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Knowledge Transfer & The Challenges of Tech Ecosystem Growth in Africa: A New Global Political Strategy?

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ABSTRACT

One of the key powers in the social economic and political standing at the global landscape in recent time is technology. Many countries of the world, especially in Europe and America, and far Eastern part of the world are taking advantage of the new impactful tools to deepen their strong hold of the global politics and power play. It is on this basis that this paper examined technology's knowledge transfer in relation to its challenges in Africa and global politics. The piece sought to know if the perennial challenges facing the growth of technological innovations in Africa have impact on the economic, social and political powers of African continent in the global political scene. The paper highlighted the current state of technological manipulation for social impact in Africa, the economic gains attached to the use of technology as well as how the continent's teaming youth populace can be converted into an overwhelming tech powerhouse. The study found that there is huge presence of foreign investments in Africa, and are hoping on dominating the market for a very long time. It also discovered that many talents of Africa origin are already been shipped out into mostly Europe and America to hack for growing businesses and other multinationals. The study concludes that though the continent may not be able to wholly develop the sector on its own, but must be weary of implications of relying solely on the support readily offered by foreign investors. The study therefore recommended that government is needed to build social infrastructure that would speed up the process of localizing all IT solutions, support the sector and begin the process of giving all the necessary and required legal framework for the successful operation and development of brilliant ideas by the youth of the continent.

Keywords: Africa, Ecosystem, IT, Knowledge Transfer, Technology.

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1. INTRODUCTION

As the world's second-most populous continent, and developing region and high-growth market, major players, such as Visa and Google, are staking their claims as they launch mobile payments and smart messaging in certain African countries. A ride-sharing battle has erupted as tech transit players continue to enter the market. Infact, the United States tech vintage and Facebook co-founder and Chairman, Mark Zuckerberg visited Sub-Saharan Africa in what he described as a need "to learn how to better support tech development and entrepreneurship across the continent". With the continent's population at about 1.2 billion and a projection for an increase up to nearly about 2.5 billion by 2050, there are close to four hundred (400) tech hubs in Africa. This has put the continent on a new shift, ready for a chance at the centre of the global play in the tech ecosystem. At a time most economies, especially the super powers are facing aging populations and a declining share of their working-age population, according to the International Monetary Fund, Africa's youth population is better educated than in previous generations.

It was estimated that "59% of 20- to 24-year-olds will have a secondary education in 2030, compared to 42% today (Armstrong, 2016). As well, the share of Africans moving to urban areas will increase from 36% in 2010 to 50% in 2030, opening access to a growing consumer base. Generally, countries on the African soil are believed to have remained a dumping and extraction ground, hence, the reason for the underdevelopment of the region. David Pilling, in an article published by Financial Times in 2019, re-echoed this line of thought when he noted that "foreign-owned start-ups are driving an African tech revolution — and prompting old fears of exploitation". It is on this note that this paper examines if Africa can wholly develop its technology sector for the development of her economy, and her people while carving a name for herself as an important player in global politics and regain an important position in the emerging market in the world rather than having her talents exported or deployed by foreign organizations and tech giants.

2. LITERATURE REVIEW

2.1 Technology in Africa

No doubt, the technological revolution sweeping the world is beginning to have a profound impact on the continent. This is as Dario Giuliani, co-author of the GSMA report that "tech hubs represent a true catalyst for innovation and investment in Africa." So, if you say the great leveller of new technology offers a solution, you will not be mistaking. Africa's tech revolution is accelerating. In 2017, International Finance Corporation (2019) notes that investment in tech start-ups across the continent topped $195 million. The number of funded start-ups grew by 8.9 percent. Total funding of African tech ventures grew by 51 percent compared to 2016, taking investment into African start-ups to an all-time high.

Behind such hopes, however, lies a familiar anxiety over ownership and control. What if Big Tech, far from being a liberating force, turned out instead to be a new kind of colonialist? On April 12 this year, Juliet Anammah, chief executive of the Nigerian operations of a company called Jumia, stepped forward to ring the opening bell of the New York Stock Exchange. Anammah was one of several senior executives there to celebrate the initial public offering of an e-commerce company that had been dubbed the "Amazon of Africa" (Pilling, 2019). Jumia, which operates in 14 African countries from Nigeria to Egypt and from Ivory Coast to Kenya this year became the first entirely Africa-focused e-commerce company to be listed on the prestigious US stock exchange. Jumia, has whilst combining online technology and strategic offline infrastructure — including warehouses and fleets of motorbikes — offered an expanding African consumer class the opportunity to have goods delivered directly to their homes. Customers are able to order anything from an iPhone or an LED television to a chicken korma at the touch of a screen, bypassing the potholed roads and exhaust-filled traffic jams that characterise many fast-growing African cities.

There is, however, one problem with the Jumia story. No sooner did the company complete its New York listing than a backlash began. Jumia, say its detractors, is not an African company at all. Jumia fits into the narrative of a technological solution to Africa's problems and a path towards a future commerce offers as a pointer of technological growth. Jumia was incorporated in 2012 in Berlin, though it has been known to tell inquirers that it was headquartered in Nigeria. It was originally called "Kasuwa", which translates to "market" in Hausa, a language used in northern Nigeria. Later, it was renamed the Jumia Group. At the most senior level, the company is managed French executives, who operated according to Pilling, (2019) operated out of Paris until they moved to the current headquarters in Dubai. The author further adds that "most of the technicians who design and maintain Jumia's online systems work out of Portugal and many, though not all are Portuguese nationals. Much of Jumia's capital was raised in Europe and America". In view of all of these, one wonders what differentiates Jumia from companies like Shell or Coca-Cola, which both employ thousands of Africans, but can hardly claim to be African.

The row over the origins of Jumia is part of a larger debate about race and appropriation. The organization has made much of its supposedly African roots. On listing day, co-chief executive Sacha Poignonnec, a French citizen, emphatically told CNBC: "We are completely an African company." To his detractors, it was an odd thing to say about a business that was about to make millions for the company's mainly white directors. If Jumia isn't really African, say its critics, is it not merely the latest iteration in a long history of exploitation stretching back to the likes of Goldie's Royal Niger Company? Though that is far-fetched to some, Jumia has become a lightning rod for a sometimes heated debate about the nature of technology and foreign capital in Africa. While some see much hope in Africa's participation in this brave new world, others see the old patterns of extraction and reasserting in a new guise. According to this school of thought, rather to exploitation of oil wells and blocks, "companies such as Jumia are plundering data and profits. You might call it 'techsploitation'".

Interest in Jumia's initial public offering had been intense. Not long after the ceremonial bell ringing, the company's stock began to surge from its initial price of $14.50. By the end of the day, it was up 75 per cent, valuing the company within a whisker of $2bn and making small fortunes for its founders. In the following few days, the share price continued surging to break through $40. Jumia's listing had shone a light on what close watchers of Africa had long known: that the continent was buzzing with tech ideas. After the leap to mobile, the story began in earnest a little over a decade ago in Kenya, with the invention of M-Pesa, a system for transferring small amounts of money by mobile phone. As easily as sending a text message, people could transfer money home to relatives in their village or pay for goods or utilities. M-Pesa and dozens of variants like it are now used by hundreds of millions of Africans, many of them otherwise excluded from the formal banking system. Even the poorest can build up a credit history and take out microloans.

In the Kenyan capital Nairobi, the ecosystem has become a very vibrant hub known as "Silicon Savannah". Hundreds of companies have built on the spine of the money transfer network to offer services such as the renting of solar panels, where customers make micropayments by phone. Online pharmacies have been launched, enabling customers to screen for fake drugs and gouge dishonest middlemen. Lagos, Nigeria's commercial capital is not found wanting in the IT game. Nigeria's ecosystem has its hub in Yaba area of the populous city, widely known as "Yabacon Valley". Even neighbouring Cameroon, despite being a small economy has not only one but two tech hubs. These are "Silicon River" and "Silicon Mountain". Without doubt, the explosion in the use of mobile phones – including the smart wide penetration of smartphones – has opened the possibility of app-based services that can, at least theoretically, address problems from poor education standards and low farming yields to dire infrastructure and even corrupt tendering processes. This is the reality of today's African continent.

Health Apps in Rwanda offer the poorest citizens the prospect of cheap medical consultations driven by AI. One online company in Nigeria, known as Cars45, seeks to address the problems of theft and fraud that plague Africa's huge second-hand car market by offering a real-time online auction in no time. Other companies, including Bridge, backed by Bill Gates and Mark Zuckerberg, hold out the possibility – still controversial to many – of tech-based solutions to poor-quality education in which a standardised curriculum is relayed to tablet-wielding teachers. Though it appears much effort have been made, but as (Pilling, 2019) would later posit, Africa's technology sector is still relatively small. Last year, African start-ups raised a record $726m, according to WeeTracker, just over a 10th of the $7bn mustered by Indian tech start-ups in the same period. But interest and activity are rising fast. Last year's figure represented a 300 per cent rise over the previous year. Though that was still tiny by the standards of Silicon Valley, to the Afro-optimists, particularly ones with a technological bent, Jumia's listing was a hugely significant event. It showed the world that African tech had come of age and that investors could make money out of a company with big African expansion plans. Surely now more investment would follow, argued Jumia's advocates, helping African businesses and African economies to chart a new future.

2.2 Technology Knowledge Transfer in Africa

The emergence of new global players in the former underdeveloped countries and the integration of new players in the global economy challenge existing comparative advantages and competitiveness of countries and regions (Hoskisson, Wright, Filatotchev & Peng, 2012). Technology transfer is strongly considered on the regional level, following Porter's argument that "the enduring competitive advantages in a global economy lie increasingly in local things—knowledge, relationships, motivations—that distant rivals cannot match" (Porter 1998:78). An increasing body of literature both theoretically and empirically has since emerged to analyze how knowledge and ideas spill-over that lead to economic growth and welfare (Dejardin and Fritsch, 2011; Audretsch & Lehmann, 2005; Audretsch, Keilbach & Lehmann, 2006).

The annual conference of the Technology Transfer Society in 2011 with the theme; "Technology Transfer in a Global Economy" was dedicated to uniting professionals from academia, research institutes and business practitioners. The collection of thoughts shared during the event is summarized as noted by Audretsch & Lehmann (2005) in that "while technology transfer may have several objectives, depending on the resource, user or mechanism, the main objective is to promote movement of federally developed ideas, knowledge and technologies created in public institutions to the marketplace for commercialization". Within this context, the role of universities is intensively discussed as a primary source and factor within the technology process. This problem is thus primarily dedicated to the role that government and university institutions play in shaping the commercialization of federally developed technology and knowledge within a global economy. The aim of this special issue is to shrink this gap, by analyzing the technology transfer process from both a macro and a micro perspective.

A 1995 report by United Nations Economic Commission for Africa holds that technology transfer is growing at about four times the pace of global economic growth and it is taking new forms on daily basis some of which include multiplication of strategic alliances and collaborative arrangements, complex forms of networking between fierce competitors, and complex forms of financing, including build-operate-transfer schemes (BOT) which are popular in Asia. In today's world, all major technology actors, including the largest and most technologically advanced corporations are working with a large number of partners who pool their resources to mutually complement their technological strengths. This creates insuperable barriers to new entrants in cutting-edge technologies, and makes it very difficult for enterprises to succeed on their own. The result is the emergence of an increasingly complex, innovative, competitive and densely intertwined global system of technology transfer, with tremendous implications for African developing countries, governments and private enterprises.

For example Andela since its establishment inception in 2014 has formed partnerships with more than 100 companies worldwide. These corporations were those seeking out talented developers for their front-end and back-end software needs. Andela integrate these young African developers into virtual teams, and get them on placement which can last between a few months up to two years. The Zebra, a car-insurance-comparison website with headquarters in Austin, Texas, is another one of Andela's partners. Attesting to the super brilliance of Andela engineers, Meetesh Karia, Chief Technology Officer at The Zebra says;

> "Since we started working together, our Andela engineers in Africa have given us a key competitive advantage not only with the quality of their work but with the enthusiasm and energy they bring to our team. Any company that limits its talent search to local geography would be doing itself a disservice. There is talent worldwide – if you know where to look for it."

Andela's model has attracted the attention of international financiers. IFC is supporting Andela through a fund established with Learn Capital Venture Partners III L.P. The early-stage venture fund seeks out companies that are expanding access to quality education in emerging markets. Along with IFC's investment, Andela is reported to have received around $80 million in venture capital from Google Ventures, the Chan Zuckerberg Initiative, among other key players in the global tech world.

Over the next 10 years, Andela plans to train 100,000 software developers across Africa. A significant contributing factor has been the proliferation of tech hubs including incubators, accelerators, and co-working spaces scattered across major urban cities in the continent. Speaking on the reason for the investment in Andela's programme, Salah-Eddine Kandri, IFC's Global Sector Lead for Education notes with concern that;

> Only a tiny fraction of African youth gets a chance for higher education. Andela's innovative model of combining high-quality IT training and talent-as-a-service agency is demonstrating how to connect top talent in Africa with employment opportunities at global technology companies.

In 2015, reports show that there were around 120 hubs in Africa. New research carried out by the trade association GSMA in early 2018 shows that the number of active tech hubs across the continent has risen to 442, with imminent possibility of more in the coming years. IFC report indicates that "forty-five percent of these tech hubs are concentrated in five countries –South Africa, Kenya, Nigeria, Egypt, and Morocco – with cities of Lagos, Nairobi, and Cape Town as internationally recognized technology centres. Still, the tech landscape is decidedly pan-African, with at least one active tech hub in almost every country".

2.3 Driving Economic Growth in the 21st Century: Technology as a Force

With global economic challenges and continuous volatility, countries of the world are considering policies aimed at stimulating the growth of their economies which will in turn create new jobs for the people and speed up developmental aspirations. This view is supported by the duo of Stever & Muroyama (1988:1) who noted that "the effects of technological change on the global economic structure are creating immense transformations in the way companies and nations organize production, trade goods, invest capital, and develop new products and processes".

As such, Information Communications Technology (ICT) has become one of the go-to materials needed to make the difference. According to Kvochko (2013) report cited by World Economic Forum, mobile subscriptions in the world have hit a record of 6.8 billion, almost the size of the global population figures. Out of this number, the report further accounts, about "40% of people in the world already online. In this new environment, the competitiveness of economies depends on their ability to leverage new technologies". Stever & Muroyama (1988) adds that sophisticated information tools now permit instantaneous flow of communication among the globally spread enterprises. In addition, the new technologies are revolutionizing sectors including but not limited to construction and communications. Also, advanced manufacturing technologies have influenced the many year patterns of productivity and employment while there is wholesome improvement in air and sea transportation, which is currently revolutionizing global flow of goods and people. Here are the five common economic effects of ICT.

1. **Direct job creation**

   With new technologies come employment opportunities for the younger and older generations. The ICT sector according to Kvochko (2013) is, and is expected to remain, one of the largest employers of labour across the world. This is undoubtful as it can be seen in the recruitment of young Africans for job placement locally and internationally by Andela. In the US alone for instance, computer and information technology jobs are expected to grow by 22% up to 2020, creating 758,800 new jobs. The situation is the same with many other countries of the world. Kvochko alludes to this statistics when he claims;

   > In Australia, building and running the new super-fast National Broadband Network will support 25,000 jobs annually. Naturally, the growth in different segments is uneven. In the US, for each job in the high-tech industry, five additional jobs, on average, are created in other sectors. In 2013, the global tech market will grow by 8%, creating jobs, salaries and a widening range of services and products.

2. **Contribution to GDP growth**
   Kvochko (2013) says findings from various countries confirm the positive effect of ICT on growth. For example, he recounted that a 10% increase in broadband penetration is associated with a 1.4% increase in GDP growth in emerging markets. In China, this number can reach 2.5%. The doubling of mobile data use caused by the increase in 3G connections boosts GDP per capita growth rate by 0.5% globally. The Internet accounts for 3.4% of overall GDP in some economies. Most of this effect is driven by e-commerce – people advertising and selling goods online.

3. **Emergence of new services and industries**
   Owing to the disruptive nature of technological innovations, these days, many public service programmes are now available online; these can also be accessed through computer and at least mobile phones. The transition to cloud computing is one of the key trends for modernization. The government of Moldova is one of the first countries in Eastern Europe and Central Asia to shift its government IT infrastructure into the cloud and launch mobile and e-services for citizens and businesses. ICT has enabled the emergence of a completely new sector: the app industry. Research shows that Facebook apps alone created over 182,000 jobs in 2011, and that the aggregate value of the Facebook app economy exceeds $12 billion.

4. **Workforce Transformation**
   New "microwork" platforms, developed by companies like oDesk, Amazon and Samasource, help to divide tasks into small components that can then be outsourced to contract workers. The contractors are often based in emerging economies. Microwork platforms allow entrepreneurs to significantly cut costs and get access to qualified workers. In 2012, oDesk alone had over 3 million registered contractors who performed 1.5 million tasks. This trend had spill-over effects on other industries, such as online payment systems. ICT has also contributed to the rise of entrepreneurship, making it much easier for self-starters to access best practices, legal and regulatory information, marketing and investment resources.

5. **Business Innovation**
   Countries in Organisation for Economic Co-operation and Development (OECD) can boast of more than 95% of businesses with an online presence. In these 36 countries, the Internet provides them with new ways of reaching out to customers and competing for market share. Over the past few years, social media has established itself as a powerful marketing tool. ICT tools employed within companies help to streamline business processes and improve efficiency. The unprecedented explosion of connected devices throughout the world has created new ways for businesses to serve their customers.

3. TECH ECOSYSTEM & GROWTH IN AFRICA: THE POLITICAL LINK

Given Africa's education gaps, challenges of social infrastructure among other issues associated with governance, technology would have been a big bank alert for the continent. Some of the obvious challenges include power, non-governmental support, low or scarce local funding opportunities, illiteracy, poverty and absence of supportive legal frameworks. So, in order to tap into the goldmine the tech ecosystem offers, firms in Africa as noted by Leke & Sibanda (2019) must navigate some big infrastructure challenges "including the fact that internet data is still significantly slower and more expensive in Africa than on other continents. Although penetration is growing fast, two thirds of Africans still lack internet access altogether". Facebook, the largest social media platform on earth has reportedly signed up almost half the countries in Africa. A report by The Guardian's Maeve Shearlaw on Monday, 1st of August 2016 estimated that a total of 635 million users have been registered on Facebook's free Internet service in what has been described as "a controversial move to corner the market in one of the world's biggest mobile data growth regions". Zuckerberg has though repeatedly made it clear that he was concerned about the world connectivity to the internet, having described access to Internet "as a basic human right".

His Free Basics initiative, which allows mobile users to access the social networking website free data charges, is currently running in not less than 40 countries, half of which are in Africa. But Shearlaw's report notes that "digital campaigners and internet freedom advocates argue that Facebook's expansion is a thinly veiled marketing ploy that could end up undermining, rather than enhancing, mass efforts to get millions more people connected". Apparently, Facebook is profiting from the infrastructure debacle in Africa. While testing a solar-powered drone, Zuckerberg is also developing a satellite – aimed at making Internet access even to remotest communities in the continent.

Meanwhile, there is a huge backlash against Facebook. First, it was the Chinese government which banned it from her country. Now, the Free Basics has been axed in an effective ban by the Indian government. Reports have also indicated that the free data Facebook has been blocked in Egypt and Uganda. Despite early attack on the initiative of the Free Basics' Facebook, it did not elicit a response from the social networking site until after Indian ban. Using the platform of 'Times of India', Zuckerberg according to the account given by Shearlaw wrote an opinion piece "denying that Free Basics was about maintaining Facebook's commercial interests". He was quoted as saying; "If people lose access to free basic services, they will simply lose access to the opportunities offered by the internet today," adding that the platform fully respected the principles of net neutrality.

Just like Facebook, other popular social media platforms which are product of new innovations have been accused of working in cahoots with the agenda of some powerful countries and their agencies across the world. But, it is important to state that inventions such as the social media platforms are part of the existing globalized and inter-connected world that has for long been predicted. And the implications of their operations may never seize to be a source of suspicion. One of the set of scholars that have made a case for globalization is Audretsch, Lehmann and Wright (2014) who noted that activities in recent years have further emboldened the concept of globalization and trade across the border. The authors noted that exports and foreign direct investment (FDI) have emerged in this era as key channels for international integration and technology transfer through multinationals (Acs and Preston 1997). With this development, there is no denying the fact that the rapid pace of globalization has changed the global landscape significantly.

In particular, the emergence and rapid growth of multinational firms emanating from Brazil, Russia, India or China (BRIC) are now also involved in the international process of production and economic integration. Recent rankings of the Top 100 firms as measured by market value reveals this impressive growth. However, not all manufacturing industries are affected by globalization to the same extent. Studies from OECD countries show that in particular medium and high technology intensive industries are more internationalized due to a lack of in-house knowledge (OECD 2007). This leads to a reverse process in the technology transfer process. Currently, as Audretsch et al (2014) posited,

> Global technology transfer is focused on transfer of technologies, knowledge and overseas subsidization of firms. Instead of the former North–South transfer from developed to underdeveloped countries, the focus of technology transfer now is less concerned about the acceleration of economic development or fostering the transition process of underdeveloped nations but on the exploitation of comparative advantages within global competition (p.302).

3.2 Growing Africa's Technology Business: A New Agenda

There is wide optimism about Africa's prospects; many groups, researchers and professionals have been very instructive on what the future holds for the African continent. A recent McKinsey & Company November 2018 Survey undertaken by the trio of Mutsa Chironga, Georges Desvaux, and Acha Leke is one of such latest research. In this survey, two-thirds of respondents predict that "Africa's combined GDP will be among the fastest growing in the world over the next 20 years more than three times the share of those who believe that its GDP growth will stagnate".

The study also shows that adoption of digital technologies and demand for basic services and infrastructure is Africa's biggest opportunities for driving social, economic and political changes. This only goes to show that there are expectations of a more diversified economy in the years ahead. While result show that across regions, there is consensus of opinion in that resource sector in Africa will contribute significantly to its long-term growth, the abundance of mineral resources is regarded as a lower-order opportunity for growth.

McKinsey Global Survey further shows that;

> With expectations of technological growth, high demand for infrastructure, and rapid urbanization, respondents to a McKinsey Global Survey on business opportunities in Africa are confident about the continent's long-term economic prospects. In fact, respondents in Africa and in other regions believe that 20 years from now, its combined GDP will be among the fastest growing in the world. But the results also suggest that on-the-ground knowledge is key to capturing this business potential. Respondents in Africa report higher revenue and profits there, as well as higher expectations for future growth and a more nuanced outlook on the specific countries where the best opportunities lie.

Hence, focus must shift to the new tool of economic growth – the technology. Meanwhile, other sectors of the Nigerian economy particularly the mineral resources and traditional sources of economic growth stand a chance of improvement with due deployment of innovations driven by science.

Every company that wishes to survive Africa must be able to meet certain bottlenecks that are fast becoming a part of survival must know strategy for many thriving business. Some of these are political instability, corruption, decadence in social amenities amongst others. This means, beyond what is expected to be spent on putting the business together. Key best practices among the high performers include a more active approach to developing talent, a formal strategy for growth in Africa, and a quicker embrace of mobile and digital technologies to support that strategy.

Even at the country level, respondents with on-the-ground knowledge have a different perspective on where the best opportunities lie. Nigeria and South Africa are cited most often by respondents inside and outside the continent. But respondents elsewhere are far more likely than average to cite South Africa, while those in Africa are more likely to identify smaller but much faster growing economies such as Ghana, Ethiopia, and Senegal. Respondents in Africa and their companies have another clear advantage over the others, according to the results. These local respondents are nearly three times more likely than all others (30 percent and 11 percent, respectively) to report outsize growth and profits in Africa.

Further to this, International Finance Corporation (2019) believes that there must be clear cut marketing strategy among the tech hub coming up in Africa; most of which are focusing exclusively on fintech and agritech. This position has been further supported by Dario Giuliani, co-author of GSMA's Tech Hubs Landscape while reporting the trends that have accompanied the growth of tech development in Africa over the past couple of years. In his words, he succinctly posits that; "We're now seeing a lot of hubs that were previously sector-agnostic focus exclusively on fintech, and some focus exclusively on agritech."

These businesses are most definitely hoping to tap into the abundance of farming land as well as the huge number of residents in the continent as basis for their choice of technological-based company. Beyond this, however, attention must be given to other sectors that stand better chance of performance when visited with the rampaging technological innovations that have changed the face of financial and agricultural practices and marketing on the continent, just as it has in other parts of the world.

4. CONCLUSION & RECOMMENDATIONS

Local and regional strengths are undeniably an important advantage for a robust economic plan in a globalized world. As (Audretsch et al. 2006) holds, firms may be attracted to activities and skills that exist specifically in some regions and locations. These activities and skills may be linked to scientific or academic institutions, which changed their mission and vision towards an entrepreneurial orientation. Academic entrepreneurship orientation, the quantity and quality of social networks and experience with industrial collaboration, increase with time and play an important role in the knowledge and technology transfer (Siegel, Waldman & Link, 2003). At the aggregate level, the creation of technological collaboration between countries can be considered as mutually beneficial or detrimental. Such global innovation networks are emerging as a result of the international division of innovation processes through, among others, international technological collaborations (Gassler & Nones, 2008). Consequently, the dynamics and evolution of the technological collaborations can be expected to fulfill the criteria of a complex network.

Walshok, Shapiro & Owens (2013) in their study of growth of transnational networks of innovation proposed a preliminary classificatory system of four distinct kinds of forces which give rise to social networks that facilitate knowledge flows, relationship building and collaborative activities important to accessing global markets. They argue that networks may form around a technology sector, be identity based, emerge from a government-led initiative, or be stimulated by a civic or philanthropic organization. They state that each has a different mode of organizing, financing, and meeting its objectives. In Africa, a 1995 report by United Nations shows that one of the reasons why Africa lags way behind in socioeconomic development is its inability to efficiently manage technological change, and integrate the most productive technologies in various sectors of the continent's ever growing industry including in the area of agriculture to enable its goods and services to compete in the world market.

Though, illiteracy and poverty are major challenges in this regard, as most of the adopted technologies experience hostility from those they were meant for. In view of the foregoing, the following are hereby recommended;

1. States in African continent must be ready to work with one and other in a bid to build a strong footing in development of the technology ecosystem of Africa continent. This must be duly given necessary support including but not limited to legal frameworks, funding, and deployment of state and non state machineries;
2. Youths in Africa must be ready to develop skills within the technology subsector and use same for the development of African continent and trades;
3. Organizations of African descent must be prepared to support fully home grown technologies. This support can come in form of providing the right atmosphere for engagement, learning and training as well as funding of important and value inducing ideas.
4. Banks in the continent must also be prepared to give stress-free and low interest loans where necessary to support entrepreneurs
5. Academic institutions in Africa must be ready to provide an easy and less cumbersome study programme for those gifted with tech knowledge but have little or no formal education to advance their career so they can compete favourably at the global stage.

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