loose confederation to a strong cooperation and

economically viable entity is yet to be realised. The paper is not unaware of the various impediments as acknowledged above, the contention is that if such an entity will be possible, there is the critical need to fulfil some preconditions. It should also be stated at this juncture that, the paper shares the sentiment for political enhancement of United States of Africa but the strong contention is that the economic viability remains a sufficient condition for the realisation of the idea of strong and competitive union. This argument is predicated on the belief that economic competitiveness will facilitate and strengthen global political power and relations (Olaopa and Akinwale, forthcoming).<sup>[32]</sup>

### Federalism, Economically Viable United States of Africa and the place of Science, Technology and Innovation (STI)

As can be deciphered from the various analysis above, Africa is poor going by all indicators of development. This notwithstanding, all her aforementioned weaknesses and disabilities still provide her with opportunities to develop if appropriate strategy is employed. The continent, as argued by Nkrumah<sup>[33]</sup> still has the prospective ability to initiate development process using its endowments to transform the continent to a wealthy and industrialised one.

As far back as at the time the idea for the establishment of the United States of Africa was proposed there has been little or no changes in the production and contributions of Africa to global agriculture and mineral resources. African continent still provides more than 60 percent of cocoa and palm oil, over 50 percent of sisal, more than 10 percent of coffee and olive oil, and above 20 percent of groundnuts of the total global agricultural produce.<sup>[33]</sup> The continents' contributions to the world's minerals especially the gem diamonds, cobalt, and gold is superlative. With antimony, manganese, chromite and phosphate rock, it contributes more than 30 percent respectively while its contributions to world copper, asbestos, tin, iron and bauxite are significant.<sup>[33]</sup>

To be specific, Nigeria produced 85 percent of the global supply of columbite while Ghana was the second largest manganese producer in the world. As argued by Nkrumah,<sup>[33]</sup> the first proponent of political integration of Africa, the continent is endowed with the world acknowledged significant reserves of uranium ore and the highest waterpower potential in the world, with Congo sharing more than 20 percent of this total. With regard to oil deposit, Africa has about 27 percent of the world's total oil deposits.<sup>[33]</sup> These resources are spread across the federal states in the continent and could be pooled and harnessed to drive a viable loose federation being proposed.

An exploration of the top 15 states richest in natural resources on the African continent, for instance, as reported by Eric,<sup>[34]</sup> Botswana remains the world's leading producer of high-valued diamonds rated as 35% share of African diamonds



**Table 1: Spread of Agricultural and Mineral Resources across Africa.**

Countries	Agriculture	Mineral	Countries	Agriculture	Mineral	Countries	Agriculture	Mineral
Algeria	Wheat, Oates, Olives	Petroleum	Equatorial Guinea	Timber, Coffee, Rice, Yams	Petroleum	Namibia	Millet, sorghum, livestock	Diamond Copper, Uranium, Gold
Angola	Coffee, Bananas, Maize	Petroleum, Diamonds	Eritrea	Sorghum, lentils, fish, livestock	Gold, potash, zinc	Niger	Cotton millet, sorghum, cassava	Uranium, Coal, Iron ore
Benin	Coffee, Cocoa, Yams	Petroleum	Ethiopia	Coffee, tiv, pulses, livestock	Gold, copper	Nigeria	Cocoa, Groundnuts, Palm oil, Maize, Sorghum	Petroleum, tin, Columbite, Iron ore
Botswana	Maize, Sorghum Livestock	Diamonds	Gabon	Cocoa, coffee, oil palm, cassava	Petroleum, manganese	Rwanda	Coffee, Tea, Sorghum, Beans, Bananas	Gold, Tin ore
Burkina Faso	Groundnuts, Cotton, Sorghum	Managanese, Limestone	Gambia	Groundnuts, millet, sorghum, rice	N/A	Sao Tome and Principe	Fish, Palm kernels, Bananas	N/A
Burundi	Coffee, Cotton, Maize	Gold	Ghana	Cocoa, cassava, groundnuts, maize	Gold, bauxite, manganese	Senegal	Cotton, Groundnuts, Sorghum, Rice	Phosphates, Iron ore
Cabo Verde	Bananas, Maize, Fish	Salt	Guinea Bissau	Rice, maize, cassava, fish	Bauxite, phosphates	Seychelles	Coconuts, cinnamon, vanilla, cassava	N/A
Cameroon	Coffee, Cocoa, Cassava	Petroleum, Aluminium	Kenya	Coffee, tea, maize, sugarcane, livestock	Limestone, soda ash, rubies	Sierra Leone	Rice, coffee, palm kernels	Diamonds, Bauxite, Iron ore
Central African Republic	Cassava, Cotton, Millet	Diamonds	Lesotho	Livestock, maize, sorghum	Water (hydro)	Somalia	Bananas, sorghum, fruits, livestock	Uranium
Chad	Cotton, Millet, Sorghum	Uranium	Liberia	Rubber, timber, rice, cassava	Iron ore, diamonds	South Africa	Maize, wheat, sugar, fruits, livestock, poultry	Gold, Diamonds, Uranium, Chromium
Comoros	Vanilla, Copra, Bananas, Fish	N/A	Madagascar	Coffee, vanilla, sugar, timber	Graphite, chromite, coal, bauxite	Sudan	Cotton sorghum, millet	Petroleum, Iron ore, Copper
Congo (Brazzaville)	Rice, Groundnuts, Maize	Petroleum, Diamonds	Malawi	Tobacco, tea, maize, cassava	Limestone	Swaziland	Sugar, maize, fruits, timber	Asbestos, Coal, Clay
Congo (Kinshasa)	Cassava, Maize, Coffee, Rubber	Copper, Diamonds, Cobalt, Gold, Zinc.	Mali	Cotton, livestock, millet, rice	Gold, phosphates	Tanzania	Coffee, tea, cotton, maize tin, phosphates, iron ore, diamonds, cassava	
Cote d'Ivoire	Coffee, Cocoa, Timber, Maize, Rice	Petroleum, Diamonds, Manganese	Mauritania	Fish, livestock, millet, rice	Iron ore, gypsum, copper	Togo	Coffee, cocoa, yams, cassava, maize	Phosphates, Limestone
Djibouti	Sheep, Goats, Fruit	N/A	Morocco	Wheat, barley, citrus, dates	Phosphates, iron ore, manganese	Tunisia	Olives, dates, citrus, wheat	Petroleum, Phosphates, Iron ore
Egypt	Cotton, Rice, Maize, Fruit	Petroleum, Iron ore, Phosphates	Mozambique	Cotton, cashew nuts, maize, cassava	Coal, titanium	Uganda	Coffee, tea, cassava, maize, bananas	Copper, Cobalt
Western Sahara	Fish, Livestock	Phosphates, Iron ore	Zambia	Maize, sorghum, groundnuts	Copper, cobalt, zinc, lead	Zimbabwe	Cotton, tobacco, maize, livestock	Coal, Chromium ore, Asbestos

Source: World Reach/Exploring Africa (2020). Available at <http://exploringafrica.matrix.msu.edu/list-of-agricultural-and-mineral-resources/>

among other valuable mineral resources. South Africa is renowned world number one in the production of chromium, manganese, platinum, vanadium, vermiculite, and is placed in second position in the production of ilmenite, palladium, rutile and zirconium. The DRC is the world's largest producer of coltan, an important component of any mobile phone and one of the big producers of diamonds and copper in Africa. In Namibia, a quarter of its annual income comes from uranium receipts. Mozambique serves as a foremost player in African aluminium production while Zambia is the main producer of copper on the continent. Niger's uranium represents 44% of the continent's supply and Zimbabwe has the second largest platinum deposit in the world. Egypt possesses major gas fields in the Mediterranean. The Republic of Guinea is endowed with rich subsoil, which contains iron, bauxite, diamond, gold, uranium, petroleum, phosphate, and manganese among other potentials. Ghana produces more than one-fifth of Africa's total gold production and ranks second best after South Africa. Ghana also ranked the second largest cocoa producer behind the Ivory Coast. Libya's oil reserves estimated at 48 billion barrels is ranked the largest in Africa and ninth in the world. Cameroon is endowed with different fertile soil and subsoil which contains significant mineral, natural forest and agricultural resources while Equatorial Guinea's economy is being developed from significant income from mining and discovery oil fields (<https://www.afrikatech.com/energy/top-15-african-countries-richest-in-natural-resources/>).

The full integration of the African economy through the pooling of resources and risks will facilitate and ensure the attainment of the levels of development existing in the most industrialized countries. For instance, states in the union or entity will enjoy advantages of reduced cost of per unit production and increase in outputs which may not be benefitted or achieved under individual production activities.

Economic integration will also ensure integrated planning which will make the continent more attractive to foreign investment, make funding of big project easier, and offer opportunity of acquiring and enjoying the highest benefits of modern technology that can only be procured through joint efforts.<sup>[33]</sup>

The argument for economic enhancement and integration is predicated on Wittman's<sup>[35]</sup> framework for determining the size of a nation though using industrial firms.<sup>[35]</sup> According to Wittman, the size of a nation is directly related to the rate or extent at which it can make the most of its wealth. In his comparative nations-firms analysis, he emphasises that what motivates firms' interest in merger and acquisition is when the worth of merging is of great benefits than the sum of benefits accrued through single or individual operations. Using this as a background, Wittman recommends that countries should come together when the economic benefits,

advantages or worth is significantly better for the group or union than as separate independent entities. The alliance also offers opportunities for strong political and military strength, increased production, reduced wastes, strong bargaining power, reduced competition, facilitates and ensure economic growth and development. Alesina<sup>[36]</sup> position supported Wittman's point of view when he outlined four major advantages of larger size for nations. These include reduction in unit cost of many public goods; low propensity to external attack; large markets and its accompanying increased productivity; and opportunity to create distributive schemes across different countries and geographical boundaries. All these are without prejudice to various critiques advanced against economic integration and size of nations' point of view.<sup>[36-38]</sup>

What then is required to assist a continent with this significant and unmatched natural endowments to initiate the process of economic development? Our contention is *Science Technology and Innovation (STI)*, the sort of STI that will be integrated into continental socio-economic development processes in ways that will afford the continent the opportunities to benefit from many global breakthroughs in biotechnology, space research, energy development, infrastructures and information and communication technologies (ICT), among other advantages, must be conferred the utmost concern.

### Science, Technology and Innovation (STI) and (Economic) Development in Africa

There are various contestations regarding the meaning of development and the level of its sustainability.<sup>[10,39-44]</sup> This notwithstanding, the term development is generally construed to mean an established and steady all-encompassing productive activities and better variations in people's living conditions throughout a particular time complemented with their innovative ability free from any external interference. The effective attainment of this requires Knowledge as a strategic resource.<sup>[45-47]</sup> Its deployment in manner conducive to wealth creation and employment generation remain vital and the principal facilitator of organisations' value.<sup>[48]</sup> However, taking advantages of these require intellectual developments in science, technology and innovation (STI) system.

The propensity and potentials of (STI) to facilitate and strengthen growth has been generally recognised.<sup>[49]</sup> Utilising S&T raises proficiency of manufacturing systems and boosts industrialisation.<sup>[50,51]</sup> In fact, what give a nation competitive edge is what it knows, how it uses it and how fast it can learn new things.<sup>[52]</sup> Food availability which is the basis of trade and industrial growth in Africa can be achieved by harnessing and deploying S&T in facilitating agricultural practices. In fact, the search for different energy sources in Africa can be facilitated through effective development of S&T.

It should be stated that, the process of finding sustainable solution to Africa's critical development problems must be dedicatedly pursued using scientific and technological solutions. Also germane is to create a framework for innovation<sup>[53-55]</sup> directing at exploiting Africa's endowments exemplified by their resources and Indigenous knowledge. Thus, of critical importance in the process of STI utilisation for sustainable African growth and development is to see it as an engagement of African indigenous knowledge independent of foreign knowledge.<sup>[56]</sup>

Every society in Africa has discovered, developed, tested and utilised these resources in various ways and in diverse human endeavours such as agriculture, health, security, resources exploration and management, governance and administration among others, over some period of time to sustain their livelihood.<sup>[56-58]</sup>

Specifically, Indigenous knowledge has offered indigenous people opportunity to predict when rain will come and as a result determine when to farm, different agricultural practices to adopt in order to boost soil productiveness, raise productivity, control unwanted plants, plant breeding, among other agricultural practices and techniques.<sup>[58]</sup> In bionetwork management, indigenous people are verse in using local plants, forest products and animal derivatives for meeting their health demands, sustainable farming coordination and resource preservation.<sup>[59]</sup> Now, various essential oils and cough remedies as well as other medicinal plants in Africa, as products of IK, are being brought to market.<sup>[60,61]</sup> In fact, some countries, South Africa for example, have provided a wide nursery of all the medicinal plants in their environment in order to prevent their extinction. Interestingly, some like the hoodia plant, a local type for preventing fatness and enhance survival in the severe desert conditions is now being marketed on the international scene.

Indigenous people have also been made life easy and bearable for themselves through the use of simple technologies before the introduction of modern technology.<sup>[62]</sup> Some of these indigenous technologies that facilitate wealth creation and employment generation include growing unwanted plants, varieties of local crop and animal pests' repellents in line with the dynamics of their local environmental conditions.<sup>[63,64]</sup> For example, in Sudan for instance, shows the display of local technical knowledge of the indigenous people in conducting impeccable soil analysis and mapping faster compare with a formal scientific approach.<sup>[65,66]</sup> The indigenous research conducted by pastoralists in Mali has been effective in understanding the cause of people's nervous and irritability when taking a lot of tea.<sup>[67,68]</sup>

Rwanda's controversial anti-Covid-19 indigenous concoction provides another example of indigenous knowledge of

health management.<sup>[69]</sup> In Kenyan, integrating Indigenous knowledge and mother-tongue instruction in the curriculum for pastoralist schools have been advocated as a veritable tool in human capital and sustainable development.<sup>[70,71]</sup> *In a related manner, the work of Kilungu and Moronge<sup>[72]</sup> in Kenya confirmed the significance role of indigenous culture, culture, technology and policy framework role on the sustainable ecological conservation in in Kenya and consequently recommended the need to enhance and maintain indigenous cultural beliefs, hitherto neglected, through improvement on the indigenous education, in environmental management.* In Nigeria, during the 1967 civil war, it was reported that some Igbo soldiers had, through creativity and inventiveness refined petrol using locally made processing plant in the East. They also skilfully converted tipper Lorries into armoured tanks, among many other unbelievable technological exploits and accomplishments<sup>2</sup>.

Indigenous capacity for management of natural resources, as argued, has been observed in several African empires since the ninth century, particularly in the Nok, Hausa, Eze Nri (Igbo Ukwu), Ashate, Gao, Kanem, Mali and Ashanti empires<sup>[73]</sup> as well as in Songhai, Oyo, Benin, Dahomey and Zulu.<sup>[63]</sup>

Scientific and technical knowledge is not sufficient for development, it has to be complemented with indigenous-based knowledge systems (Lodhi and Mikulecky, 2010).<sup>[74]</sup> African STI should mean African way of knowing and, application and deployment of such knowledge in creating wealth rather than a receipt-knowledge from elsewhere as being stigmatised in some STI literature.<sup>[56]</sup> Thus, development agenda that recognises the existence and innovations of the indigenous people and their societies should be adopted and intensified. Mwantimwa<sup>[75]</sup> emphasised this when he argued that IK owners and innovators inspire economic independence for indigenous peoples, and also offer motivation for sustainable environmental preservation and utilisation. IK, apart from providing the foundation for local-level decision-making on vital parts of human existence,<sup>[76]</sup> it gives evidence-based solution to challenges facing poor indigenous group of people,<sup>[74]</sup> and has a very high propensity for accelerating production and real economic growth rate with due regard for environmental implications and hazards.<sup>[77,78]</sup>

All these, which are neglected by African policy makers due to their orientation, must be harnessed and developed in a way that its benefits will be enjoyed by the people in the continent in terms of better living condition and provision of jobs. Fiscal allocation to science, technology and innovation, therefore, accelerates sustainable growth, and is critical component to accomplishing many serious issues in any development agenda.

2 Brigadier General Samuel Ogbemudia who was the Military Governor of Midwest State during the civil war reported this in Thursday, May 20, 2001 while expressing his disenchant with the Nigerian governments' lack of motivation in funding innovation and motivating inventors.







In fact as specifically asserted by Isehunwa,<sup>[79]</sup> harnessing the full benefits of STI under good governance have a very high propensity for realizing Africa’s optimism for getting independent from state of despair characterised by sequence of starvation, poverty, illiteracy, and severe debt. This view was supported by Aderemi<sup>[80]</sup> who opines that attainment of all-encompassing development will be difficult without the utilisation of Science and Technology. This becomes stronger when considered within the social, cultural and economic environment.<sup>[79]</sup>

Consequently, one may not be wrong to conclude that strong relationship exists between a country’s Science and Technology status and its level of economic development to the extent that African states must appreciate and buy-in in order to bring about significant changes in her political economy.

Literature and global practical experiences confirming a great profits accruing from investments in Science and Technology abound. OECD<sup>[81]</sup> confirmed this when it submitted that, globally out of the 130 countries, only 50 countries have enjoyed long-term economic growth much higher than others due to their heavy spending and utilisation of Science and Technology. Specific examples include the United Kingdom and France. The United States of America in particular was able to transform her agrarian economy into an industrial superpower in the 20<sup>th</sup> century due to the effective application of Science and Technology. Other countries in the same development trajectories include Brazil, China and India. In fact, these countries, with the same ethno-tribal diversities and economic conditions like Africa,<sup>[82,83]</sup> were able to harness their national diversities coupled with the development of human capital. These resources were developed using the fundamentals of Science and Technology.

The above argument is predicated on the fact that a nation’s resource endowment is just a necessary condition for economic development but the sufficient condition is how such resources are transformed by adding value through the application of S&T. This value addition gives much monetary benefit and revenue in the globalised world. Besides, the application of S&T will reduce the resources’ production/processing costs, improve the products’ quality and increase revenue yields. The Figure 1 below shows and illustrates the role and effect of human capital knowledge and technology in production.

The above Figure shows the production stages in the transformation of raw bauxite into different products (Silica, Aluminium, semi-finished products (castings, sheets, profiles) and casting machine). The sale of raw bauxite will require 1 (one) worker per weight unit, 1 labourer within grade level 1-0; and with the revenue yield of USD5 per ton of the

ADDED VALUE OF ALUMINUM PRODUCTS IN DIFFERENT STAGES OF PRODUCTION		VALUE (USD/TON)	WORKERS PER WEIGHT UNIT (5,000 ton)	WORKFORCE QUALIFICATION (Grade 1-10)	PROFIT
BAUXITE		5	1	1	(-) (+)
SILICA		15	3	2	
ALUMINIUM		1,300	30	4	
SEMFISHED PRODUCTS, CASTINGS, SHEETS, PROFILES		1,800	50	7	
FINISHED PRODUCTS, PRECISION CASTING MACHINE		8,000	200	10	

**Figure 1:** The role and effect of human capital knowledge and technology in production.

**Source:** Siyanbola (2008)<sup>[54]</sup>

bauxite. However, the revenue yields increase at every stage of value addition due to efficiency in production resulting from increase in production technology and its accompanying human capital development.

However, for a country or an entity to be able to attain this level, that is, increased innovation capacity – the ability to practically use new knowledge to solve life challenges – is significantly hinged on four indices. Egbertokun; Adeniyi and Siyanbola<sup>[84]</sup> summarised these as the country’s level of technological capability; the formal and informal institutions as well as their supporting systems; physical infrastructure; and an advanced knowledge infrastructure. Unfortunately, these S&T indices are lacking in many countries in African continent.

The Technology Capability Composite Index (TCCI) measures those indices that determine an entity, organisation or country’s ability to use and apply its knowledge in production for value addition and enhanced commercialisation. There exists a positive relation between technological capability and an entity performance, hence an increase in investment in technological capability will surely increase the performance of an organisation or entity.<sup>[85]</sup> This fact strengthens that which was advanced by Calestous,<sup>[54]</sup> that, the development of technological capability and value addition required for sustainable African economic affluence and transformation is dependent on agricultural innovations and inventions facilitated by the application of science and technology.

The Technology Capability Composite Index (TCCI) when compared with that of the first ten most developed economies in the world show that African countries are still lagging behind in these innovation indicators as show in the Table 2.

According to World Population Review, globally, literacy rate is relatively high. Developed nations generally have a literacy rate of 99.2% while the greatest number of the illiterate adults can be found in South Asia, West Asia, and



**Table 2: Technology Capability Composite Index (TCCI): Comparing the 10 most economically developed countries with selected African countries.**

Countries	LPI (2018) (160 countries)	Population <sup>2</sup> (2020)	Literacy (2020)	Poverty (Below \$1.90) (2011)	GDP <sup>3</sup> (2019 IMF Estimates) US\$Million	GDP Growth (2018 IMF Estimates)	Teledensity (2018)	Power Generation <sup>4</sup>
		(Million)	(Adult %)	(Level %)	(\$ per cap)	(%)	(%)	Kwh
World					87,265,226			
United States	3.89 (14)	331,002,651 (3)	99	1.2	21,439,453 (1)	2.3 (101)	129.0	1,074,000,000 (2)
China	3.61 (26)	1,439,323,776 (1)	96.4	0.5	14,140,163 (2)	6.1 (19)	115.5	1,646,000,000 (1)
Japan	4.03 (5)	126,476,461 (11)	99	0.2	5,154,475 (3)	0.7 (159)	141.4	322,200,000 (4)
Germany	4.20 (1)	83,783,942 (19)	99	0.0	3,863,344 (4)	0.6 (160)	129.3	204,100,000 (7)
India	3.18 (44)	1,380,004,385 (2)	71.2	13.4	2,935,570 (5)	4.2 (56)	88.56	308,800,000 (5)
United Kingdom	3.99 (9)	67,886,011 (21)	99	0.2	2,743,586 (6)	1.4 (134)	118.3	94,640,000 (14)
France	3.84 (16)	65,273,511 (22)	99	0.0	2,707,074 (7)	1.3 (137)	108.4	129,300,000 (10)
Italy	3.74 (19)	60,461,826 (23)	99.2	2.0	1,988,636 (8)	0.3 (166)	137.5	117,000,000 (11)
Brazil	2.99 (56)	212,559,417 (6)	92.6	4.4	1,847,020 (9)	1.1 (146)	98.8	150,300,000 (8)
Canada	3.73 (20)	37,742,154 (39)	99	0.5	1,730,914 (10)	1.6 (131)	89.6	147,600,000 (9)
Nigeria	2.53 (110)	206,139,589 (7)	59.5	53.5	446,543 (27)	2.2 (110)	88.2	10,480,000 (50)
South Africa	3.38 (33)	59,308,690 (25)	94.3	18.9	358,839 (35)	0.2 (170)	159.9	47,280,000 (23)
Egypt	2.82 (67)	102,334,404 (14)	73.8	3.2	302,256 (40)	5.6 (30)	95.3	38,880,000 (27)
Algeria	2.46 (117)	43,851,044 (33)	80.2	0.5	172,781 (53)	0.7 (158)	111.7	17,120,000 (48)
Morocco	2.54 (109)	36,910,560 (40)	68.5	1.0	119,040 (58)	2.2 (111)	124.1	8,040,000 (69)
Kenya	2.81 (68)	53,771,296 (27)	78.0	36.8	98,607 (61)	5.6 (28)	96.3	2,253,000 (109)
Angola	2.05 (159)	32,866,272 (44)	71.1	47.6	91,527 (62)	1.5 (181)	43.1	1,704,000 (119)
Ethiopia	N/A	114,963,588 (12)	49.1	27.3	91,166 (63)	9.0 (5)	37.2	2,704,000 (102)
Ghana	2.57 (106)	31,072,940 (47)	76.6	13.3	67,077 (71)	6.1 (18)	137.5	3,795,000 (92)
Tanzania	N/A	59,734,218 (24)	70.6	49.1	62,224 (74)	6.3 (17)	77.2	1,187,000 (126)

2 Worldometer: Countries in the world by population

3 [https://en.wikipedia.org/wiki/List\\_of\\_countries\\_by\\_GDP\\_\(nominal\)](https://en.wikipedia.org/wiki/List_of_countries_by_GDP_(nominal))

4 Central Intelligence Agency: The World Factbook. Available at: <https://www.cia.gov/library/publications/the-world-factbook/rankorder/2236rank.html>

**Note:** The highlighted numbers are ranking position

sub-Saharan Africa. (World Population Review. Available at: <https://worldpopulationreview.com/country-rankings/literacy-rate-by-country>). According to Fedena<sup>[86]</sup> adult literacy rate is the fraction of people ages 15 and above who can both read and write with understanding a short simple statement about their everyday life. As specifically stated, the global literacy rate ratio of all males to all females is 90.0:82.7%. The rate varies throughout the world with developed nations having a rate of 99.2% (2013); Oceania having 71.3%; South and West Asia having 70.2% (2015) and sub-Saharan Africa at 64.0% (2015).<sup>[87]</sup>

As can be seen from Table 2, literacy rate for first 10 most developed economies is extremely high while it extremely poor in the selected African countries. The reason is obvious, while most developed economies spend heavily on education in order to build their human capital, developing countries of Africa are very lackadaisical about education investment. For example, Canada invests 6.6% of GDP on education and has the highest share of career and skill-based education which made her economy to boasts an overall 51.3% of literacy rate of people with tertiary education. Japan spends 5% of the GDP

on education and has 46% of the population with tertiary education. In the United States of America, the literacy rate of 43%, 5<sup>th</sup> in the world, as a result of its education expenditure of 7% of GDP while United Kingdom can boast of 40% of the population having tertiary education due to its investment of 7% of the GDP on education. Rarely can we find any African country spending up to 5% on education with the exception of the few highlighted countries. The effect of this spending is significant on Human Capital Development and innovation capability.<sup>[87]</sup> In fact, the percentage of GDP spent on education by Africa summed together is less than 5% as shown in the Table 3.

In the current globalised world dominated by complex and dynamic socio-economic and political relations, the development of a complete infrastructure especially in the telecommunications sector remains a critical factor in economic.<sup>[88]</sup> This view corroborates that which was expressed in the World Bank Telecommunications Sector Reports (1991)<sup>[89]</sup> that the facilitation and strengthening of any economic growth agenda require instituting of a state of the art, dependable, and increasingly dynamic

**Table 3: Government expenditure on education, total (% of GDP) in some countries of Sub-saharan Africa.**

Countries	Most recent years	Most recent values	Countries	Most recent years	Most recent values	Countries	Most recent years	Most recent values
Sub-Saharan Africa	2018	4.6	Gabon	2014	2.7	Sao Tome Principe	2018	5.1
Angola	2010	3.4	The Gambia	2018	2.4	Senegal	2018	4.7
Benin	2018	4.0	Ghana	2018	4.0	Seychelles	2016	4.4
Botswana	2009	9.6	Guinea	2018	2.6	Sierra Leone	2018	7.1
Burkina Faso	2018	6.0	Guinea Bissau	2013	2.1	Somalia	N/A	N/A
Burundi	2018	5.0	Kenya	2018	5.3	South Africa	2018	6.2
Cabo Verde	2017	5.2	Lesotho	2018	6.5	South Sudan	2017	1.0
Cameroon	2018	3.1	Liberia	2018	2.6	Sudan	2009	2.2
Central African Republic	2011	1.1	Madagascar	2018	3.2	Tanzania	2018	3.7
Chad	2018	2.2	Malawi	2018	4.7	Togo	2018	5.4
Comoros	2015	2.5	Mali	2017	3.8	Uganda	2018	2.5
DR. Congo	2017	1.5	Mauritania	2016	2.6	Zambia	2018	4.7
Congo Rep.	2018	3.6	Mauritius	2018	4.8	Zimbabwe	2018	4.6
Cote d'Ivoire	2018	4.4	Mozambique	2018	5.6			
Equatorial Guinea	N/A	N/A	Namibia	2014	3.1			
Eritrea	2006	2.1	Niger	2018	4.9			
Eswatini	2014	7.1	Nigeria	N/A	N/A			
Ethiopia	2015	4.7	Rwanda	2018	3.1			

Source: UNESCO Institute for Statistics (uis.unesco.org). Available at: <https://data.worldbank.org/indicator/SE.XPD.TOTL.GD.ZS?locations=ZG>

telecommunications infrastructure. Infrastructure is not only limited to communication. As expressed by Duffin (2019) it encompasses several factors such as the quality and efficiency of air, water and road transport services and their connectivity index, electrification rate, electric power transmission and distribution losses, exposure to unsafe drinking water, reliability of water supply, among others. All these determines the ease of doing economic activities in a country. It is on this note that the Logistics<sup>[90]</sup> Performance Index (LPI) 2018 as shown in Table 2 below ranks countries on six dimensions of trade -- including customs performance, infrastructure quality, and timeliness of shipments. Out of the 160 countries ranked, only South Africa, ranked 33 was among the first 60 countries in terms of infrastructure development and other indices used in LPI.

Related to the level of a country's telecommunications infrastructure is its teledensity.<sup>[91,92]</sup> Tele-density is expressed as the number of mobile phones used in a country as a percentage of its population. Even though some countries like South Africa, Ghana, Morocco, and Algeria performed better among the selected African countries, general performance with respect to these indices are still comparatively poor in Africa.

According to the International Energy Agency, One-third of people in sub-Sahara are connected to the electricity network

while only half of the population have access to clean drinking water. This situation impedes economic growth in Africa. In the continent, there is dearth of the transport, energy and water supply infrastructure which require estimated investment of about 360 billion dollars by 2040 (Dakie.org). Lack of energy and its accompanying infrastructure have been argued to be responsible for the expensive nature of goods produced in Africa in the global market thereby reducing competitiveness.<sup>[93-97]</sup> This is so in that energy is the principal driver of industrialization, advances communication, makes innovation to flourish, aids good health-care delivery systems and improves people's wellbeing.<sup>[98]</sup> As can be deciphered from the table, power generation in terms of Kwh in Africa in relation to its population use when compare with the 10 most industrialised economies in the world is significantly low, thus portend energy insecurity.<sup>[99]</sup> According to the World Bank, the whole of sub-Saharan Africa generates only as much electricity as Spain.<sup>[100]</sup>

### Concluding Remarks

A new political and economic vision for creating a United States of Africa is well conceived. However, the agenda should be guided by strong frameworks that define both the states and continent as a competitive entity. This will entail placing policy emphasis on the available opportunities in

the continent especially the agricultural, mineral and human resources endowment as well as increasing involvement in the global economy. Of significant importance is the appreciation of African Indigenous Knowledge and its emerging contributions and how they can be integrated to generate and apply knowledge and increase value-addition to the endowed resources for global competitiveness. However, much of the efforts at economic development has focused on the share of national budgetary allocations dedicated to finance resource exploration and research and development. While financial resources are critical and entail special attention, serious attention should be directed at restructuring Africa's resources innovation system. No doubt, substantial work has been done by respective governments over the last couple of years to redefine the role of all stakeholders and the need to strengthen partnership in the development and management of African resources. Little results have been achieved. The major challenge, however, is to build on the little achievements and take daring steps aimed at improving all indices of socio-economic development and promote the status and performance of institutions, policies and legal frameworks and ensure collaboration. This will help in creating genuine innovation systems that recognise African Indigenous Knowledge, involve all stakeholders' participation, encourage value addition, capability building, effective research and development, and commercialization. This process will be indispensable and will require bold political action, dedication and sincerity of African leaders.

### Policy Recommendations

The propensity of STI for sustainable growth is incontrovertible. However, its development in Africa has been hindered by a dearth of proper and appropriate education at all levels. Most educational institutions are being poorly funded due to recourse to seeing other sectors, security for example, as of more important and having competing rights and demand on public finances. Although, sometimes in 2004, African leaders pledged in one of their meetings to commit at least 1% of their GDP to the development of STI, this has not been totally enforced by most of the countries. The implication is reflected on the 2021 - 2022 World university rankings, released by the Centre for World University Rankings (CWUR). Among the 19,788 institutions ranked, and on the list of the top universities that made the world 2000 list, only six African Universities that can be said to be somewhat competitive in terms of quality education and research performance are the University of Cape Town (269), University of the Witwatersrand (292), Stellenbosch University (435), University of KwaZulu-Natal (483), Cairo University (546) and University of Pretoria (580). The reasons for this low-ranking status is obvious. African Universities lack in all indices used in the ranking procedure.

This is likely to be the basis for Calestous's<sup>[34]</sup> conclusive assertion for the need for emergence of the first generation of research universities in Africa that is built on a strong research tradition and wide global networking and collaboration.

To solve this and other related problems, like brain drain, education infrastructure, needed researchers for R&D among others require a holistic approach that can be provided through the development of STI in the continent. To this end, there is a critical need to establish an African Continental Research and Innovation Council (ACRIC). African leaders should be dedicated to raising funds for STI by committing 1% of their GDP. Disbursement of ACRIC should go to the education (Research and Development, Human Capital Development), health, agricultural and infrastructural development of African economy in this manner: 30% to education (Strengthening/establishment of more Research and Knowledge institutions, HCD); 25% to health (strengthening/establishment of hospitals) 25% to agriculture and 20% infrastructure development. In the establishment of an ACRIC Committee, all Ministers for Finance, education and STI of each country in the continent will be representative. Members of this committee will propose an independent Board of Trustees (BOT) who will manage the fund. The BOT membership, hopefully, will include a tested and trusted President and Attorney General/Minister of Justice or their representatives in each country. The Committee will set an African research agenda, attract top scientists to the continent and direct researches towards African priorities.

As revealed in Table 1, Africa is at the vantage position to be the global food basket and exporters of mineral resources and related products. An upgrading of the continent's agricultural sector and productivity through STI interventions is very critical for value addition, wealth creation and employment generation. The role of STI in this circumstance will embrace innovatively improved seed varieties, proficient irrigation knowhow and network in distribution processes. This will be facilitated and strengthened by given necessary training to farmers in order to increase their knowledge and improve their entrepreneurial skills in agricultural techniques and practices (e.g., better seed selection, animal hygiene, storage techniques and processing techniques), networking and marketing (strengthening producers and agricultural associations), and institutional developments (business ideal building, marketing and sales). Government should also endeavour to encourage public-private sector initiatives. All of these will be made easy through effective institution and legal framework that recognizes the continental diversities and regulatory environments for all sectors.<sup>[101]</sup>

African leaders should embark on indigenous scientific knowledge and practices renaissance. There is a need to partner indigenous people of the continent to learn how

their practices are effective and integrate with modern scientific knowledge and breakthrough in all the activities dominated by indigenous practices. As researchers identify the effectiveness and potencies of indigenous knowledge and practices and develop it within scientific principles, it will surely enhance their commercialiseability. Besides, it will facilitate the preservation of all intellectual property rights and assist it to be retained by the communities from which the originals developed. This will encourage innovativeness and greater participation in the economic and other development agenda by the indigenous people.

## CONFLICT OF INTEREST

The author declares that there is no conflict of interest.

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