

Global Utilization of ICT Services in the Fight against COVID-19: The Gains and Way Forward for the Nigerian Economy

Njoku, D.O.¹, Nwabueze, C.E.¹, Chilaka, U.L.², Agbakwuru, A.O.³

¹Department of Computer Science, Federal University of Technology, Owerri, Nigeria

²Department of Computer Science, Ebonyi State University, Ebonyi, Nigeria

³Department of Computer Science, Imo State University, Owerri, Nigeria



Abstract – The increasing number of COVID-19 cases around the world has subsequently triggered surge in the demand for Information and Communication Technology (ICT) to give “life” to the global economy and keep people together despite the physical separation as a result of the lockdown policy of various countries. This paper has studied the essential support provided by ICT in the global action taken to contain the spread of the COVID-19 pandemic with specific focus on the gains and opportunities for Nigerian economy afterward. It considered the role ICT has played in enabling health experts to share their experiencing and collaborates on medical research findings in the fight against COVID-19. The social care supports through the use of social media platforms, machine learning systems, and others provided by ICT to keep people safe and sustain social distance and contact tracing policies of the various governments and their agencies were considered. The use of ICT tool in by world governments and their respective agencies to raise fund, hold meetings and strategise in winning the fight against the pandemic has been considered. With the use of ICT, remote teaching and learning as well as job interviews and business were sustain activities via online interaction and thereby enabling the educational sector and the global market to be relatively busy and lively. The Nigerian economy also recorded significant gains by leveraging ICT sector especially the contribution of the market to the GDP during the first quarter of the year. The gains achieved notwithstanding, Nigerian government and stakeholders in the ICT sector should implement policies to encourage its population to embrace digital economy as the normal way of life around the world. It should also ensure to grow the ICT market of the country to reduce over dependent on imported parts and other technologies by sincerely pursuing, encouraging and supporting Research and Development (R&D) by collaborating with Universities to fund postgraduate educations especially in the field of science and engineering.

Keywords – COVID-19, Economy, ICT, Nigeria.

I. INTRODUCTION

In December 2019, the Chinese government began to battle with a cluster of pneumonia cases from an unidentified virus that surfaced in Wuhan. The disease was named Coronavirus disease 2019 (COVID-19) according to initial laboratory findings. COVID-19 was described as an infectious disease which is caused by Severe Respiratory Syndrome (SAR) Coronavirus 2. The World Health

Organisation (WHO) declared a public health emergency related to COVID-19 on January 28, 2020 [1]. With increasing number of cases globally, a pandemic was declared by WHO on March 11, 2020. The declaration of COVID-19 as a pandemic caused the economy of nations all over the world to suffocate as economic activities were brought to standstill.

Obviously, there was complete halt in economic growth and developmental pathways occasioned by the stringent measures such as lockdown which were taken by some nations globally to contain the spread of the disease. This consequently affected income with more adverse effect on the vulnerable (poor) populations in developing countries. The health crisis caused by COVID-19 has resulted to scarcity in food supply, losses in employment, livelihood, income, and payments. This goes to show that COVID-19 pandemic is well beyond health hazard and human consequences. The economic uncertainties and disruptions of goods and service delivery have led to a significant cost to global economy. However, a consolation has been taken by most central banks, finance institutions and ministries, and independent economic professionals around the globe based on the prediction that impacts of the COVID-19 pandemic might be sharp but brief, and thereafter economy activities will return to fullness. This is yet to be seen.

With the confirmation of the first case of COVID-19 in commercial city of Lagos, the memories of the fears triggered 6 years ago by Ebola epidemic were stirred all over the country. As one of the developing economies, the chances of sliding into a recession are steadily being anticipated as the outbreak of the pandemic continues to put pressure on Nigerian economy. The impact of the dreaded corona virus, it was believed, can deal a serious blow to the already fragile economy of developing countries like Nigeria even before the outbreak. With the dwindling revenue of the government due to decline in global oil market which the Nigerian economy largely depends on and the introduction of lockdown (in form of full or partial restriction on movement) by the Federal Government of Nigeria (FGN) in Lagos and Ogun states as well as the Federal Capital Territory (FCT), Abuja, movement, commercial and social activities were brought to halt. This was further intensified by sub-national governments who quickly followed suit by imposing lockdowns in their states [2].

Since the lockdown was meant to reduce the spread of the virus through physical contact, the global economy has taken the advantage of Information and Communication Technology (ICT) infrastructure in providing health and social cares, remote sensitization and awareness campaign on the reality and impact of the pandemic on the economy. Governments of nations from time to time brief their citizens using various channels of electronic media. Various social media platforms were used to keep friends and family together, to sustain businesses by public and private institutions. In fact ICT became the life line holding whatever remains in the world economy. Therefore, there is need to

examine the influence of ICT on Nigerian economy during the COVID-19 lockdown and its improvement and inclusion capacity after the economy resumes in earnest.

II. ICT AS A LIFE LINE FOR GLOBAL ECONOMY DURING COVID-19

According to International Data Corporation (IDC) as in [3], the outbreak of the COVID-19 pandemic would make the ICT sector of the Chinese economy to face both opportunities and challenges. The virus which was first reported in Wuhan, China, in late December has spread to many other regions around the world, which has resulted to shutdowns in major religious and cultural activities. Also food services, small businesses, entertainment, tourism, and education have been close down with many other businesses postponed with no date of resumption insight. The emergence of the pandemic did not only affect social economic development and daily living, but has also taken toll on the Chinese and world economy, and as well as the ICT market [4]. Also, in developing countries like Nigeria, where law enforcement agencies do not live up to their responsibilities, there was anxiety that available ICT infrastructure in the country can be destroyed due to the rumored effect of the 5G network linking it to the cause of COVID-19. An illustration of global action on the prevention of the spread of COVID-19 is shown in Fig. 1

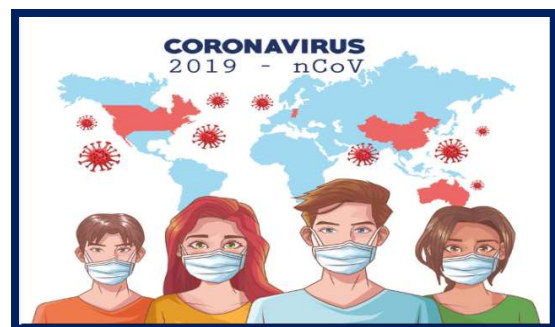


Fig. 1 Illustration of COVID-19 prevention globally [5]

There is overwhelming fear that the increasing cases of COVID-19 in Nigeria will affect the overall economy with the ICT market impacted due to the greater role it plays today in the Nigerian society. For instance, a report by IDC stated that the macroeconomic disruption caused by the outbreak of COVID-19 was expected to significantly affect ICT sector of the Chinese economy and slow it down by approximately 10% at the first quarter of 2020 [3]. Comparing the Nigerian ICT market that largely relies on importation with China's ICT market that is to a great extent autonomous, the level of impact will be enormous. Nevertheless, there are huge opportunities for the ICT market in Nigeria due to the

growing number of contactless business and services across the country –including local and international trading.

In order to critically examine the position of ICT during the COVID-19, the following subsections outline the role of ICT within the health care, social care, global and government agencies, education sector, and agriculture sector.

2.1. ICT Services in Health Care

On March 13, 2020 a video conference was held between health officials and professionals from China and their counterparts from 17 Central and Eastern European Countries (CEEC) on the prevention and control of the COVID-19 pandemic. An illustration of the digital session is shown in Fig. 2.



Fig. 2 Digital meeting of Chinese and Lithuanian health experts [6]

Similarly, on March 19, 2020, Chinese and African health experts held a video conference session hosted by the Africa Centres for Disease Control and prevention (Africa CDC). The aim of the digital/online meeting was for the Chinese medical experts to their share experience and knowledge so as to educate members of the Africa CDC on how to manage the situation across the continent. The video conference of the meeting is shown in Fig. 3.

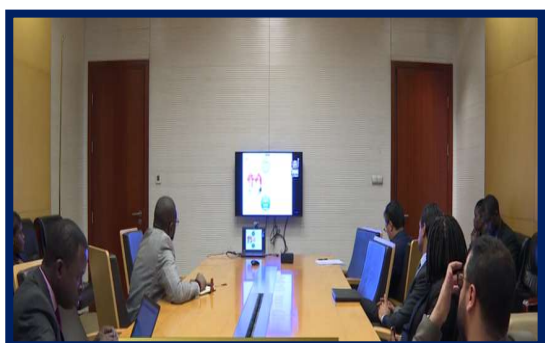


Fig. 3 Online session between Chinese and Africa health experts [7]

The Chinese officials expressed their country readiness to provide advice and consultation where necessary on the corona virus and the treatment and prevention methods used in handling the disease.

Also in Africa, a webinar was organized on May 15, 2020, by the Joint United Nations Program on HIV and AIDs (UNAIDS) for Chinese medical experts and health experts from Uganda and South Sudan to share their experience of responding to the COVID-19 pandemic. Figure 4 shows the digital session. At the opening of the online meeting, the UNAIDS Regional Director for Eastern and Southern Africa submitted that the corona virus was not only challenge affecting the health sector but has the potential to take the global economy back by many years.



Fig. 4 Video session of China, Uganda and south Sudan health experts [8]

In their response, the acting chairman of South Sudan Doctors' Union and the president of the Uganda Medical Association described the session as a unique and important opportunity to learn from frontline medical expert from China on how to handle the pandemic. On the Chinese part, the chief medical epidemiologist of the China Centre for Disease Control and Prevention (China CDC) used the meeting to make known the strict measures taken by the Chinese government to stop the spread of the disease. Responding to various questions, which includes the creation of a herd immunity to stop the spread of the disease, the Chinese expert offered two options including, a) exposing the population to the virus, and b) development of vaccine. The first option was said to have the potential of severe cases including fatalities while the second option was said to be the ongoing approach and may be ready at the end of the year. This meeting actually came shortly after similar one organized on April 18 with the Kenya Medical Women Association.

One area of ICT in healthcare in the fight against the spread and the treatment of coronavirus is the use of remote healthcare and patient monitoring technologies that are being

used by medical personnel to fight the pandemic globally. For instance, in Israel several remote healthcare and patient monitoring systems were used to contain the pandemic such as [9]: a) a clipboard-sized sensor which can be embedded in a mattress to monitor sleep, critical signs, and motion, to assist health personnel in early detection of patient declining health status developed by EarlySense. b) Speech analysis technology was adapted to provide remote monitoring and diagnosis of the COVID-19 status of patients based on voice samples. This technology is developed by Cordio Medical. c) A voice-based test study launched by Vocalis Health, was used to triage, screen and monitor for symptoms of the novel corona virus and others developed by some tech giants.

2.2. ICT for Social and Commercial Care Services

Exploiting the advantage of social media platform to reach out to many people, several medical experts used Facebook, Whatsapp, twitter and others to reach out to people during the COVID-19. For example, the Autism Society of America launched a Facebook live series aimed at providing appropriate COVID-19 information for Autism community. The series is every week and is expected to discuss particular subject matters such as mental health, federal emergency funding, and continuing education at home [10]. In order to debunk some of the fake information being spread about COVID-19 and provide the correct facts from medical experts and current knowledge of the disease, the Kennedy-Lugar YES Alumni Association of Nigeria (YAAN) started an online campaign led by members who are health experts by conducting live Question and Answer (Q/A) sessions on their Facebook page [11]. According to YAAN, the campaign which began on April 1st has all three live streams on its page proven to very success and appreciated by the Nigerian public. Figure 5 shows a flyer of the sessions on Facebook.



Fig. 5 Facebook session in Nigeria

Over 150 active alumni participated and shared the post on their personal social media accounts to continue spreading the

right information on COVID-19 to as many people that can be reached in a language they can understand.

As a key towards fighting many diseases, contact tracing mobile apps is being developed by app developers to track the novel coronavirus. There is ongoing work to boost the efforts of human disease detectives, who by finding and interviewing contacts of those infected are able to track the virus's spread. Mobile phone data could widen the extent of contact tracing by making the process automatic [12]. However, the challenge to these apps is privacy. Bluetooth can offer privacy features since the technology measures the proximity of a user to contagious people. While the Global Positioning System (GPS) data reveals the physical locations with a centralized server and can more easily point back to individual users [12].

An infectious disease expert at Oxford University, who researches digital contact tracing, stated that their contact tracing mobile app can halt the spread of the epidemic if nearly 60% of the U.K. population uses the app. Globally various mobile apps to aid contact tracing in the fight against the spread of the COVID-19 pandemic are being rollout. A report credited to Singapore official, has it that in mid-April, an approximately one-fifth of populace downloaded the TraceTogether app of the country just a month after it was made public. In Australia, COVIDSafe app was released for the citizens to download. In North Dakota, United States, Care19 mobile app is used to trace persons that have come in contact with corona virus infected person. It is reported that 25,000 persons have downloaded the app since April 7, 2020. Figure 6 is an illustration of contact tracing in the fight against the spread of COVID-19 using mobile phone app.

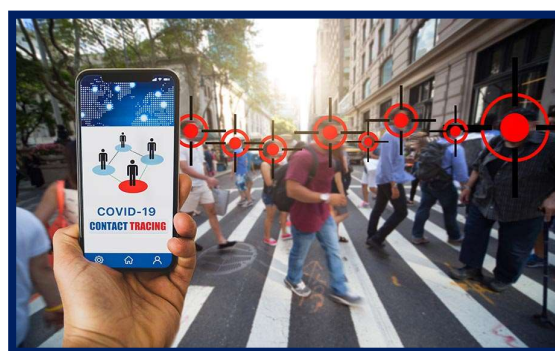


Fig. 6 Contact tracing using mobile app [13]

Google and Apple created an app to help people know their risk of being exposed to person who has been infected by coronavirus. The app augments the effort of human disease detectives using contact tracing. It begins with Exposure Notifications on user's smartphone, which enable contact tracing apps to send notification to the user if he has

likely been exposed to COVID-19 [14]. Figure 7 shows how the Exposure Notification System (ENS) works.

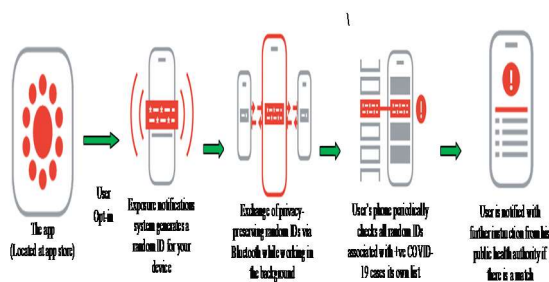


Fig. 7 Working principle of the exposure notification technology

A smartphone user locates the app for his area (if available) at the app store and then can decide to opt-in. Once the user opt-in to the notification system, the ENS generates a random ID for the user's device. These random IDs change every 10-20 minutes to ensure that they are not used to identify the location of the user. Next the user's phone and the phones of other individuals around will work to exchange these privacy-preserving random IDs via Bluetooth at the background. The app does not necessarily need to be open by the user for background exchange process to take place [14].

One of the challenges of the pandemic is food security. With the STAY AT HOME order in place, most of the people in developing countries across the world were experiencing serious hunger since majority live on daily income for their survival. In Nigeria, within two weeks of the implemented lockdown order, an alarming situation threatening life of the larger population who are mainly living below poverty level was noticeable which was caused by food scarcity and lack of income. Since people prefer to go out and get something to eat, they maintained that the coronavirus was not their fear but hunger—a situation which they called “hunger virus.” In order to arrest the situation, the government, private organisations and spirited individual began to provide supports to the poor and vulnerable in the society by hand to hand distribution sharing of food items in partial obedience to the social distancing policy. However, in some places like Vietnam, precisely, Ho Chi Minh City, to address the hunger caused by the pandemic why ensuring that people are adequately protected, innovative solution was invented by Vietnamese entrepreneur. In taking care of the hungry population in Vietnam during this pandemic, a “rice ATM”, which is a mix of human, machine, and mobile technology

[15] was used to dispense rice to the country's population as shown in Fig. 8.



Fig. 8 Automatic rice dispensing machine [15]

Hundreds of people form lines up at semi-automated rice distribution centres. At the back of the machine is stored a giant elevated vats and channeled through a plastic pipes into a bag held by an individual. When the button on the rice ATM is pressed by an individual, a volunteer gets an alert on app on his mobile phone to release the rice [15]. Since the service of the automatic rice dispensing machine came into service, it has been deployed and used by many other businesses and donors across the nation.

In the fight against the COVID-19, one strategy that has proven to be successful in containing the spread of the disease is the social distancing. Even though millions of people stayed at home due to the STAY AT HOME policy implemented by governments of nations around the world to flatten the curve, there was still some group of people who were given a work permit because of the nature of their work. This group is called essential workers in Nigeria. In order to help this group of workers who are in the manufacturing, medical, pharmaceutical, media and security sectors, an artificial intelligent (AI) powered tool that can analyze real-time event to check whether social distance rules are being appropriately observed. Generally, this technology that is a social distancing tool has proven that ICT could be the solution to curbing the spread of the pandemic. And until a vaccine is rollout for the disease, this social distance machine tool as shown in Fig. 9 will continue to assist in curbing the spread of the novel corona virus even as the sit at home order is being lifted and people now returning to their normal life



Fig. 9 Social distance detector technology [16]

The technology as shown in Figure 9, to detect if a social distancing protocol is being observed, highlights people whose distance from others is below the minimum required distance by red rectangular line. This software is capable of issuing warning to remind people to maintain a safe distance if the social distancing protocol is violated. This software from Landing AI is without a doubt a leap into the management of pandemic in future [16].

The ICT sector also provided opportunities to for job creation through online businesses and help in reducing vulnerability of people during the lockdown. In order to leverage on this basic and most essential social care, government of nations and private enterprises have taken advantage of the ICT to sustain employments and keep businesses running. A report has it that the Chief Executive Officer (CEO) of Israeli esthetic medicine clinic chain, American Laser Ltd, stated that shifting to remote process has reduced the required time for an employee to be recruited by 50% [17]. Figure 10 shows a remote job interview process



Fig. 10 Online job interview process [17]

Leveraging the sophistication of ICT to sustain economy through job creation, the government of Kenya through the Minister of Information and Communication Technology, Innovation and Youth Affairs, stated that with the increase in the use of technology due to the coronavirus pandemic, the government was focusing on training over 5000 youth on how they could go online and get jobs to earn income [18].

2.2. Use of ICT Services by Global and Local Authorities

In an Extraordinary China-Africa Summit on Solidarity against COVID-19 held on June 17, 2020, via video conference as shown Fig. 11, African leaders and experts expressed the need for cooperation and solidarity in defeating the novel corona virus. The leadership of the African Union and the Nigerian president voiced their deep appreciation of the effort of the Chinese government in helping African nations to win the fight against the pandemic.



Fig.11 African and Chinese leadership summit on COVID-19 [19]

The video conference became necessary and important due to the constrained separation caused by the coronavirus pandemic. The summit was organized to demonstrate solidarity and commitment towards winning the fight against COVID-19 through sheer effort among nations around the world. An adviser to Nigerien government stated that the intervention of the Chinese has afforded African countries, which were not well-equipped for the pandemic to gain from the expertise of Chinese doctors and have prevention equipment [19].

In an effort to contain the spread and win the fight against coronavirus in Nigeria, the government of Nigeria set up a Presidential Task Force (PTF) saddled with the responsibility to brief the government and the public on the position of the country in the battle to flatten the curve. Since the leadership of Nigeria must meet with the PTF from time to time, video conferencing facilities were installed in the office of the president. One of such remote meeting via video conference was held on April 15, 2020 as shown in Fig. 12.



Figure 12 Video session of Nigerian leader and PTF [20]

Similarly with the use of video conference by global and national leaderships continues to grow, and the rising use of the technology in Nigeria becoming normal during the COVID-19, the Kaduna State government used this ICT facility to hold a virtual meeting with the executive members as shown in Fig. 13.



Fig. 13 Video meeting of a state government and cabinet [21]

On April 23, 2020, the European Union (EU) leaders held a summit via video conferencing to agree on an emergency fund and common measures to protect European workers, businesses and countries worst affected by the outbreak of the coronavirus pandemic as shown in Fig. 14.



Fig. 14 Video session of EU members to raise fund for the COVID-19 [22]

The union stated that in addition to the fund, EU members have been collaborating in the sharing of protective medical equipment and specialist medical teams with one another [22].

On May 12, 2020, a meeting was held by the United States (US) senators with public health official, who address the members of parliament (MP) remotely via video conference as shown in Fig. 15. Also, report has it that remote court activities were being used to hear arguments through video call in US.



Fig. 15 Remote video session between US MP and official [23]

Also, the use of ICT during the COVID-19 world economy lockdown was observed in a meeting involving a group of 20 (G20) world leaders in March 26, 2020. The group held an interaction via video conference to discuss the impact of the coronavirus pandemic on global economy as shown in Fig. 16. The world leaders at the meeting made a commitment to inject more than \$5 trillion into the world economy to neutralize the impact of the COVID-19 pandemic [24]. The group pledged on expanding manufacturing capacity to meet the large and rising demand for medical equipment that will be made available at a reasonably priced rate and in the shortest possible time [24].



Fig.16 World leader virtual meeting [24]

The United Nations (UN) Secretary-General, while delivering a message to the leaders at the summit, stressed that a combined action be taken to contain the novel

coronavirus and to reduce the social and economic impact of the disease. On his part, the WHO chief called on the leaders to unite and show solidarity in the fight against the pandemic, and to speed up the manufacturing of the tools protective equipment and treatments capable of potentially save the lives of thousands. At the time this meeting was held, WHO data indicated that approximately 500,000 COVID-19 cases have been reported and with recorded death of more than 20,800 while nations and territories affected were 199 [24].

2.3. Use of ICT for Teaching and Learning

In the wake of the COVID-19 pandemic, educational institutions around the world were closed. According to United Nations Educational, Scientific and Cultural Organization (UNESCO), about one billion students and youth around the world are affected by the closure of schools and university as a result of the COVID-19 pandemic. There is a large-scale effort by nations and organizations to make use of ICT in support of remote teaching and learning during the coronavirus pandemic. This demand has been increasingly emerging and evolving rapidly.

Many countries and school systems globally are adopting electronic learning (e-learning). Using available and affordable ICT infrastructure, online classes/educational conferences and seminars (via a Learning Management System LMS) or virtual teaching platforms (face-based webinars via Google Hangout or Zoom) [25], have become increasingly common during the coronavirus pandemic. However, despite the growing demand for distance education in this critical time, the choice of the form of ICT infrastructure that can be effectively deployed by nations and organizations around the world to have wider reach among the populations has become an issue of serious concern. This highlights the need for governments and organizations to determine the most suitable and accessible form of distance learning infrastructure to be deployed so as to make project successful.

There are some ICT infrastructures that are most common in supporting e-learning and are basically four namely: radio, television, mobile phones and internet learning. Even in this age and time that the world has gone digital, radio broadcasting lessons are still being used for distance learning purposes and serves as the quickest option to continue schooling [25]. For instance during the sit at home order, the government of Abia State in Nigeria, used radio lessons to conduct distance learning classes for students in secondary schools in the state. Television on its part is being used by most countries with some state governments in Nigeria using this medium to hold distance lessons for students in their

territory during the COVID-19 pandemic. An example of students learning from home via television class is depicted in Fig. 17.



Fig. 17 Remote distance learning via television [26]

Mobile phone technology has also been used by governments and organizations in corporation with telecommunication companies to provide distance learning during the pandemic. On May 20, 2020, United Nations International Children's Emergency Fund (UNICEF) made known its partnership with Airtel Africa in providing remote learning access to children. The partnership was aimed at using mobile technology to assist approximately 133 million school age children currently affected by the closure of schools in 13 countries across sub-Saharan Africa during the coronavirus pandemic [26].

III. BENEFITS OF ICT TO NIGERIAN ECONOMY DURING COVID-19

With the coronavirus pandemic biting hard on global economy, and Nigeria economy looking very much threatened, peoples movement restricted, swarms of users flood the cyber space adopting available ICT tools to carry out various tasks including office duties. The Nigeria Stock Exchange (NSE) leverage on digital collaborative tool to trade remotely. Application and softwares such as Skype, Zoom, WhatsApp video, and others, were largely used in Nigeria to carry out meetings, trainings and virtual classes during the COVID-19 health crisis. In fact, the pandemic has brought about increased awareness and interest in digitization of operations across sectors in Nigeria.

Taking advantage of the ICT tools to provide cutting edge business during the coronavirus global crisis, the Nigeria Petroleum Corporation (NNPC) was reported to have commenced the online sales and tracking of petroleum products across Nigeria to curtail human contact across its depots. According to the Group General Manager (GGM), Information Technology Division (ITD), the online sales and tracking of the petroleum products was said to have been

become possible due to the deployment of a sales and distribution app called Customer Express, in the Oil and Gas Secondary Model Portal, which can help marketers buy petroleum products online [27]. The GGM stated that during the lockdown, the NNPC business value chains continued to operate by holding 4,000 virtual sessions, 9.3 million minutes of audio time, and 6.7 million minutes of video time and 2.1 minutes of screen shared times. Also, a contact tracing app was said to have been developed called NNPC Medical to reduce the spread of the virus within its formations and ministries, departments and agencies of the government. The app also can be used by NNPC staff to document their private visitors at their homes [27].

Besides the use of ICT tools for video session, healthcare services, social activities and engagement, and learning purposes all over the world, Nigerian government through its Ministry of Agriculture leveraged on the relatively increasing ICT penetration and coverage capacity to carry out agricultural training programme for enumerators during the COVID-19 pandemic by creating an app called ODK Collect located at the Google Play Store on their Smartphone as shown in Fig. 18. The programme which is a joint project called the Agricultural for Food and Jobs Plan (AFJP) anchored by the Federal Ministry of Agriculture and Rural Development (FMARD) and the Project for Agricultural Coordination and Planning (PACE) Secretariat, aims to boost locally grown food supply, create job opportunities in the agriculture sector and export food surplus [28]. Interested enumerators were trained via video session on how to engage and collect details of smallholder farmers and obtain the soil sample of their farm lands including the geographical location and area of their farms using the ODK Collect.

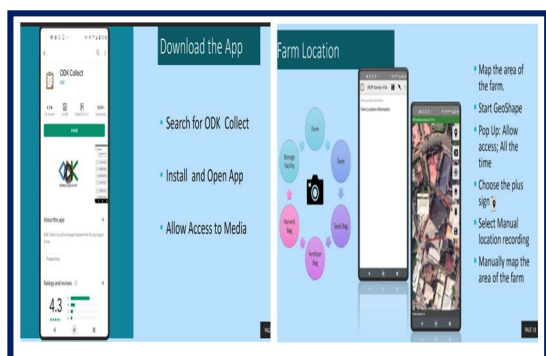


Fig. 18 Agricultural support app for food supply in Nigeria

An example of an email sent to an applicant to participate in the training as part of the processes for employment into the programme is shown in Fig. 19.

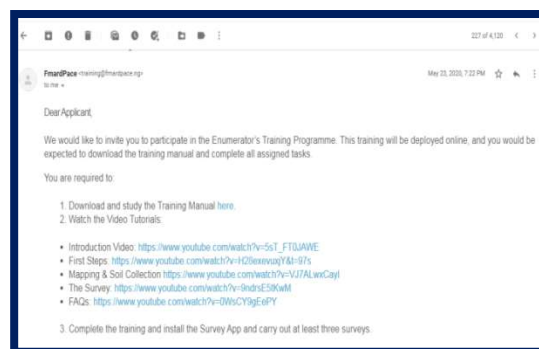


Fig. 19 Screen shot of an email to an applicant

With the outbreak of the COVID-19 posing a critical moment for African economy, the WHO in Africa held its first hackathon for COVID-19, which brought together a number of innovators in ICT from sub-Saharan Africa to initiate local creative solutions to overcome the pandemic, and solve critical problem in the region [29]. One of the innovations showcased was a triaging app developed by Wellvis health, a health tech startup in Nigeria. The app is a free online COVID-19 tool that is aimed at helping users self-assess their risk category of the dreaded novel virus disease based on their symptoms and their history. Users are provided with remote medical counsel or redirected to healthcare facility close to their proximity. Another health tech startup developed COVID-19 tracker called Infodemics that helps users to report isolation or ask for testing after providing answers to a few questions about possible symptoms [29].

An economic gain, which can be attributed to the growth of ICT's contribution to Nigerian economy, was announced by the National Bureau of Statistics (NBS) in its Nigeria's Gross Domestic Product (GDP) report in the first quarter of 2020 (Q12020). According to Abidoye [30], a report by NBS made available on May 25, 2020, stated that the GDP of Nigeria grew by 1.87% (year-on-year) with the ICT sector of the economy contributing 14.07% to the total real GDP, which is a higher record than its contribution (13.32%) in 2019 and in the preceding quarter, in which its contributed 13.12%. This reported obviously showed that the ICT sector was critical in the growth of Nigerian economy during the COVID-19 pandemic.

IV. CHALLENGES AND SUGGESTIONS FOR FUTURE SUPPORT AND GROWTH OF ICT IN NIGERIA

With the uncertainty around the end of the COVID-19 pandemic, and the realistic potential of ICT as the most viable alternative to sustaining economy growth including job creation, the Director General (DG) of a government own agency, National Information Technology Development Agency (NITDA), encouraged the youths to develop their

digital skills to assist the government in her effort to build digital economy. The government of Lagos State in Nigeria has partnered with Microsoft Office to train 18,000 teachers in the secondary school on digital literacy so as to prepare them to deliver on their jobs through ICT during the lockdown [31].

However, despite the effort of the Federal government and sub-state governments, there are still some noticeable hindrances to sustain ICT growth and its adoption by Nigerians so as to fully deploy it in the time of economic crisis like the coronavirus pandemic. The following challenges are obvious in the Nigerian society:

- a) Implementation of policy: Existing set of regulations aimed at promoting ICT skill (or digital literacy) in Nigeria are not passionately implemented.
- b) School curriculum: Components of ICT skills that will be pertinent in the future of vocation are not reflected in the regular school syllabus.
- c) Cost of infrastructures and poor internet network: There is high cost of ICT infrastructures such as internet and power system facilities. Even where these facilities can be seen, they are very irregular. This is a significant factor that has hindered the use of ICT to effectively conduct effective remote teaching and learning by schools in Nigeria during the COVID-19 lockdown.
- d) Existence of digital divide: There exist a huge digital divide that is very obvious in Nigeria when the urban and rural communities are compared. In fact there are communities in Nigeria especially in the rural areas that are not yet aware of the concept of ICT or digital technology as the world normal.
- e) Over dependency of Nigerian economy: The Nigerian economy including the ICT sector is over dependent on technology from other nations.
- f) Illiteracy Rate: The high rate of illiteracy can be attributed to the attitude of many Nigerians towards digital literacy and the skepticism that has hindered its acceptance as part of normal life.

These challenges can be overcome if the following suggestions can be adopted and implemented:

- a) Stakeholders in the ICT sector should endeavour to engage more citizens by increasing the awareness of new and existing regulations on ICT skill.
- b) The regular school curriculum in Nigeria should be laced with components of ICT that will aid Nigerian students and the population at large to be better equipped in economic crisis like the one caused by COVID-19 pandemic and prepare to create job for themselves in ICT sector especially in the area of artificial intelligent (AI) and machine learning which has become the world normal. This is because a person equipped with the knowledge of AI can excel in all field of human endeavour.
- c) A strong partnership should be established between organisations whose operations are ICT based with tertiary institutions in Nigeria to facilitate robust learning and digital economy.
- d) Tax reliefs should be granted to stakeholders in telecommunication by the government to allow them reduce data cost and other digital related services.
- e) The Nigerian government and stakeholders in the ICT sector should be committed in supporting Research and Development (R&D) and promoting home grown technology by collaborating with tertiary institutions in Nigeria to train post graduate students on the use of high technical softwares such as MATLAB, LABVIEW and others in the field of science and engineering to develop artificial intelligent (AI) and machine learning models and tools that can be implemented in real-time and in practice for the growth of the country's technological competence.
- f) The skeptical attitudes which are as a result of ICT illiteracy among many citizens that have caused resistance to the adoption of ICT as a normal life can be reduced through well and sincerely organized people oriented programmes that are aimed at reaching the nation's population at the grass-roots.

V. CONCLUSION

This paper has presented the global use of ICT during the coronavirus pandemic with focus on the gains recorded by Nigeria during the period and what should be done for better deployment in the post COVID-19 economy. A general view of the various components of the ICT infrastructure used

around the world has been considered with focus on the support for healthcare, social care, international and local governments and their agencies, and distance learning. Some of the gains acquired by the Nigerian economy using ICT as a critical tool during the COVID-19 have been highlighted. The challenges and possible solutions to better use of ICT have also been enumerated.

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