Spurring Digital Revolution For Decent Jobs In Sub-Saharan Africa: A Comparative Analysis Of Cote D' Ivoire And Kenya

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Abstract

The global economy is in a constant state of dynamism, driven in contemporary times by the emergent digital transformation. The development has embraced a paradigm shift in innovation practices, driven in large part by digital technologies. The prospects of digital transformation on the global economy are enormous, with the potential to add US$1.36 trillion to global economic output between 2015 and 2020. Accenture Strategies and Oxford Economics (2016) reveal that GDP growth rates in advanced economies would increase by 0.25% and by 0.5% in emerging market economies by 2020. Africa is embracing the digital revolution, driven in large part by mobile technology, which has helped to transform lives across the continent. Indeed, by 2016, 22% of the region's population had access to the internet. Projections reveal that if internet access approaches the same level as mobile phones, Africa's GDP could increase by US$300 billion by 2025.

Keywords: Digital revolution, Decent jobs, Africa, Cote D' Ivoire, Kenya

1. Introduction

The global economy is in a constant state of dynamism, driven in contemporary times by the emergent digital transformation. At the core of the digital transformation is hyper-connectivity or the growing interconnectedness of people, organizations and hardware attributed to the internet, mobile technology and the internet of things (IOT) (Deloitte, 2019). The growth triggered by the digital economy transcends all countries and regions and contributes even greater gains in emerging markets. Africa has embraced the digital revolution, transforming various sectors of the economy, ranging from agriculture, industries and services, and accompanied by the emergence of job opportunities that have deep implications for human development across the continent.

2. Objectives

The major objective of the paper is to explore the digital revolution and its implications for decent jobs in sub-Saharan Africa. Specific objectives are to:

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- Elaborate the emergence of the digital revolution across the global economy;
- Shed light on the marginalization of Africa in the world's digital revolution;
- Discuss the emergence of Africa's digital revolution; and,
- Conduct a comparative analysis on the digital revolution in Cote D' Ivoire and Kenya.

3. Methods

The study employs empirical data, comprising quantitative and qualitative approaches for trend analysis associated with the region's digital economy. This involves the application of descriptive and inferential statistics to analyze the data. It relies on interviews with stakeholders across the region, complemented by secondary data generated from various sources, including the World Bank, International Monetary Fund, the United Nations and its agencies, the Africa Union, as well as Journal papers, monographs etc.

4. Results and Discussions

The global economy has embraced a paradigm shift in innovation practices, driven in large part by digital technologies, which are shaping enterprise and national competition strategies, with various emergent techniques and business models (Carmichael, 2016). According to the International Monetary Fund (2018), only three previous technologies are associated with this trend: the steam engine, the electrical generator, and the printing press. The previous transformations, like the digital economy, are accompanied be enormous long term benefits. For example, the steam engine, originally designed to pump water out of mines, became a powerful tool for rail roads and industry through the application of mechanical power. Benefits associated with the steam engine also enabled farmers and merchants to deliver their goods across countries and regions, facilitating global trade.

The digital revolution is rapidly manifesting across the world, transforming jobs and skills, in addition to overhauling industries, including retail, publishing and banking. According to the IMF (2018) report, internet transactions in the United Kingdom accounted for about one-fifth of retail sales, excluding gasoline; up from a paltry one-twentieth in 2008. In addition, e-commerce, driven by digital technologies, is applying data skills to transform finance.. The emergent universal digital inclusion under way in parts of the developing world has empowered poor people to participate in formal networks, enabling them to communicate, transact, and access basic

financial services; as well as to obtain information; and claim rights and recognition (Brookings Institution, 2016).

Indications are that the digital divide within countries can be as high as that between countries. The World Bank (2016) reveals that, worldwide, nearly 21% of households in the bottom 40% of their countries' income distribution lack access to a mobile phone, and 71% also lack access to the internet. However adoption gaps between the bottom 40% and the top 60% and between rural and urban populations are reducing for mobile phones, while increasing for the internet. The World Bank (2016) report also reveals that the digital divide across Africa's demographic groups remains significant, with women less likely than men to use or own digital technologies. Indeed, gaps are even larger between youth (20%) and those more than 45 years old (8%).

Figure 1 illustrates why digital dividends are not spreading rapidly in parts of the developing world and what can be done. It reveals digital technologies are enabling internet connectivity accessible, affordable, open and safe. It also shows digital technologies are associated with such dividends as inclusion, efficiency and innovation. The framework therefore reduces risks associated with control, inequality and concentration of the digital revolution.

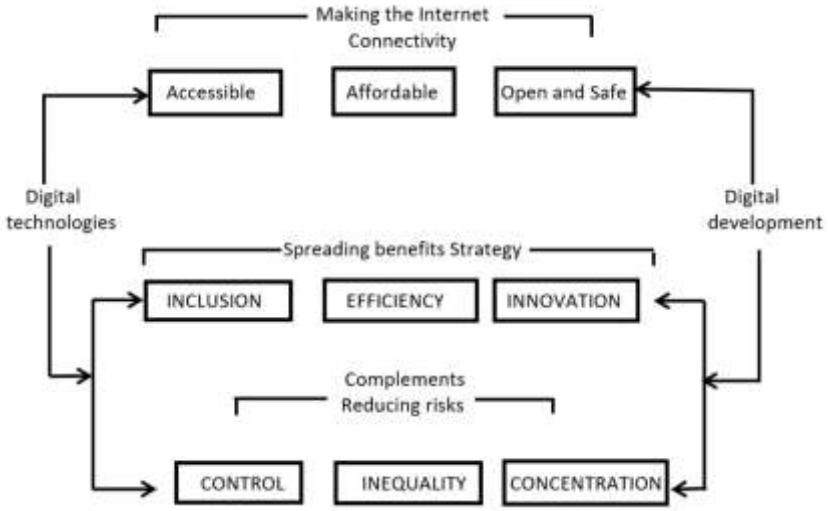

Figure 1: Why Digital Dividends Are Not Spreading Rapidly – and what can be done
Source: World Bank (2016)

McKinsey Global Institute (2017), in a report on technology, Jobs, and the future of work; reveals large disparities in the adoption of digital

technologies between large enterprises, as well as between different sectors of the economy. The report also reveals that sectors that are highly digitized-financial services, media and the tech. sub-sector-are associated with the highest productivity and wage growth. The prospects of digital transformation on the global economy are enormous, with the potential to add US$1.36 trillion to global economic output between 2015 and 2020 (McKendrick, 2016).

In a joint report, Accenture Strategy and Oxford Economics (2016) reveal intensification of digital technologies would add the equivalence of an economy the size of South Korea's to the global market by 2020. Relying on a 10-point improvement in digital intensity (on a 100-point scale) over five years, Accenture Strategies and Oxford Economics (2016) reveal that GDP growth rates in advanced economies would increase by 0.25% and by 0.5% in emerging market economies by 2020. In addition, the United States alone would witness an increase in GDP growth estimated at US$365 billion, while such emerging economies as Brazil, India and China would experience rises of between US$97 billion and US$418 billion over the period in view. Table 1 shows the projection between gross domestic product impacts from digital intensity optimization in selected countries by 2020.

Table 1: The Gross Domestic Product Impact from Digital Optimization in Selected Developed Economies, by 2020.

Country	Change in 2020 gross domestic product (%)	Change in 2020 gross domestic product (US$ billion, 2015 prices)
Australia	2.4	34
Brazil	6.6	120
China	3.7	527
France	3.1	80
Germany	2.5	90
Italy	4.2	81
Japan	3.3	146
Netherlands	1.6	13
Spain	3.2	43
United	2.5	84
Kingdom	2.1	421
United States		

Source: Accenture Strategies and Oxford Economics (2016).

Table 1 features a projection of the GDP impact from digital intensity optimization in selected countries by 2020. It reveals China with the highest value of output, at US$527 billion, while Brazil features the highest proportion of GDP change, at 6.6%.

5. Digital Revolution and Implications for Decent Jobs in the global economy

The digital revolution is accompanied by the transformation of jobs across the world. While the number of direct jobs created by digital technologies is relatively modest, the number enabled by it can be large (World Bank, 2016). For example, in developing countries, the Information and Communication Technology (ICT) sector accounts for a paltry 1% of the workforce on average: less than 0.5% in Bolivia and China, and just under 2% in Columbia and Sri Lanka. On the other hand, in the Organization for Economic Cooperation and Development (OECD) countries, about 3-5% of employment is in this sector. However, ICT jobs are usually accompanied by good pay, with each high-tech job generating 4-9 additional jobs in other sectors in several economies. In Kenya, the M-Pesa digital payment system is a source of additional income for more than 80,000 agents. Additionally, China's State Information Centre estimates that the emergent boom in the country's e-commerce sector has generated 10 million jobs in online stores and related services, or about 1.3% of the country's employment, according to the World Bank (2016) report.

A study by the Brookings Institution (2017) on digitization and the American Workforce reveals that the diffusion of digital technologies is reshaping the U.S economy and its world of work. The study presents a detailed analysis of changes associated with the digital content of 545 occupations covering 90% of the U.S. workforce in all industries since 2001. This is accompanied with a categorization of U.S. occupations into jobs that require high, medium or low digital skills, while tracking the impacts of rapid change. Findings reveal that between 2002 and 2016, the proportion of U.S. jobs requiring substantial digital knowledge increased sharply, driven by large changes in the digital content of existing occupations. The study reveals that workers of every stripe, ranging from corporate finance personnel to sales people to utility workers and nurses, are now engaged with tools that require digital skills in sizeable proportions of their workdays. For example, in 2002, 56% of the jobs surveyed required low amounts of digital skills, while 40% required medium digital skills and only a paltry 5% required high digital skills. However, by 2016, the share of jobs requiring high digital skills had accelerated to 23%, while the share of medium digital skills rose to 48% and, in a significant shift, the share of jobs requiring low digital skills declined from 56 to 30%. At the same time, the study reveals an increase in digitization scores over the period in view, rising in 517 of 545 analyzed occupations. The average digitization score across all occupations also rose from a low level of 29 in 2002 to a medium level of 46 in 2016, or

a 57% increase. Additionally, virtually all industry groups feature mean digital increases during the period in view; however, with varying degrees and speed of digital adoption. The study further reveals that leading the digitization race is a group of broad band service sectors, including professional, scientific and technical services (55); media (52); as well as finance and insurance (55). On the other hand, at the lower end, education, transportation and warehousing, basic goods manufacturing, and construction feature scores mostly in the 30s. A significant development associated with the Brookings Institution (2017) report is that digitization is a key pathway to increased earnings.

Indications are that digitization is set to transform people's jobs around the world. McKinsey Global Institute (2017) reveals that up to one-third of the U.S. workforce, or about 50 million people could be transformed by 2020, with about half of all paid activities becoming automated and using existing robotics and artificial intelligence. While development of automation enabled by such technologies as robotics and artificial intelligence is accompanied by higher productivity, increased efficiencies, safety and convenience; the trend raises difficult questions about the broader impact of automation on jobs, skills, wages and the nature of work itself, among other things. Indeed, several activities that workers are currently engaged in have prospects of being automated. At the same time, independent workers are increasingly offering their services on such digital platforms as Upwork, Uber and Etsy, thus challenging conventional trends about how and where work is structured and undertaken.

6. Africa and the Digital Revolution

Africa is embracing the digital revolution, driven in large part by mobile technology, which has helped to transform lives across the continent. McKinsey & Company (2013) reveals that while only 16% of Africa's populations were online; the trend was set for a dramatic transformation, to be triggered by the continent's rapid urbanization and robust economic growth. The report revealed that Africa's major cities, where the emergent middle class has experienced increasing disposable income, more than half of the population have internet-capable devices, as well as 3G networks that drive the technology. The trend is also complemented by significant infrastructure, including increased access to mobile broadband, fibre-optic cable connections to households and power-supply expansion. When the trend is viewed against the backdrop of the rapid spread of low-cost smart phones and tablets; the development has empowered millions of African to connect with the internet infrastructure for the time. While the

contribution of the internet to GDP remains low (at 1.1% in 2013); McKinsey and Company (2013) projects a significant rise to 5 or 6% by 2025, matching that of such leading economies as Sweden, Taiwan and the United Kingdom.

It is noteworthy that Africa's internet penetration continues to rise, breaking the 15% barrier recently (Mourdoukoutas, 2017). Indeed, by 2016, 22% of the region's population had access to the internet. This development has positive implications for economic growth. McKinsey and Company (2013) reveals that if internet access approaches the same level as mobile phones, Africa's GDP could increase by US$300 billion by 2025.

The digital revolution has the potential to transform the African economy much the same way as railroads did for Western economies in the 19th century. During the World Economic Forum on Africa, in 2016; a new epoch of economic transformation on the continent, driven by digital revolution, was acknowledged as critical to mitigating youth unemployment, political instability and widespread impoverishment. Juma (2016) identifies five strategies that lie at the core of the continent's digital revolution:

1. **Investment in Digital technology:** The high initial cost and low capacity utilization of undersea fibre-optic cables around Africa are manifestations that these investments share the same attributes as railways, electric grids, roads, as well as water and sanitation; however, dearth of investment capital is a binding constraint on critical digital infrastructure. A solution is the development of smart partnerships between governments and the private sector. Figure 2 shows the enormity and scope of the undersea fibre-optic cable infrastructure that connects Africa to the rest of the world. This is a capital-intensive initiative that drives the internet and mobile technologies across the continent.

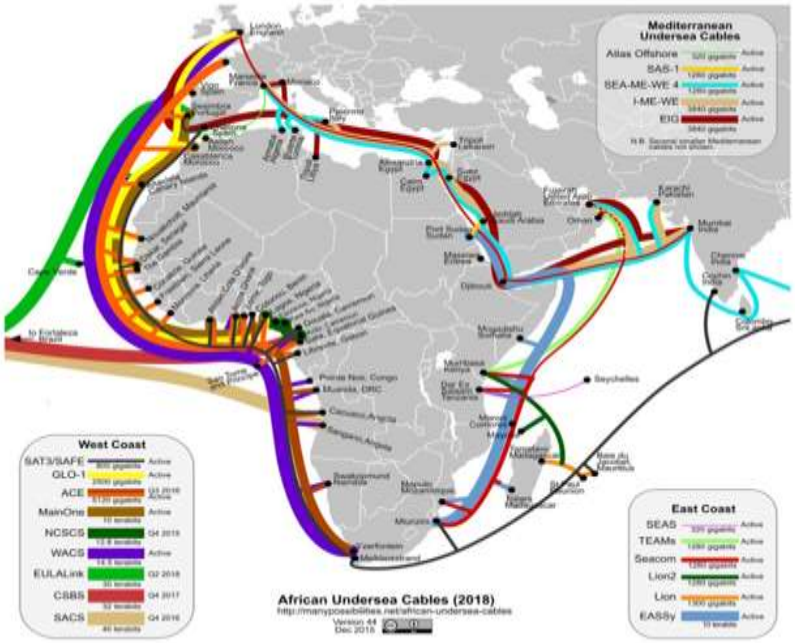

Figure 2: Undersea Fibre-optic Cables Connecting Africa with the World
Source: World Economic Forum, 2016.

2. **Acknowledgement that digital phenomenon is beyond communication:** African policy makers, like their peers around the world, need to understand the power of exponential growth associated with digital platforms and the imperatives to harness them. Indeed, novel digital technologies have emerged as driving forces behind 3D printing, drones, artificial intelligence, robots, as well as the Internet of things, among others.

3. **Training a new generation of Africans:** Concerted efforts are necessary to train a new generation of Africans to understand emerging digital technologies, as well as their applications. This is critical in leveraging them for entrepreneurial opportunities. Inculcating training in ICT from high school presents advantages for children and youth to appreciate the potentials of digital technologies and career prospects in the sector.

4. **Assisting companies to scale-up production and services**: In order to reap the enormous dividend associated with the digital revolution, there is need to attract investors with critical capital resources to assist more established enterprises to scale up activities critical to leveraging their competitiveness regionally and globally.

5. **Thinking Big**: The spread of terrestrial fibre-optic cables is a manifestation of opportunities associated with continent-wide digital integration. Indeed, digital networks have potentials to form the new backbone for intra-African trade, critical to economic growth and transformation on the continent.

The emergence of digital revolution in Africa is rather unique in many respects. The accelerated transition to digital technology is in sharp contrast to centuries-long pace of technological and economic development that characterized European and the United States economies. Many Africans are transitioning from having little or no access to modern technologies to owning digital devices, with several instances occurring "overnight" (Krach, 2017; African Vibes, 2019).

The digital revolution in Africa features a rapid adoption of mobile technologies. For example, in 2016, about 80% of the African population owned a mobile phone, a significant increase from 71% in 2014. The transition to digital technology is driven by a number of forces. A prominent one is the development of undersea fibre-optic cables around the continent, dramatically increasing the access of people in several countries to 3G mobile telecommunications technology, as well as 4G in some major urban centres. The momentum for the rapid diffusion of digital technologies in Africa is largely spurred by Venture capitalists financing technology start-ups. For example, there was an exponential increase in the investment profile of venture capitalists, rising from US$40million in 2012 to more than US$400 million in 2014. Across the continent, more than 200 innovation hubs, accompanied by thousands of tech-related ventures have emerged in the past few years; with Nairobi, Lagos, Cairo and Durban, among several other African cities becoming hotspots for digital entrepreneurial activity, according to Krach, 2017.

Price Waterhouse Coopers (2017) also reveals that digital connectivity lies at the core of Africa's mobile technology revolution; not only by increasing consumer choices associated with the production of goods and services, but also allowing entrepreneurs and innovators to work together in virtual communities. While mobile connectivity is relatively advanced, internet availability lags behind in Africa, with less than 30% of the African population having access to mobile broadband (Compared to 43% in Asia) and only a paltry 15% owning internet at home. It is noteworthy that Africa's emergent digital revolution is accompanied by disruptive innovation forces that are transforming markets and societies across the continent Price Waterhouse Coopers (2017) identifies the forces as follows: i. efficiency in business and public service; ii. market access and ease of doing business; iii. healthcare and crisis prevention; iv. education, innovation and job

creation; v. public trust and anti-corruption; and vi. economic transformation, from the largely informal sector to the main stream economy.

Thus, the transformational innovations associated with the digital revolution in Africa range from drone delivery services to affordable solar-powered units, the application of block chain ledgers to combat fraud, to harnessing robotics and big data analytics to map the prevalence of diseases, and target medical aid. Disruptive technologies have potential to create their own demand dynamics, with the smart phone as a key example.

Over the past decade, African leaders, in a paradigm shift culminating in Vision 2063, have deepened concerted efforts to adopt Information and Communication Technology (ICT) as a tool to drive the region's development policies and practices. The exponential rise in mobile communication applications is largely attributable to the paradigm shift. The efforts have also yielded a digital dividend manifesting in a 'mobile revolution' sweeping across the region, with mobile phone use transforming people's lives, accompanied by novel applications that have positive implications for inclusive growth and development (European Parliament, 2015; Mourdoukoutas, 2017; Atlantic Council, 2021).

In a recent study of Africa's digital revolution, Chakravorti and Chaturvedi (2019) acknowledged Africa as the next big growth market, increasingly enabled by the emergent digital technologies. In an empirical study of the digital momentum across the continent, the authors examined six key countries selected from geo-political sub-regions of the continent, representing distinct archetypes of size (economy and population), economic growth, median age, quality of governance, as well as digital momentum: Egypt, Ethiopia, Kenya, Nigeria, Rwanda and South Africa. Three primary categories of levers with the potential to translate digital technology uptake into development and inclusive growth were assessed. The framework was employed to explore jobs enabled by digital platforms; institutional drivers critical for digital success; and the foundational digital potential of the country in view. The levers were subsequently integrated into a framework known as the African Leapfrog Index (ALI), which evaluates each country against a continent-wide "best performance" benchmark. Figure 3 illustrates the different profiles of the six African countries in the study, highlighting the strengths and gaps in each country.

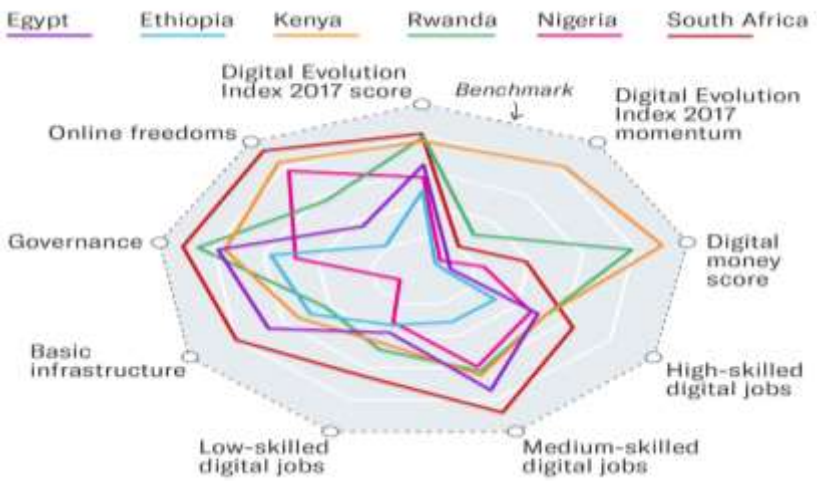

Figure 3: How Selected African Countries Compare on Nine Metrics Needed for Digital Growth
Source: Chakravorti and Chaturvedi (2019)

Figure 3 shows the relative standing of each country along each of the essential factors. The outer boundary features the benchmark, and each country's footprint is indicated in thereon. The closer the footprint is to the outer boundary, the higher the leapfrog potential in the country.

Chakravorti and Chaturvedi (2019) categorized the six African countries in the study into four segments in line with their performance: i. Paving the way: Kenya and South Africa; ii. Punching above its weight: Rwanda; iii. Untapped opportunities for growth: Egypt and Nigeria; iv. Potential for greatest digital gains: Ethiopia. The performance of each African country in the study reveals the following dimensions:

- **South Africa:** The nation has emerged as a regional hob in the Ease of Creating Digital Jobs, reinforced by a robust consumer demand for digital businesses and underpinned by and institutional framework that offers supportive regulations comparable to emerging market economies in Latin America and Southeast Asian regions. It remains a leading player in such emerging technologies as biometric data and payment cards to deliver social security, drones in mining, which underpin its innovation and creativity.
- **Kenya:** Acknowledged as a "Silicon Savanah," Nairobi, Kenya's capital, features a robust and growing tech savvy ecosystem, driven largely by the M-Pesa, the mobile payments' system offered by Safaricom. Over 70% of the country' population operates a mobile money account. In the last decade, Kenya has witnessed

considerable transformation of its digital economy, becoming a hotspot for some of the continent's most innovative digital enterprises.

- **Rwanda:** The nation has moved rapidly to as a regional digital hub, driven by several key initiatives, especially Irembo, a government-to-citizen services e-portal, high mobile accounting usage, expanded 4G coverage across the nation, as well as improved digital skills. Rwanda is acknowledged as a pioneer in Africa, with the Mara Group becoming the first manufacturers of a Smartphone made entirely in Africa. It also features a robust digital infrastructure, with 90% of the population living within 5 kilometers of a financial access point.
- **Egypt:** The country's digital technology sector is the second fastest growing segment of the economy. It is ranked with the highest number of tertiary institutions' graduates among the countries in this study. Egypt is also acknowledged as as a regional leader in skilled digital jobs creation, with online freelance pools, particularly in creative and media sector, software development and technology, as well as writing and translation. It is one of the region's fastest growing entrepreneurial hubs.
- **Nigeria:** The nation is acknowledged as an entrepreneurial digital hub, with several creative ventures, including Jumia, Interswitch, Kobo360, and Andela. These ventures traverse the education, Fintech, agriculture, healthcare, logistics, as well as the travel sectors, among others. Nigeria emerged as Africa's leading Startup investment destination in 2018, benefitting from about US$ 95 million deals. For example, Yaba, a neighborhood in Lagos, Nigeria's leading commercial hub, is acknowledged as "Yabacon Valley". Analysts have attributed Nigeria's digital revolution to the relative availability to internet services in the country.
- **Ethiopia:** While the nation is the most challenged of the countries examined in this study, Ethiopia is witnessing a rapid evolution of its digital economy, facilitating employment generation, inclusive growth and poverty reduction. The nation is upgrading its digital infrastructure with a US$ 20 million investment in the power sector. Enrollment in the nation's higher education system has has risen exponentially, rising five-fold since 2005. This development is driven by government's policy of training 70% of students in Science, Technology, Engineering and Medicine (STEM). The nation is also acknowledged with a fast emerging tech hub, known as "Sheba Valley," featuring several home-grown ride-hail ventures, Ride and ZayRide, startup marketplaces, Gebeya and BlueMoon, as well as a tech incubator and seed fund.

The study proffered a variety of recommendation for each of the six countries covered in the study, ranging from the imperatives of more enabling environment, robust institutional mechanisms, as well as higher investments to reinforce the digital revolution in Africa.

7. Digital Revolution and Decent Jobs in Sub-Saharan Africa

Sub-Saharan Africa, spurred by the imperatives of the digital dividend, is increasingly connected to the world and reaping the benefits. Unlike other major developing regions of the world, which were rapidly connected by submarine telecommunications cable (SMC) to developed countries; sub-Saharan Africa remained relatively isolated from the global internet until 2010. While the penetration is still relatively low compared with other developing regions, the momentum for rapid expansion is sweeping across the region (Joel, 2018). Furthermore, indications are that the sub-continent is set to bridge the digital divide that has marginalized it from the world until recently. Sub-Saharan Africa's recent connection to the global internet, driven by the deployment of high-capacity tele communications SMCs (combined with the dearth of terrestrial infrastructure) has left mobile telephones as the primary vehicle for internet communications. Projections are that, by 2020, more than 700 million smart phones connections will be witnessed across the region, from 226 million in 2015. This is more than twice the number expected to be witnessed in North America and not too far from the total in Europe (GSMA, 2018). Figure 4 illustrates the comparative projections of Smartphone connections in Africa, Europe and North America by 2020.

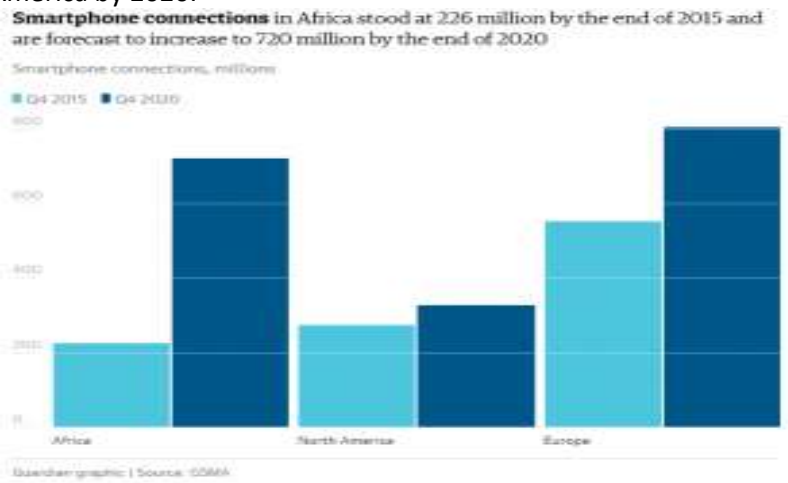

Figure 4: Comparative Projections of Smart phones Connections in Africa, Europe and North America by 2020
Source: GSMA, 2018

The digital economy in sub-Saharan Africa presents opportunities for Africa's youth to leverage digital technologies for decent jobs in virtually every sector of the economy. This includes Business Processing Outsourcing (BPO), from external and internal sources associated with small and Medium Enterprises (SMEs). As the digital economy develops across the region, the Internet of Things (IoT) and Big Data analytics provide prospects for the region's young job seekers (Ndemi, 2017).

In a study of the rapid transformation of Africa's digital economy, Allen (2021) noted the phenomenal growth of digital networks, sensors, artificial intelligence, as well as automation, which is driving the digital revolution across the continent. According to the author, such emerging technologies as the Closed-circuit Television (CCTV) cameras with facial recognition systems, drones, robots, and "smart cities" are proliferating. At the same time, digital technology is improving government income generation and curbing corruption. The digital revolution is attributed to the rapid spread of the internet across the continent, with accessibility to a quarter of the region's population, or nearly fifty-fold increase since the turn of the Millennium. Allen (2021) also projected that the continent could achieve a rough parity with the rest of the world in 2030, when three-quarters of the region's population become internet users. The economic dimensions are significant, with mobile technologies alone already accounting for 1.7 million jobs and contributing US$144 billion to the region's economy, or about 8.5% of the region's GDP.

1. Digital Revolution and Prospects for Decent Jobs in Sub-Saharan Africa

The proliferation of novel innovative devices leveraging digital technologies to deliver services across the economy is accompanied by positive prospects for job creation in sub-Saharan Africa. Hjort and Poulsen (2018), in a study of the relationship between the arrival of fast internet and employment generation in Africa, shed light on employment prospects associated with the digital economy in Africa. Relying on three different databases in 12 countries across the region, accounting for a combined population of about 500 million people; findings reveal a significant and large relative increase in employment rate in connected areas associated with the emergence of fast internet. The findings reflect a causal effect of access to fast internet on employment rate. They also reveal that the technology's impact is attributable to increase in employment in higher skill occupations. Findings further reveal that fast internet lowers (un)employment inequality across educational attainment levels in Africa.

The IMF (2018a), examining the future of work in sub-Saharan Africa against the backdrop of an emergent digital revolution; reveals that previous studies point to a large but uncertain impact on jobs. For example, McKinsey Global Institute (2017) estimated that a number of jobs remain at risk across the region, adjusting for technological feasibility and diffusion of technology to low-income countries. Its findings reveal that employment across the region is a little less susceptible than in advanced economies, but still high, with estimates for individual countries ranging from 40 to 60%. IMF (2018a) adopts an economic model to analyze the impacts of the Fourth Industrial Revolution on job creation in sub-Saharan Africa. The Fourth Industrial Revolution comprises a range of novel technologies, including automation, machines learning and artificial intelligence. In the model, robots and labour can be either complements (help workers to do their jobs better) or substitute (take away jobs from workers). This has implications for an advanced economy and sub-Saharan Africa. Under the first scenario of the IMF model, if labour and robots are complements, the increase in per capita GDP is larger is sub-Saharan Africa than in the advanced economy, particularly in the long run, leading to a convergence. However, sub-Saharan Africa benefits more because it features lower wages, making it more profitable to invest in robots where they are combined with relatively cheap labour. Under the second scenario, if labour and robots are substitutes, the increase in per capita GDP is larger in the advanced economy than in sub-Saharan Africa in the long run, with the region falling further behind. Thus, introducing robots and investing in complementary traditional capital is most profitable, where wages are high because they save on the cost of employing expensive workers. Therefore, the IMF (2018a) report reveals that employment generation will increase in sub-Saharan Africa in the emergent digital revolution if robots complement labour, leading to a larger increase in real wages.

In a similar report, the World Economic Forum (WEF) (2017), in an elaboration on the future of jobs and skills in Africa (in the context of the fourth industrial revolution); reveals that its Human Capital Index finds sub-Saharan Africa with only 55% of the region's human capital potential, compared to the global average of 65%. Also, it reveals that the region's demographic profile features a youth bulge, with more than 60% of its population aged under 25years and projects that the region's working-age population is set to increase by two-thirds, from 370 million adults in 2010 to over 600 million in 2030.

The WEF (2017) acknowledges the emergent job disruption tendencies associated with the fourth Industrial revolution, with 41% of all work

activities in South Africa susceptible to automation, as are 44% in Ethiopia, 46% in Nigeria and 52% in Kenya; however, this will likely be mitigated by comparatively low labour costs and offset by new job creation. The report added that employers across the region already identify inadequate jobs skills as a constraint in their enterprises, including 41% of all firms in Tanzania, 30% in Kenya, 9% in South Africa and 6% in Nigeria. However, the pattern is likely to deteriorate even further in future against the backdrop of the fourth industrial revolution.

Given the rise of the digital economy in sub-Saharan Africa, unemployed youth stand to benefit considerably. A major development constraint in the region is the prevalence of youth unemployment, which has oscillated above 10% over the past decade, while nearly 70% of working youth live in moderate or extreme poverty, a reflection of precarious and widespread underemployment trend that characterize the informal economy (Nasman, 2017). However, the diffusion of innovation through digital - focused hubs, incubators and hackathons in both urban centres and rural areas holds the key to creating decent jobs in Sub-Saharan Africa.

8. Digital Revolution and Decent Jobs in Cote D'Ivoire

Cote D'Ivoire has embraced the digital revolution, accompanied by its dividends that are increasingly transforming every sector of the economy for inclusive growth and development. The momentum that drives the digital revolution was unleashed in Cote D'Ivoire in 1995, with the granting of the first mobile license. While the pace of growth was slow initially, with 11% of the population subscribing to mobile phones by 2005; the trend was reversed, with a rapid increase in subscription rising over the next 10 years to 53% of the population. The penetration of the mobile industry was driven by the launching in 2012 of the 3G services, broadening internet access from 3% of the population in 2010 to almost 25% by 2015 (GSMA, 2017). Indeed, mobile technology has transformed people's lives in Cote D'Ivoire, revolutionizing agriculture and healthcare services. Platforms have also emerged enabling doctors and other health care professionals to communicate directly with patients through voice calls and SMS, bringing considerable benefits to rural inhabitants that would otherwise have to embark upon long distance travels to access such services.

The financial industry as emerged as a major beneficiary of the digital revolution in Cote D'Ivoire, deepening financial inclusion across the country. Mobile money lies at the heart of Cote D'Ivoire's emergent financial inclusion. For example, while the proportion of the adult

population operating an account at a formal financial institution stagnated at 15% between 2014 and 2017; the proportion of adults with mobile money account increased by at least 40%, with between 34 and 38% of the adult population operating a mobile money account by 2017. This is acknowledged as the highest rate of penetration in the West African Economic and Monetary Union (Riquet, 2018). Indication is are that almost all adults operating accounts in traditional financial institutions (banks and microfinance institutions) also use mobile money, with a mere 2% of the financially included not accessing mobile money, while 11% of adults access only informal financial services like rotating savings and credit associations or money guards. Details of financial inclusion profile in Cote D'Ivoire, driven largely by mobile banking, are illustrated in Figure 5.

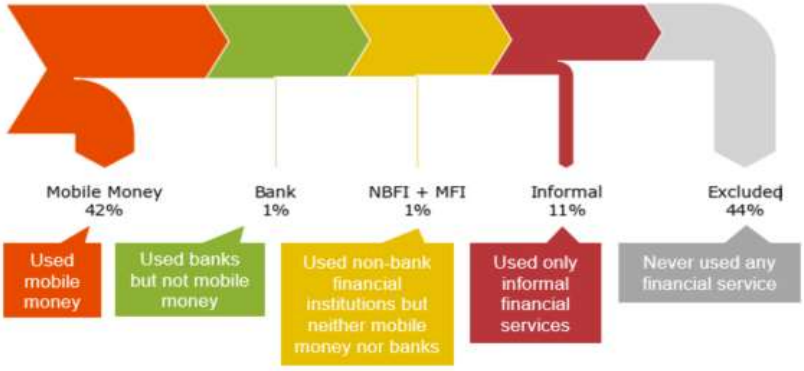

Figure 5: The Profile of Financial Sector Inclusion in Cote D' Ivoire
Source: Consultative Group to Assist the Poor (CGAP), 2018.

With the emergence of digital revolution, characterized by a rapid growth in mobile penetration and its network infrastructure across the country; the government realizes the pivotal role of ICT in transforming the economy through improved quality of education, training and research. Therefore, policy makers have leveraged the African Digital Schools Initiative (ADSI) to develop student competencies in the following areas (GESCI, 2015):

- Science, Technology, English and Mathematics (STEM)
- Skills to innovate, create and work in teams
- Skills for higher order thinking, analysis and synthesis
- Development of entrepreneurial mentality to exploit the business and self-employment opportunities that the digital world embraces.

The ADSI is a programme driven by the Global E-Schools and Communities Initiative, founded by the United Nations in 2004 to provide capacity building, technical and strategic advice to countries seeking to harness the potentials of ICT to increase access to, and

improve the quality and effectiveness, of education. The ADSI model features a phased approach for digital whole school and teacher development in ICT applications to incrementally move schools and teachers towards transformative educational practices and quality student learning outcomes.

An important issue associated with the digital revolution in Cote D'Ivoire is the prospect of decent jobs to complement the spread and uptake of ICTs. The sub-sector accounts for 8% of the nation's annual GDP, employing more than 150,000 people. Indeed, policy makers strive to increase ICT's contribution to GDP to reach 15% by 2020 (GSMA, 2017). The nation's employment profile reveals a dynamic framework, with unemployment rate of 6.7% of the labour force in 2014. This is relatively low in comparison to the average in sub-Saharan Africa (7.5%) and above the global average, at 4.5% (Sow, 2017). The World Bank (2017), in a jobs diagnostic report on Cote D'Ivoire, reveals that the majority of individuals are employed in agricultural or non-agricultural self-employment (47.5% and 29.7% of the population, respectively). However, a limited proportion holds non-agricultural jobs, estimated at19.9% of the population. The World Bank analysis of recent trends reveals that the low quality and low-earning jobs profile in Cote D'Ivoire are largely structural issues. Indications are that the share of non-agricultural self-employment has increased as the nation emerges from prolonged political instability and civil war.

In the light of the structural transformation under way in Cote D'Ivoire's economy, driven by an average growth rate of 9% over the past decade; there are prospects for decent jobs associated with the ICT sub-sector, as non-agricultural employment continues to rise across the country. With increasing uptake of mobile technologies, opportunities have emerged for the creation of SMEs, providing decent livelihoods for entrepreneurs. This is consistent with the nation's labour dynamics, which policy makers project that by 2025 employment in the agricultural sector will reduce, accounting for just 30% of total jobs, down from 64% in 2002 and 50% in 2014 (Morisset, 2015).

9. Digital Revolution and Decent Jobs in Kenya

Kenya is acknowledged as a cradle of the digital revolution in Africa, characterized by an emergent crop of skilled developers and programmers that operate in innovation hubs, incubators and accelerators across the country, leveraging information and telecom solutions to transform people's lives (Ndemo, 2016). The momentum for Kenya's digital revolution is traceable to two key developments: a paradigm shift in policy, focusing on the development of ICT

infrastructure, as well as the laying of the first fibre-optic submarine cable on the Eastern seaboard of Africa. Regarding the former, policy makers spurred the growth of ICT infrastructure, leveraging on ubiquitous mobile platforms to create applications, development of local content and human resource capacity, as well as embracing public-private partnerships. In respect of the latter, the fibre-optic cable heralded low-cost and easy access to mobile technologies, accompanied by the broadening of internet services. Also, broadband facilities were subsidized for universities, while entrepreneurs invested in start-ups, with access to high-speed internet (Ndemo, 2017).

Another element in Kenya's paradigm shift in favour of ICT development is the spurring of mobile learning solutions in primary schools critical to improving the quality of education and preparing pupils for a better future. On 30 September, 2016, Kenya launched a nationwide rollout of its Digital Literacy Programme, culminating in the distribution of over one million devices to more than 19,000 public primary schools by 2018. Under the initiative, some 19,000 teachers were trained to deliver digital learning content, with more than 89.2% of public primary schools supplied with the devices. The outcome has been impressive: rising school attendance, increasing pupils' alertness and resurgence of school admissions (International Telecommunication Union, 2018).

Indeed, Kenya has embraced the digital revolution in all sectors of the nation's economy. In the public sector, for example, e-government has emerged, providing solutions to previously burdensome manual processes, including the provision of a new national identity card or driver's license (Mangi, 2017). Digital healthcare has also emerged in Kenya, although the uptake is slower than in some other sectors of the economy. Such healthcare innovations as telemedicine, mhealth application and e-prescriptions are being leveraged for improved healthcare across the country, according to Mungi, 2017.

Perhaps, no other area of the Kenyan economy has reaped the digital dividend more than the financial sub-sector, with mobile-phone-based technology, M-Pesa, providing financial services across the country. M-Pesa is a low-cost, electronic money transfer product that allows users to store value on their mobile phones or mobile account in form of electronic currency (IMF, 2016). With M-Pesa, a tool for financial inclusion has been unleashed to capture the segments of the population that have been excluded from financial services. Kenya has emerged as a market leader in mobile-phone-based money, with an exponential growth, rising from zero to more than 75% of the adult population in less than 10 years. Banks have also taken advantage of

partnerships with telecommunication firms to expand their networks across the country as illustrated in Figure 6, which reveals a rise in bank branches, increasing from less than 600 in 2005 to more than 1,280 in 2014. This development is complemented by a sharp increase in Automated Teller Machine (ATM) services rising from about 1,200 in 2005 to more than 2,400 in 2014.

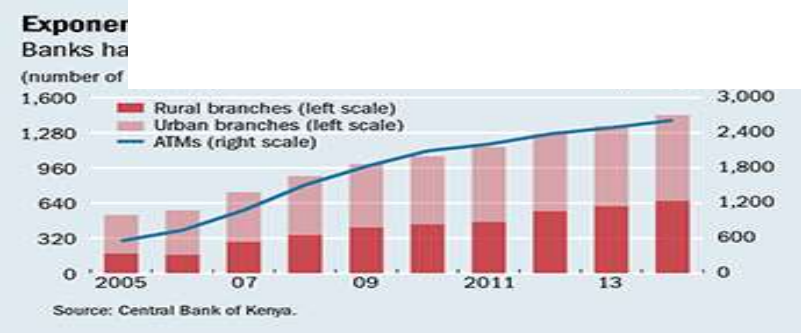

Figure 6: The Exponential Growth in Bank Networks in Kenya, 2005-2014.
Source: Central Bank of Kenya.

Driven by digital technology, more than 68,000 bank and mobile money agents are spread across Kenya, with about three-quarters of the population now living within 3 kilometers of a financial service point. Riding on the wave of the mobile payments platform of M-Pesa, new innovations in mobile banking, including Mshwari, KCBM-Pesa and Equitel, have delivered bank accounts to about 10 million people, who now enjoy savings and loan schemes (King and Heyer, 2016).
The impact of digital revolution in Kenya can be described as significant, with internet penetration increasing by about 25% between 2001 and 2016 alone, while firms in the machinery-electronics-transport sectors are leading the digital revolution. The development has spawned policies, formulating the government's 2030 vision to transform Kenya into a newly industrializing, middle-income country, providing a high quality of life to all its citizens by 2030 (Banga and teVelde, 2018).

Indeed, electronic payment has created a variety of jobs at different levels, including agents, master agents and super agents. The expanding network of agents has energized strong growth in mobile phone-based financial services. Sub-agents, supported by the telecoms companies, transform cash into electronic units of money, which are loaded into SIM cards. On the other hand, sub-agents serve in a given locality as liquidity distributors. Super agents are mainly involved in the purchase of floats from telecoms companies in bulk and

distributing them to sub-agents. The super agents include banks, micro-finance institutions (MFIs) or chain supermarkets. This development has triggered employment opportunities for several thousands of Kenyans (Ndungu, 2018).

10. Digital Revolution and Decent Jobs in Cote D'Ivoire and Kenya: A Comparative Analysis

The digital revolution in Africa is an emergent development issue, driven by ICT policy frameworks across the continent. Sub-Saharan Africa has embraced digital technologies as a key component of development policy and practice. Cote D'Ivoire and Kenya provide illustrations about the region's approaches to the digital revolution. While the two countries have adopted similar strategies in several ways, differences remain in national objectives and outcomes. The foundation of the digital revolution in Cote D'Ivoire is traceable to 1995, with the structural reform of the Telecommunications sub-sector while preliminary work actually began in 1991. The objective was to open up the industry to private sector participation and restore its productivity and competitiveness following its perennial management and control by the public sector (Kouadio, 2010). On the other hand, Kenya's ICT-driven digital revolution is traceable to various pieces of legislation, including the Kenya Communications Act of 1998, the Science and Technology Act, Cap 250 of 1997, as well as the Kenya Broadcasting Act of 1998. Also, the National ICT Policy (The Kenya Gazette, 2006) was part of the regulatory framework driving the nation's ICT policy (Waema, Adeya and Ndung'u, 2010).

The digital revolution in Kenya arrived early in comparison to several other African countries, driven by the deployment of submarine fibre-optic cables around Africa in 2010, ushering in an era of low-cost internet connectivity and broadband facilities for mobile devices (Ndemo, 2017a). In the case of Cote D'Ivoire, penetration of the internet and mobile phones was slow initially, constrained by political instability and civil war. However, over the past few years, with the restoration of political stability; the digital revolution is grounded in Cote D'Ivoire, underpinned by considerable penetration of low-cost internet connectivity, mobile phones, as well as 3G tele-communications services (GSMA, 2017).

There is considerable similarity associated with the digital revolution in the financial sub-sectors of both Cote D'Ivoire and Kenya, driven by the digital financial platforms that enabled millions of individuals to gain access to low-cost financial services. In Cote D'Ivoire, the digital revolution has driven financial inclusion, transforming people's lives

with mobile money services. By 2017, about 40% of the adult population owned a mobile money account (Riquet, 2018). Similarly, digital technologies have transformed the financial sub-sector in Kenya, driving up access to formal financial services in the nation, from 26% of its bankable population in 2006 to 67% in 2013. The introduction of mobile telephone technology and its proliferation in recent times have provided a platform for consumers to leapfrog access to financial services. The number of individual customers accessing mobile money facilities rose to 12.5 million by 2015 in Kenya (Muthiora, 2015).

Given the scope and depth of the emergent dividend associated with the digital revolution in both Cote D'Ivoire and Kenya, the implications for decent jobs are considerable. Apart from the financial sub-sector, digital technologies have also penetrated the educational, agricultural, health, as well as the sectors in both countries. While the digital economy accounts for more than150, 000 employees in Cote D'Ivoire, in Kenya, the prospects are even larger, with the deeper penetration of the international mobile devices creating opportunities for entrepreneurs, who engage in SMEs that provide livelihood opportunities for thousands across the country. A major segment of the population in both countries that stands to reap the dividend that accompanies the digital revolution is the youth. This development creates more opportunities for the youth to secure decent jobs that hold the key to sustainable development and national prosperity (Sawahel, 2018).

11.Conclusions

The digital revolution has risen since the late 20th century to transform people's lives across the world. An element of the fourth industrial revolution, the digital revolution is driven in large part by the internet and mobile telecommunication devices. The development has spawned innovations across the sectors of the economy, ranging from agriculture, healthcare, financial services and the manufacturing industry, among others. Africa has equally embraced the digital revolution, particularly over the last decade, with increased access to low-cost internet and considerable penetration of mobile phones. While Africa was largely by-passed by the first and second industrial revolutions; it has leap - frogged digital technologies to access products and services associated with the fourth industrial revolution. In some African communities, people's lives have been transformed from little or no access to modern technology to the possession of devices that drive the digital revolution, such as the mobile telephone. Sub-Saharan Africa has witnessed the digital revolution, with the transformation of its societies. The revolution is accompanied by

decent jobs created by SMEs, owned and operated by budding entrepreneurs. Cote D'Ivoire and Kenya are part of trends unfolding across the region. Both countries have witnessed the transformation of their financial sub-sectors, which have leap - frogged digital technologies for financial inclusion, transforming phone-enabled mobile banking services in the two countries.

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