



Digital Economy Impacts of NICTBB in Tanzania

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ABSTRACT: The National ICT Broadband Backbone (NICTBB) project was commenced in year 2009 to enable Tanzania to have a universally accessible broadband infrastructure and Information and Communications Technology (ICT) solutions that enhance sustainable socio-economic development and accelerated poverty reduction nationally, as well as to become a hub of ICT Infrastructure regionally and be a full participant in the global Information Society. The usage of ICT applications for sustainable socio-economic development including implementation of e-government, e-learning, e-health, and e-commerce have been enhanced at large following implementations of NICTBB. Therefore this paper access the digital economic impact in Tanzania and recommend what approach to be improved for Tanzania to makes into fully digital translations.

KEYWORDS: Digital economic; Digital technologies; NICTBB; NICTP; ICT

I. INTRODUCTION

The National ICT Policy (NICTP) 2016 [1] is a result of the revision of the National ICT Policy 2003 [2]. The NICTP 2003 has provided a national framework for ICTs to contribute effectively towards achieving national development goals and transform Tanzania into a knowledge-based society through the application of ICT [2]. This policy has facilitated the development of the Tanzanian ICT industry over the past decade and created a broad range of economic and social activities. These developments have led to job creation, enhanced productivity and efficiency that led to increased ICT contribution to the Gross Domestic Product (GDP) from 1.5% in 2004 to 2.4% in 2013 [1].

This policy has been implemented for a period of more than ten years, a period in which the industry has witnessed major technological changes. The government has been making efforts to accommodate these changes. These include introduction of Converged Licensing Framework (CLF), migration from terrestrial analogue to digital television broadcasting, putting in place a National ICT Broadband Backbone, extension of telecommunication networks to rural communities and financial inclusion through mobile money innovation [1]. One of the major initiatives that the government has pursued is the improvement of the ICT infrastructure to bridge the digital divide and lower the cost of communications.

Accordingly to [2], the policy has envisioned making Tanzania a hub of ICT infrastructure and ICT solutions in Eastern and Southern African region by launching the NICTBB project in year 2009. NICTBB was proposed to be implemented into four phases (1-5); Phase 1 initially started in Feb 2009 and completed in June 2010, while phase 2 started in August 2010 and completed in March 2012 [3]. Phase 1 and 2 provide 7,560 km of optical fibre cable which have been connected to 21 regional and some district towns. Phase 3 is partially implemented and phase 4 and 5 are not at all implemented. Phase 3-5 once implemented will connect all Tanzanian districts and villages. NICTBB constitutes three rings; Northern, Southern and Western optical fibre rings as shown in Fig. 1 and is land locked with neighbouring countries i.e. Kenya, Uganda, Rwanda, Burundi, Democratic Republic of Congo, Zambia, Malawi and Mozambique and is currently connected to two submarine cables (SEACOM AND EASSY cable) to provide international connectivity as per Fig. 2.

Currently, NICTBB is managed and operated by the Tanzania Telecommunications Corporation (TTCL Corporation) on behalf of the government, through the Ministry of Works, Transport and Communications. The NICTBB is operated as a wholesale business that is engaged in lease of capacity to Tanzania's licensed operators, i.e. Mobile network operators, Internet Service Providers (ISPs), local television and radio stations, Fixed Network, Fixed Wireless Voice and Data Service Providers. Services offered (on wholesale) include STM-1 (155 Mbps), STM-4 (620 Mbps), STM-16 (2.5 Gbps), STM-64 (10 Gbps), FE (100 Mbps) and GE (1000 Mbps) [4]. All service providers have the right to use these capacities and all (including TTCL) are supplied on the same basis and also are able to resell them to the Internet service providers who provide Internet services to consumers. These service operators in Tanzania who have been connected to NICTBB are TTCL; Airtel; Tigo; and Simbanet.

One major achievement that the NICTBB has successfully met is providing cheap and fastest data connection to the people of Tanzania something that was a dream to many Tanzanians and organisations. Call rates have now been



lowered to a big percentage beyond people’s expectations. Many people in the country are now familiar with technology and are using the internet to obtain important information and to do business. This has motivated a number of investors from different parts of the world to come and invest in ICT and telecommunication sectors in Tanzania.

In addition, NICTBB helps to fulfil the increasing demands of information services, strengthen competitive abilities of domestic data and voice operators as well as bridging the digital divide. It is necessary in developing high speed broadband and helps to efficiently exploit the benefits from undersea submarine cables landing in Dar es Salaam by providing high quality capacity fibre optic connectivity from Tanzania to within Africa and the rest of the world. NICTBB is redefining everything that we know in e-government, e-learning, e-health, e-commerce, etc.

Two critical events that have had a large impact on the Tanzanian ICT sector by increased broadband connectivity are: the launch of the National ICT Broadband Backbone (NICTBB); and the linking it to the SEACOM and Eastern Africa Submarine Cable System (EASSy) [5]. The implementation of the NICTBB was also acknowledged in the National Development Vision 2025, for its importance in enabling ICTs to accelerate achievement of the goals and objectives of the National Development Vision 2025: National Economic Growth and Poverty Reduction Strategy [6]. As a result, NICTBB represents the beginning of a new era of connectivity for the Tanzanians, promising greater international bandwidth, more reliable connectivity and sustainable economic development. This to a large extent has contributed to the economic development of the nation as well as social development.

Therefore this paper assess the digital economic impacts in Tanzania following implementation of NICTBB and recommend what approach to be improved for Tanzania to ensure that the national backbone facilitates the transformation of Tanzania into an ICT-enabled knowledge-based economy as per [1].

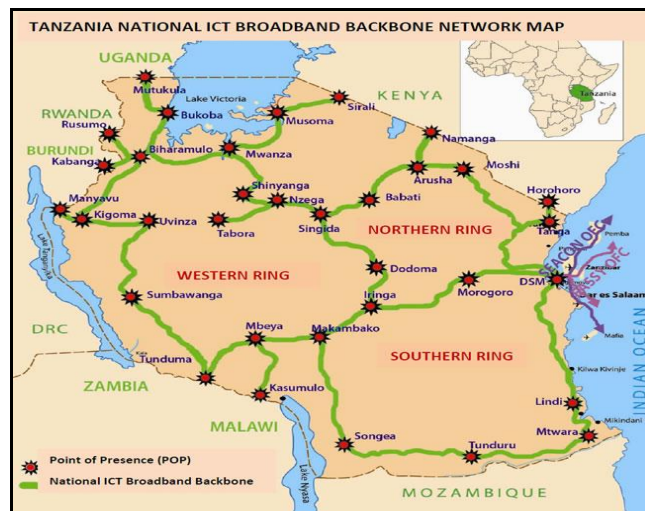


Fig. 1. Tanzania National ICT Broadband Network

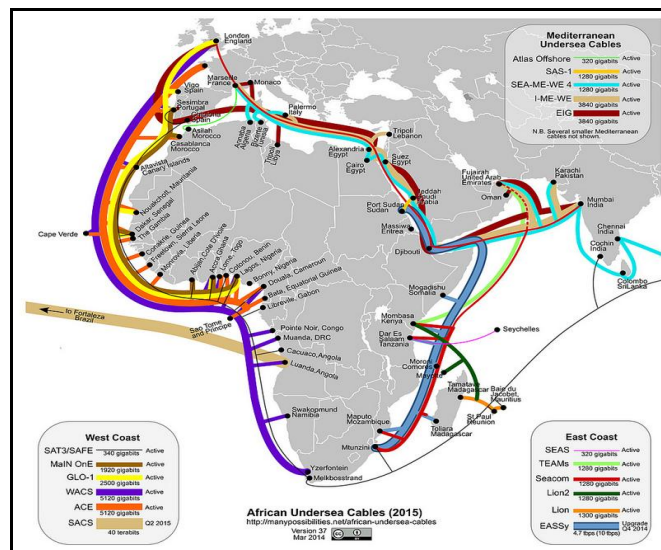


Fig. 2. African Undersea Optical Fibre Cables



II. RELATED LITERATURE

The national ICT policy 2003 [1] recognized two dimensions of the ICT sector: the growth of the sector itself and ICT as an enabler of other sectors. The first dimension captures the reality that how the ICT grows in terms of speed and pattern matters in influencing what it can do to facilitate growth and to reduce poverty. The second dimension recognizes that the ICT sector plays an important role in facilitating all other sectors of the national economy through providing Telecommunications infrastructure and services to allow fast information flow, exchange and sharing amongst customers for increased efficiency and productivity.

In line with the above ICT sector dimensions, the National ICT backbone (NICTBB) is portrayed as part of core digital ICT sector under Telecommunications infrastructure as depicted in Fig. 3 [7]. This means that the ICT sector provides the digital economy that is the global network of economic and social activities that are enabled by information and communications technologies, such as the internet, mobile and sensor networks. As ICT sector encompasses both the core digital sector and the broader range of extensive digital activity to contribute the digital economy. It is also noted that the digital economy consists of the digital sector plus emerging digital and platform services; and the narrow scope, is the use of ICTs in all economic fields, referred to as the ‘digitalised economy’.

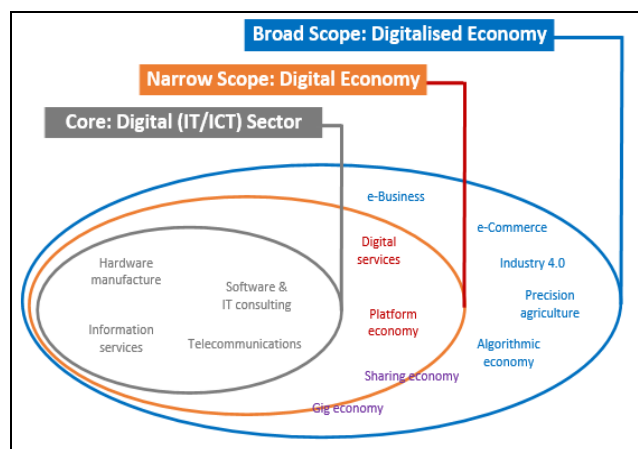


Fig. 3. The Digitalised economy [8]

This broad-scope definition of digital economy covers e-business (ICT-enabled business transactions) and its subset, e-commerce (ICT-enabled external business transactions), algorithmic decision-making in business, use of digitally-automated technologies in manufacturing and agriculture including Industry 4.0 and precision agriculture, etc. In summary, the digital economy represents all extensive applications of digital technologies plus the production of those digital technologies as illustrated in Fig.3. Also, according to [8] the true digital economy is the part of economic output derived solely or primarily from digital technologies with a business model based on digital goods or services.

It is noted that, the European Commission [9] defines the digital economy as “an economy based on digital technologies.” Whereas, the World Economic Forum [10] and the Group of Twenty (G20) [11] define the digital economy as “a broad range of economic activities comprising all jobs in the digital sector as well as digital occupations in non-digital sectors”. These include activities that use digitised information and knowledge as the key factor of production; modern information networks as an important activity space; and ICT to drive productivity growth and optimise economic structures. The digital economy has enabled fast revenue growth for many firms; encouraged the shift from tangible flows of physical goods to intangible flows of data and information; enabled firms in developing economies to connect across borders; and has thus facilitated a surge in cross-border data flows.

The digital economy also includes paying for goods with your debit or credit card at the store, or when your doctor receives your pathology results electronically. For businesses, the digital economy can provide opportunities to engage more efficiently with suppliers, and expand and better serve their customer base. The digital economy can also refer to lecturers posting course outlines, study materials and even lecture videos online for their students. It includes the ability to collaborate and participate through online photo or video sharing sites, and the use of sensor networks to monitor water levels or traffic flows. Digital economic spreads across all industry sectors [12], for example, in the mining industry, sensor technology and autonomous remotely operated mining processes are being trailed to improve efficiency and lower production costs. The digital economy also permeates all aspects of society, influencing the way people interact and bringing about broad sociological changes.

There is significant promise that the digital economy will boost economic growth, raise productivity of capital and labour, lower transaction costs and facilitate access to global markets in any developing countries. Digital engagement can also boost productivity. It can bridge distances and improve service delivery for regional and rural areas. In addition, it can improve educational and health outcomes allow for better management of the countries growing and



ageing population, promote social inclusion and facilitate more environmentally sustainable better management of the built and natural environment.

Furthermore, the digitization of the economy creates benefits and efficiencies as digital technologies drive innovation and fuel job opportunities and economic growth. The driving forces behind digital economy are economic and political, but they of course also have roots in technological innovation. For example in the 1990s, economic changes were associated mainly with emergence of the Internet, and this remains a foundation for growth of the digital economy. But during the 2000s and 2010s a succession of new information and communication technologies (ICTs) has diffused and underpinned economic change. This includes the embedding of connected sensors into more and more objects (the Internet of things); new end-user devices (mobile phones, smart phones, tablets, notebooks, laptops, 3D printers); new digital models (cloud computing, digital platforms, digital services); growing intensity of data usage through spread of big data, data analytics and algorithmic decision-making; and new automation and robotics technologies [12]. Arising from these technologies is a set of digital affordances: potential actions an individual or organization with a purpose can undertake with a digital system within the context of the environment within which they function [8]. These include datafication (an expansion of the phenomena about which data are held), digitisation (conversion of all parts of the information value chain from analogue to digital), virtualisation (physical disembedding of processes), and generatively (use of data and technologies in ways not planned at their origination through reprogramming and recombination) [13]. Accordingly to [12], it was noted that the digital economic is also driven by smart technology that helps change the behaviors and manage of critical infrastructures in such ways that benefits the environment. It can also make use of scarce natural resources like water more efficient and reduce energy demand.

Digital Economy has gained substantial importance within the global economy as a driver of innovation and competitiveness. As digital economy become the cornerstone of our daily activities, Governments, businesses and individuals must adapt to this new reality. Going digital is no longer simply part of how we conduct our day-to-day activities but the bedrock of our economic growth. Economies around the world are steadily harnessing the benefits that digital technologies offer to replace and streamline traditional systems and processes, increase efficiencies and productivity and develop new markets and revenue streams. For example in Australia, the adoption of smart technology in energy, water, health and transport, and the roll-out of high-speed broadband is estimated to add more than 70 000 jobs to the Australian economy and 1.5 per cent to the level of Australia's Gross Domestic Product within a few years [14].

The Digital Economy is growing faster than overall economies in developing countries, as evidence shows that information and communications technologies (ICTs) account for 17% of GDP growth in developing countries [15]. The fastest growth of e-commerce is in the global South [16] and the Internet economy in developing economies is growing at 15-25% annually" [17], for example in Kenya, the value of the ICT sector expanded by 12.9% from 2017 to 2018 driven by growth in the digital economy [18]. Similarly in Tanzania, during the second quarter of 2019 the county's GDP grew by 7.2%, whereby ICT sector contributed to 10.3 percent of GDP. The ICT sector was the third fastest growth after construction (19.6 percent) and mining (17.2 percent) [19].

With all that said, Tanzania intends to implement Digital Tanzania Project (DTP) to increase access to affordable, high quality internet services for government, businesses and citizens and improve the government's capacity to deliver digital public services [20]. This project will further accelerate digitally driven economic and social development in the country. Likewise in Kenya, the government has developed a digital economy blueprint in year 2019 that is aimed to tap into the unique opportunities that will spur the unlocking of the benefits of the digital economy potential and guide the transformational journey espoused by new and emerging digital technologies [18]. On the other hand in Europe, The European Commission adopted its Digital Single Market strategy for Europe in 2015, highlighting it as one of its political priorities. The strategy will create digital opportunities for citizens and businesses and aims to strengthen the EU's position as a world leader in the digital economy. It aims to increase access to information, lead to jobs for those with the right digital skills and transform public services [21].

III. METHODOLOGY

A case study research method is used to analyze and gain in-depth understanding of the digital economic impacts of national ICT broadband backbone (NICTBB) in order to meet the research objectives. Questionnaire and unstructured interviews were chosen as a data collection instruments whereby questionnaire was distributed to collect information's related to research questions from households/ individuals, who live in urban and rural areas of the major city of Tanzania i.e. Dar es Salaam, Mwanza, Arusha, Dodoma, Moshi, Morogoro, Mbeya and Iringa. Similarly, unstructured interviews were selected to extract primary data from senior officers in public and private organizations that are connected with NICTBB. A purposive sampling technique was applied to select senior officers from various public and private organizations for interviews. Similarly random sampling technique was used to select households/individuals from rural areas to participate in this research study.

In addition to the questionnaires and the unstructured interviews, a review of the literature from the above organizations and other sources, for example: newspapers, ICT journals, copies of letters, minutes, meetings and



websites, as well as observation from site visits was undertaken to supplement information collected through interviews. Quantitative and qualitative data analysis was applied in this study to analyse primary and secondary data so as to understand the above phenomenon. Coding was done in order to ensure whether the response categories were appropriately classified and exhausted to the problem under the study and arrange data collected according to group or classes they base on the basis of their common characteristics. Tabulation was done to arrange data in logical order so that to facilitate data comparison and analysis.

IV. DIGITAL ECONOMIC IMPACTS OF NICTBB

A. PROVISION OF BACKBONE AND LAST MILE BROADBAND CONNECTIVITY

The NICTBB is operated and managed by the Tanzania Telecommunications Corporation (TTCL), which provides a wholesale capacity of the high-speed data streams i.e. Synchronous Transport Module-STM-1 (155 Mb/s), STM-4 (622 Mb/s), STM-16 (2.4 Gb/s), and STM-64 (10 Gb/s) to Tanzania licensed operators, notably Mobile Network Operators, Internet Service Operators (ISP), Local television and Radio Stations, Fixed Network, fixed Wireless Voice and Data Service Operators. With this means NICTBB enables last mile connectivity to 150 Local Government Authorities (LGAs), 150 District Hospitals, 121 Police Stations, 65 Post Offices, and 25 Magistrates' offices for improving public services delivery. In addition, NICTBB provides a backbone and last mile connectivity for the Government Communication Network (GOVNET) that facilitates communication across the Government, whereby more than 150 Public Institutions are connected. With this way, the GOVNET has reduced at larger the Internet costs as well as eased the sharing of resources within the Government such as: Centralizing and share some common Government Applications; Keeping privacy and integrity and sharing of government ICT applications and related data between relevant Institutions; Establish and providing reliable and high capacity voice intercommunications between institutions; Establish video conferencing between institutions; and Optimal and efficient use of the existing public infrastructure.

Furthermore, NICTBB connects 28 Higher Education and Research Institutions (HERIs) with last mile Internet broadband connectivity for the purpose of enhancing knowledge sharing and improvement of research capability. Similarly 455 secondary schools have been connected to the NICTBB to enhance learning process for teachers and students across the country.

B. INCREASED VOICE AND INTERNET SUBSCRIPTIONS

In order to bring more flexibility to the NICTBB services, and align the bandwidth capacity to those of the international market. The Indefeasible Right of Use (IRU) pricing was developed and released in 2012 [22]. With IRU terms, the purchaser pays upfront for the whole contract sum for services at the beginning of the contract; the short contract term is 10 years. Accordingly to the report, the bandwidth capacity costs is reduced from a range of US\$ 107.14 to US\$ 23.14 per month for leasing a monthly STM capacity based on a 10 year contract. Bandwidth capacity cost is much less when the STM capacity is leased for a longer contract (i.e. 15 or 20 years). Hence using this pricing model the bandwidth capacity cost per annum in the year 2010/2011 was significantly reduced by more than thirty percent (30%) in 2012. This shows that, since implementation of NICTBB and its connections to the submarine optical fibre cable; the capacity bandwidth costs for leasing STMx to telecomm operators is much lower and will be reduced further in the coming years.

In addition, the International bandwidth cost has been reduced dramatically from \$1,500 per Mbps to \$180 per Mbps [14] that is equivalent to an eighty eight percent [88%] reduction. Due to the decrease of the above costs, the NICTBB has facilitated the dramatically increase of voice subscriptions from 17,642,408 in 2009 to 44,798,361 in Dec 2019 [23] (Fig. 4), which is equivalent to 61% increase. Similarly Internet services have increased from 4,378,392 users in 2009 to 23,142,960 users in Dec 2019 [23] (Fig. 5), which is equivalent to 81% increase.

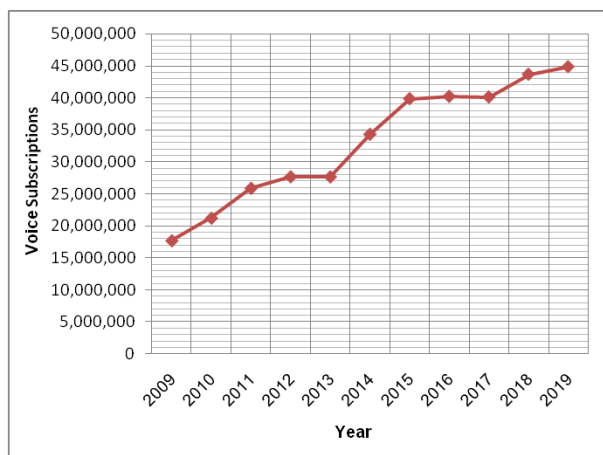


Fig. 4. Voice Subscriptions from year 2009 to 2019

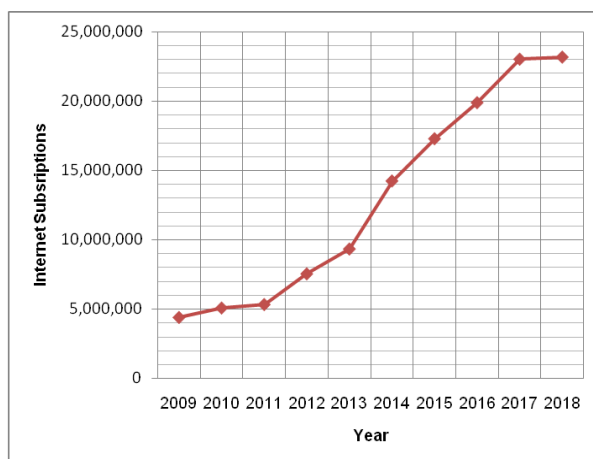


Fig. 5. Internet Subscriptions from year 2009 to Dec 2019

C. PROVISION OF E-GOVERNMENT SERVICES

In Tanzania there is the e-Government Authority (e-GA) [24] which was established in 2019 to coordinate, oversee and promote e-Government initiatives as well as enforce e-Government related policies, laws, regulations, standards and guidelines in public institutions. e-GA is a succeeding institution to e-Government Agency which was a semi-autonomous institution established in 2012 with the mandate of coordination, oversight and promotion of e-Government initiatives. The Agency became operational effective in April 2012 and officially inaugurated in July 2012 and ceased after seven years of operation.

With the support of eGA, public institutions in Tanzania have implemented various information systems and connected them to NICTBB, for example at Muhimbili National Hospital-MNH (a referral hospital), a telemedicine system has been implemented and connected to eighty (8) regional/districts hospitals by the use of NICTBB. This facilitates doctors in other regional/remote areas to call in the help of specialized doctors at Muhimbili hospital so that to give the right diagnose and decides upon the right course of treatment. Similarly at the Registration, Insolvency and Trusteeship Agency, the Birth and Death Registration System (BRS) system is implemented and connected by NICTBB to nearly 30 branch offices and other 60 sites (i.e. hospitals, health centers, and wards) in the country. This System registers birth and death registration to the most part of Tanzania, whereby it enables all newborn children to be registered within 90 days of their birth.

Also at the Ministry of Lands, Housing and Human Settlements Development (MLHSD), Integrated Land information systems (ILMIS) has been implemented and connected by GOVNET (NICTBB platform) to other five Municipalities land office in Dar es Salaam for the purpose of providing affordable, secure and reliable electronic land administration services for the customers. In the second term of the project, this system will be extended to regional and districts land offices in the whole country by the use of NICTBB. Furthermore, there are many more information systems in other public institutions such as Unified National e-Procurement, Business license online registration system, e-Passports application, e-Records, e-Office, e-Ticketing, etc, which are also connected by NICTBB for the purpose of providing public access throughout the country.



However there are some government institutions whereby citizens are still required to visit their office physical in order to complete the transactions. This is inconvenient and costly for many citizens, since many citizens have to travel for long hours, as well as spend a lot of money to reach the respectively office. At the same time, government institutions use many employees to serve the customers as well as maintain much larger waiting areas for their customers. With this concern, government law has been endorsed in year 2019 to enforce the government's use of information and communication technology (ICT) in all public institutions to support increased public sector productivity [25].

D. AVAILABILITY OF MOBILE FINANCIAL SERVICES

Mobile Financial services is the use of mobile phones in accessing financial services offered by communication companies such as Vodacom, Airtel, Tigo, Zantel and Halotel, and commercial banks offering mobile banking (e-banking) services. Mobile phones have made a positive contribution to the financial services sector in facilitating the inter-branch and inter-bank settlement systems and money transfer services. As of Dec 2019, the use of mobile money subscriptions has increased to 25,864,318 million users as shown in table 1 below [23], which is equivalent to more than 58% of Tanzanian; this ranks Tanzania among the top countries in the world in the use of mobile financial services.

The dominant mobile money service is Vodacom's M-Pesa service; with have the largest number of mobile money subscribers in Tanzania as per Fig.6, which is equal to 39% in comparisons with other mobile subscribers as shown in Fig.7. The financial services are transferring in excess of 20 billion Tanzanian shillings per month with a very specific pattern of transfers mainly between major towns to villages hence reaching out where the banking networks cannot reach and at a lower cost compared to the traditional services. Furthermore, the Tanzanian government through the Ministry of Finance has developed Government Electronic Payment Gateway (GePG) which connects to all available electronic revenue collection channels for the process of facilitating electronic money transactions from the public to the Government and vice versa. Development of GePG has enhanced control and visibility of the government funds and also has increased the government revenue. This means that Digital technologies have enhanced the financial sector and significantly increased financial inclusion as well as opening up the possibilities of new business models and opportunities in Tanzania such as SIM Banking, Mobile Money, Digital credit, etc.

Table.1. Mobile Money Subscriptions

Operator	October	November	December
Airtel Money	4,728,128	4,939,677	5,180,560
Halopesa	1,528,295	1,265,866	1,614,540
Smile	0	0	0
Tigo Pesa	6,934,780	7,006,294	7,802,996
TTCL	618,209	669,407	712,475
M-Pesa	9,822,889	9,991,443	10,168,290
Ezzy Pesa	325,513	390,417	385,457
Total	23,957,814	24,263,104	25,864,318

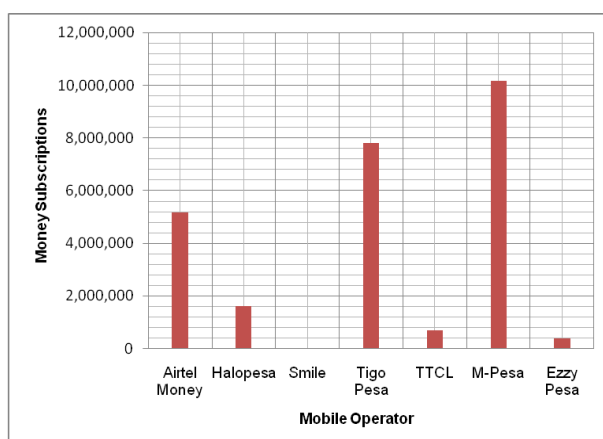


Fig. 6. Mobile Money Subscriptions

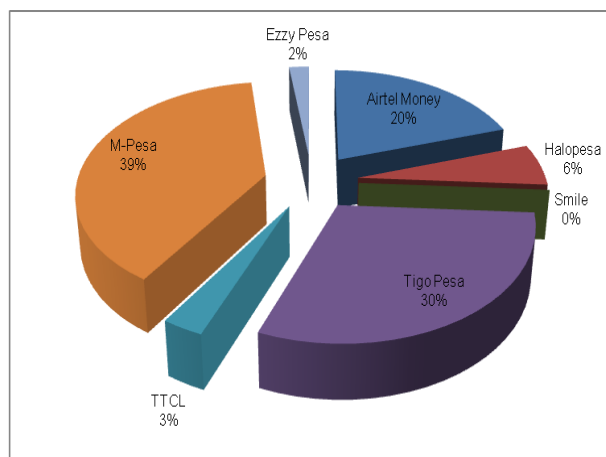


Fig. 7. Mobile Money Subscription Percentages

E. DIGITAL PARTICIPATIONS FOR TANZANIANS

The numbers of Tanzanians that connect to the Internet from home by the use of Laptop/Android phones have been increased following interconnections of major mobile operators such as Vodacom, Airtel, TiGO and TTCL-mobile to the National ICT backbone (NICTBB). As a result easy access to business and job opportunities, health, education, social media marketing and government services from majority of Tanzanians have been possible. With this perspective, digital participations for Tanzanian have contributed to social and personal benefits such as access with Instagram; face book; Twitter; Whatsapp groups; and etc. For example, Tanzanian entrepreneurs have managed to conduct their existing business processes more efficiently by the use of socio media tools such as Instagram and whatsapp groups.

In addition, the increasing availability of ubiquitous NICTBB connections and the establishment of an effective online presence have allowed Tanzanian businesses, particularly SMEs and other business individual to participate digital in a global marketplace. Hence, greater uses of online opportunities have enabled Tanzanian businesses/SMEs to maximize their overall competitiveness, grow revenues and increase productivity. It also has spurred new business processes and innovations that drive Tanzanian's future economic growth.

F. DIGITAL EDUCATION

The availability of ubiquitous, high-speed broadband connections from NICTBB has enhanced the quality of education services, particularly in both urban and rural areas thereby facilitates students and learners, who cannot access courses via traditional means, the opportunity to use online virtual learning. Similarly, during this period of Covid-19 Pandemic crisis in Tanzania, whereby all schools and University have been shutdown, NICTBB supports schools, colleges, higher education institutions and universities in Tanzania to make possible for education materials to be accessed by students at home. Whereby study notes are posted online through digital learning systems as well as video conferencing facilitating teachers/lectures to teach or conduct online discussions with students. Despite these efforts, Tanzania government is still investing more in the Digital Education so as to provide access to support teachers and students to use digital technologies.

V. CONCLUSION

The NICTBB so far have offered broadband coverage, which allows most Tanzanians who lives in urban areas to participate partially in the digital economy. However, the key elements to a successful digital economy are a Government that is digitally aware and enabling; business/industry that is digitally confident, innovative and skilled; and a community that is digitally empowered and literate. Thus developing Tanzanians digital economy requires action by government, ICT business/ industry and the community as a whole. Thereby, the Tanzanian Government's primary role in developing the digital economy is that of an enabler-enabling individuals, households and business/industry to take up the opportunities the digital economy offers. In its role as enabler, the Tanzanian Government has implemented NICTBB, facilitated innovation and setup a conducive regulatory framework. However, industry and the community need to take the lead to realise the full potential of Tanzanian digital economy. Hence, besides NICTBB implementation, Tanzania will successfully makes into fully digital translations when the efficient use of ICT has become so intervention with business/industry and the Tanzanian community in general.



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BIOGRAPHY

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