

A Survey of Challenges and Opportunities on COVID-19 and Emerging Technologies in Nigeria

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ABSTRACT

COVID-19 has devastated the world and brought untold hardship to virtually all countries of the world. It has crippled almost every sector around the globe thereby increasing death rate, poverty level and made economy stand still. To strategically overcome this deadly pandemic, there is need to deploy innovative technology such as artificial intelligence, drones and blockchain technology into health sector to address the health challenge imposed by COVID-19. The primary aim of using these technological tools was to fight and win this pandemic at a reduced risk and cost. To achieve this aim, we adopted a case study approach where several articles relating to this study were reviewed. We therefore conclude that deploying technology is necessary and will help reduce the spread of COVID-19. Finally, the researchers noted that there is urgent need for a centralized database which will be used for analysis, tested results, decision-making and tracking individuals in isolation centers.

Keywords: COVID 19, Virus, Pandemic, Technology, Patient and Death rate

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I. INTRODUCTION

Coronavirus is known as 2019-nCov, it is from the SARS-CoV-2 virus family. It is popularly recognized and named COVID-19; meaning ‘CO’ for corona, ‘V’ for virus, ‘D’ for disease and 19 stands for the year the disease started. Covid-19 as a global pandemic has affected our daily lives and events. It was first discovered in China (Wuhan). Today the whole world is battling against this virus that is spreading like a wide fire.

[1] opinioned that presently the global community is ravaged by the pandemic while the end to the COVID-19 pandemic remains unknown due to variations of its spread among the countries. COVID-19 has high infectivity but low humanity. COVID-19 attacks the upper respiratory track such as the lungs, throat and nose. It is recorded that South Korea, Japan, Croatia, San Marino, Singapore, Australia, Malaysia, Vietnam and Nigeria etc have as well recorded cases of the pandemic.

Corona virus spreads from one person who is not well to a healthy person through droplets (nose, mouth and eye) from cough, sneezing or being exposed to an infected person. These aerosols can penetrate the human body (respiratory system) via inhalation through nose or mouth [2], [3].

COVID-19 infection rates and deaths vary from one country to another; state to state. It has common symptoms like shortness of breath, fever, vomiting, coughing and sometimes with no symptoms; its incubation period varies from 2 – 14 days. [4], [5] reported that a recent modelling study confirmed that it remains prudent to consider the incubation period of at least 14 days.

COVID-19 for now has no cure, treatment or vaccine against the virus but researchers and doctors (healthcare workers) are working and trying to manage the illness. The impact of Covid-19 has affected our perception of life; we now live in fear, wash hands times without number before a single meal and possibly move around with sanitizer. These are not our style of life but an adopted approach to survive or overcome this pandemic. According to [6], wide dissemination of good hygiene practices can be a low cost and highly effective response that can reduce the extent of contagion and therefore reduce the social and economic cost.

1.1 COVID-19 in Nigeria

In Nigeria, Coronavirus pandemic has impacted on the daily lives and the way work is done and thrown up some challenges which have affected every aspect of the economy causing mass production shutdown leading to swelling negative effects and as well reducing investment opportunities. The number of cases keep increasing every day; people are being affected, more deaths are being recorded, businesses are going down, schools closed and places of worship as well. No more social gathering (wedding and burial), this is the first time in the history of Nigeria to witness such ugly incidence. Although COVID-19 has exposed the level of decay in our health sector; today our leaders can't travel for healthcare services due to covid-19 restrictions.

[7] in their paper opined that the public health sector in Nigeria has poor infrastructure such as poor emergency services, few ambulance services, ineffective national health insurance system, insufficient primary health care facilities, and these problems in the public health sector have often been linked to the high maternal and infant mortality rates in the country. These shortcomings in our Health sector, one way or the other gave room for quick spread of the virus in the country.

COVID-19 has caused serious panic in the country; the impact on economy is very bad compared to 2015 flood that caused some regions of the country to lose their homes to flood. COVID-19 has trapped us all and we must work together to fix all the sectors and end this pandemic called Covid-19. To achieve this, Government has adopted some measures such as promote social distancing in public gathering, create health education awareness on personal hygiene, building and equip isolation centers and finally introduced lockdown in the country.

Lockdown was introduced and adopted with the aim of keeping the people safe; this measure restricted people from moving from one place to another except individuals on essential service (health worker, security personnel) and moving goods and services from one state to another. This measure is new to most Nigerians but majority keyed in with the hope that it is for a short period but it lasted longer than expected thereby affecting livelihood of most Nigerians.

Within the lockdown, most affected states (FCT, Lagos and Ogun) experienced total lockdown; that

people or commuters can't travel in or out of the state. Shops, banks, schools, entertainment industry and other public places are closed for this period. In other to promote personal hygiene, government introduced social distancing; this will prevent public gathering and reduce the spread. With all these measures, the rate of the infection continues to increase. It is therefore believed that lockdown increased the poverty level of most Nigerians and as well promote social vices in the country.

Due to undue hardship that came with lockdown, the Nigerian government introduced some policies such as food distribution which is popularly known as palliatives, cash transfers to most venerable; met to cushion the effect of hardship and encourage Nigerians to stay safe.

1.2 Motivation

COVID-19 outbreak has pushed the society to a limit. The healthcare sector does not have the right information for analysis and predications about pandemic outbreak. The use of technology will control and manage this outbreak. This will help us to detect virus, predict how the virus is going to spread by analyzing the combined information of environmental conditions, access to healthcare, and the way it is transmitted and detected with high accuracy. This ascertains [8] that health is the real wealth and not pieces of gold and silver.

The use of technology can identify coronavirus within localized outbreaks of the disease and help reveal the nature of the virus. The primary motivation is to bring to the knowledge of the people that Information Technology can serve as a tool for speedy effective measure to fight, control and manage this deadly virus.

2. TECHNOLOGIES TO FIGHT/CONTROL THE SPREAD OF CORONAVIRUS

We are in a technological era; technology is changing our lives and rebranding our society by enhancing human capability and helping us to adapt to harsh situations of life such as pandemic, war, hunger, natural disaster and drought etc. Technology does grow from time to time. The situation at hand will call for the right technology to be deployed. Today, life without technology is equivalent to life without air.

With technology, healthcare workers can learn new ideals and interact with experts around the globe with less risk and cost. Therefore, introducing

technology in our health sector will enhance health safety, efficiency and performance. According to [9], the possibilities of technology are many; they include health portals and electronic health records, telemedicine services, tele-ICU services and health information networks, which will improve and promote health by assisting us to detect, diagnose, prevent, monitor and treat diseases, manage our lifestyle and improve our wellness and quality of life.

In Nigeria, COVID-19 has affected every sector negatively and there is need to introduce technology as a solution to control and manage this deadly disease. With careful analysis, the introduction of technology will transform the way we live. Some countries have adopted and introduced technology in the fight against COVID-19 and they have recorded some positive good results.

Singapore in her fight against Covid-19 makes use of mobile technology to enhance contact tracing. This system is designed to connect with Bluetooth signals when individuals are close to each other. The obtained data are recorded and stored for a period. Once an individual shows Covid-19 symptom, his record(s) are access to know possible contacts he had within the period. This technology helped to identify potential Covid-19 carriers.

In Nigeria, the Information Technology (I.T) sector has been a beneficiary of COVID-19 as Zoom, Webex and Skype have seen increased use. This opportunity can be used to achieve economic growth, job and wealth creation during this pandemic. To actualize this with ease, there is an urgent need to address broadband technology in Nigeria and enhance broadband penetration. Moreover, the introduction of Technology will promote service delivery and efficiency in the health sector as well as maintain workload balance for healthcare workers.

The technological tools that Nigeria can use to control the spread of this virus are as follows:

2.1 Artificial intelligence

Presently we can't live without Artificial intelligence (AI); Artificial intelligence is used in our day – to – day life and it has transformed our society positively. Artificial intelligence if introduced can help our healthcare officers to gain more knowledge about this pandemic and identify some hidden information about the virus and also help us to develop a vaccine quicker. [10]

acknowledged astonishing success of deep learning in identifying powerful new kinds of antibiotics from a pool of more than 100 million molecules as published in giving a strong hope to this line of research in the battle against COVID-19.

[11], [12] acknowledged that Artificial intelligence (AI) can build an intelligent platform for automatic monitoring and prediction of the spread of this virus. A neural network can also be developed to extract the visual features of this disease, and this would help in proper monitoring and treatment of the affected individuals. Apart from transforming our society, Artificial intelligence (AI) can offer the following advantages if deployed:

i. Finding persons with COVID-19

The use of Artificial intelligence (AI) can examine number of affected patients in a community and possibly identify individuals that had contacts such as friends, relatives, neighbors etc with the affected victim with ease, Also the future course of this sickness and possible reappearance can be predicted with the use of Artificial intelligence (AI).

ii. Forecast cases of COVID-19 and death Rate

Artificial intelligence (AI) as a powerful technology can give accurate predictions about the pandemic from the available data nationwide with less or no error. People will be more convinced that COVID-19 is real not an imagination, in the same vein the number discharged and death rate is also known. Artificial intelligence can identify vulnerable villages, state and people using time series case data, population density, demographic data, and safety measures are taken at the right time.

iii. More drugs and vaccines can be produced

Pharmaceutical industry will improve in drug analysis with the help of Artificial intelligence (AI). Testing and analysis of drugs takes time because standards are involved; Artificial intelligence (AI) can hasten this process and still give more accurate results than manual systems.

[13], [14] emphasised that AI helps in developing vaccines and treatments at faster rate than usual; it is also helpful for clinical trials during the development of the vaccine. It has become a powerful tool for diagnostic test designs and vaccination development.

iv. Balance the workload of health workers

The workload of healthcare workers has increased this period. Most healthcare workers are under

pressure, exposed to risk and close late at the end of day. This can result to mistakes which are not acceptable in their profession. Artificial intelligence (AI) as a technology can balance their workload by reducing potential challenges associated with health hazards and as well promote efficiency in their output.

2.2 Blockchain technology

This is another form of technology that can be used to control and win the war against COVID-19. This technology is distributed in nature; it appears to its users as a sole coherent system while in actual sense it is a collection of autonomous computing elements. There is nothing like sole authority in blockchain; no one can change or erase any transaction.

[15], [16] defined blockchain technology as a unique decentralized system of recording, verifying and approving data and carrying out a series of transactions. Introducing blockchain technology into our healthcare system will enhance the healthcare Information Management process; healthcare data can be analyzed and transmitted while maintaining data privacy and security [16].

This period of Covid-19 calls for drastic measure and blockchain as an innovative technology can fit in to provide the necessary measure needed in terms of patient assessment, screening, testing, treatment and control information. This available information is saved and secured because each user will have password that will protect and guide his/her personal information.

2.3 Drones

This is Unmanned Aerial System which can fly without a pilot and passengers; it is control with the use of remotely control (radio waves) and can come in different sizes. Drones are seen as a promising technology in our time. Its impact is felt in the Military sector and as well as health sector.

According to [17], drones are used to provide critical life-saving aid (including medicine, food, water, and supplies) to remote areas in Africa where adequate facilities are not present or travel by foot and/or car is too long.

In the health sector, drones can be used to disinfect a particular area. For example; disinfecting streets in

China, to supplying medicine to a small community in Chile. When the coronavirus hit Africa, Zipline (a drone company in Rwanda and Ghana mainly for medical deliveries) adapted its cargo. Its distribution centres in Ghana now hold stocks of personal protective equipment (PPE) and its drones also deliver COVID-19 test samples, CNN Business reported. “We are stocking a whole bunch of COVID-19 products and delivering them to hospitals and health facilities, whenever they need them instantly,” Zipline CEO and Schwab Foundation Social Entrepreneur, Keller Rinaudo, told CNN Business [18].

The easiest way to achieve social distancing with ease is through the use of drone; it can be used to deliver goods and services directly to the people mostly people at rural level and elderly (vulnerable) that are on self-isolation. Also, people within the city can order for goods from food retailers like shoprite, Next Cash and Carry, Tinapa shop, Exclusive stores etc. Management will use drones to deliver it. Drones also brought COVID-19 testing samples to laboratories, which helped the quick diagnosis and quarantining of infected citizens. More importantly, drones were used to safely transport medical supplies into hospitals where COVID-19 patients are being treated [19].

2.4 Advantages technology will offer

The following are advantages that the use of Technology will offer during this period of COVID-19:

i. **E-Learning:** This stands for Electronic Learning; it is the application of technology to boost information sharing, knowledge and communication. E-learning gives students access to material, improve value of learning and prepare them for the future. Since there is lockdown, E-learning will help students to continue their academic work without break.

E-learning is the use of Technology to pass knowledge to students. It can be in form of online, virtual distributed, networked or web-based learning technology. E-learning is a platform that gives modified learning support through information, advice, and guidance services. E-learning is the easiest way to reduce the limitations to the primary purpose of education by given access and imaginative ways of motivating students both at primary, secondary and higher education. With the implementation of E-learning, students will have the opportunity to achieve their academic dreams and

also prevent students and teachers from contacting COVID-19 and other related diseases associated with health challenges.

ii. **E-Medicine:** It is an approach to digitalize the health sector. E-Medicine will change our health care system to more quality, safety, efficiency, efficacy system. E-Medicine is also known as E-health and it can be in form of telemedicine, tele consultation, e-Nursing, E-Pharmacy, use of an online health information system and the use of interactive patient web-based system.

The use of E-Medicine within this COVID-19 period will save health practitioners and patients as well. It is the best approach for social distancing in the health sector. E-medicine as such creates new opportunities for creating e-health cards, improving medical diagnostics and treatment processes. This is achieved using sensor networks, for the analysis of log-files from psychological point of view, compilation, analysis and diagnostics of medical data, the organization of e-board of doctors, and e-medicine consultation [20].

Most countries have adopted E-medicine because of its numerous advantages such as planning, testing, providing surveillance and protecting medical history of a patient by using automated database system that will give access to only an authorized person (user). With full implementation of E-medicine, patients can consult their doctors while at home with the use of mobile device. E-medicine in time of pandemic, will serve as a shield to our healthcare workers; the risk of contacting this virus will be very low. Medical experts therefore believed that E-medicine will provide the right defense against covid-19.

iii. **E-Commerce:** This involves the use of internet technology to promote commerce using mobile (internet) application. E-Commerce reduces one on one business transaction (face to face). Nigeria as a state is using E-commerce but has not had full gain of E-commerce like increased productivity and economic growth like developed nations.

E-commerce has become an important tool for small and large businesses worldwide, not only to sell to customers, but also to engage them and E-commerce allows customers to overcome geographical barriers and allows them to purchase products anytime and from anywhere [21].

This period of pandemic, people don't need to gather in place called market just to buy and sell online but people can buy and sell online using E-Commerce (digital) platforms such as Jumia, Konga, Amazon, etc.

III. METHODOLOGY

This paper adopted a case study approach or integrative review of semantic literatures on the CoVID-19 and practices far adopted in Nigeria to manage the virus [22]. This was done using recent articles on COVID-19 and its management in Nigeria, government and regulatory agencies reports as well as official data sheets made available by Nigerian Center for Disease control (NCDC) as well as reputable reporting agencies in Nigeria.

To select the papers used, random selection of articles based on web search on the title "COVID-19" and "Nigeria" were used. Only papers with open access arrangement were selected except in few cases where IEEEExplore database were used to select technical related works to address the emerging technologies needed such as blockchain, AI, Drone, and emerging networking approaches towards the management of COVID-19 [23]. This approach has proven to be very useful where researchers do not have access to immediate primary data for collection and analysis [24].

IV. NIGERIA CASE REPORTS AND CHALLENGES

In Nigeria, Covid-19 was announced by Federal Ministry of Health on 27th February, 2020 in Lagos state. This virus came into Nigeria through an Italian who arrived Lagos from Europe. This virus spread faster than expected in Lagos state and later Ogun state witnessed patients with Covid-19 which is as a result of free movement of people from one place to another, since then the number has continued to increase daily. With immediate announcement, a Presidential Task Force (PTF) on COVID-19 was established to respond to the outbreak through a multi-sectoral and inter-governmental approach [25].

The Nigeria Center for Disease control (NCDC) declared National Emergency operations Center. A month later, Federal Ministry of Education released a circular for closure of schools (primary to tertiary institutions). These are immediate approach to reduce and control the spread of the Covid-19.

These steps taken by Federal Ministry of Health and Education did not stop the rate at which the virus was spreading.

The Federal Government therefore introduce more strict measures to control this disease by introducing policies like lockdown, social distancing, promotion of good personal hygiene, ban on social gathering, closing borders, airspace and establishment of laboratories and isolation centres in Abuja, Lagos and Edo States etc. These measures came with good intention but later (lockdown) increased poverty level of most Nigerians. Government in order to manage the hardship that came with Covid-19 introduced programmes like distribution of food items, cash transfer to most vulnerable Nigerians etc.

In the same vein, churches, mosques, non-governmental organization and some private sector keyed in by donating food items to their members and vulnerable Nigerians, providing monetary and capacity building support to their members and the nation at large. Apart from these supports, they also created awareness programmes and Nigerians keyed in to the lockdown policy as well. According to [26], [27] even most religious leaders agreed to stop large gatherings, forbid the shaking of hands and directed church members to pray at home and use hand sanitizers.

The Nigeria Center for Disease control (NCDC) used social media and mass media to give Nigerians with the correct information relating to Covid-19. NCDC on their official website publishes guideline on Covid-19; to ensure that correct information gets to Nigerians, NCDC uses SMS to send messages in three official local languages. This is meant to reach out to Nigerians and break language barrier while the National Orientation Agency (NOA) used jingles as well to reach out to most Nigerians.

[28] reported that NCDC also deployed Surveillance Outbreak Response Management and Analysis System (SORMAS) to support contact tracing. It is an open source mobile and web application for disease outbreak detection, notification, management and response which was deployed during the 2014 EVD outbreak but has now been upgraded to include a COVID-19 module.

Also, UNICEF as an International Organization helped to fight this pandemic. The impact of UNICEF is well felt in states like Rivers state, Lagos State, North East Nigeria, Enugu etc. In Lagos State, UNICEF supported contact tracing of passengers of interest who continue to be identified

at land crossings and seaports. Finally, UNICEF trained 320 healthcare workers in the North East Nigeria.

In addition to the above, recent IEEE multi conference technical series held in Nigerian, identified some key technologies needed or preliminarily adopted in combating COVID-19 in Nigeria. Examples of such disruptive technologies include Internet of things (IoT), AI and virtual reality [29].

[30] emphasized that the application of IoT in healthcare promises to help in realizing the goal of keeping billions of people healthy at affordable cost, thereby making our world a safer and better place to live in. Furthermore, it was highlighted that Nigeria may have to borrow idea from countries with evident of adoption and optimization of Information and communication technologies such as Korea, china [31]. It is believed that emerging and disruptive technologies have helped the world in general and Nigeria in managing the scourge of COVID-19.

With all these good positive measures to win Covid-19, there are limitations encountered by Federal Government of Nigeria. These challenges are:

1. Most Nigerians live in slums, are vulnerable and poor. The poverty level made some not to obey the lockdown and social distancing policy because they have to survive on what they earn on daily basis; there is also inadequate water to ensure good personal hygiene.

2. Social media is a platform for disseminating information with ease. Yes, it was a good tool used to sensitize Nigerians about covid-19 but most people saw it as an avenue to promote fake news relating to covid-19. Some were confused about information they receive or read from the social media.

3. Some Nigerians because of their faith feel that Covid-19 is as a result of sin and punishment from God, this made them not to adhere to NCDC instructions and guidelines; they believe that prayers and spiritual intervention is the only solution to covid-19 outbreak.

V. CONCLUSION

Coronavirus has negatively affected lives and increased the number of deaths; people now live in

fear and hope for immediate solution to this illness. It is only technology if combined with healthcare system can reduce or end the spread of this virus and save more lives. The application of technology will go beyond forecasting but can be used to create awareness of the disease, perform drug analysis and control the spread of the disease through personal contacts.

People do see lockdown as house imprisonment, it is only technology that can monitor and give accurate compliance with lockdown measures; the government will therefore increase sensitization in this area. Finally, technology should be completely exploited by government and the citizens so that this deadly disease will be a history.

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GENERAL FACT SHEET – DATA AS AT 10th AUGUST 2020

Table 1: States with reported laboratory-confirmed COVID-19 cases, recoveries, deaths and days since last reported case [32].

STATES	CONFIRMED CASES		DISCHARGED CASES		DEATHS		TOTAL ACTIVE CASES	DAYS SINCE LAST REPORTED CASE
	Total	New	Total	New	Total	New		
Lagos	15,957	82	13,122	0	193	0	2,642	0
FCT	4,485	18	1,298	45	45	0	3,141	0
Oyo	2,887	19	1,423	21	31	0	1,433	0
Edo	2,398	16	2,121	11	100	2	177	0
Rivers	1,944	5	1,675	25	54	1	215	0
Kano	1,634	8	1,308	0	54	0	272	0
Kaduna	1,613	15	1,380	0	12	0	221	0
Delta	1,596	0	1,409	0	43	0	144	2
Plateau	1,584	82	662	0	22	1	900	0
Ogun	1,478	9	1,245	10	24	0	209	0
Ondo	1,289	5	763	0	28	0	498	0
Enugu	914	9	500	15	19	0	395	0
Ebonyi	870	0	793	0	26	0	51	1
Kwara	865	8	460	1	21	0	384	0
Katsina	746	0	457	0	24	0	265	7
Borno	690	2	576	7	36	1	78	0
Abia	644	0	517	0	5	0	122	2
Gombe	631	0	560	0	23	0	48	1
Osun	628	0	341	0	13	0	274	1
Bauchi	577	0	528	0	14	0	35	1
Imo	479	3	161	13	10	0	308	0
Benue	409	0	109	0	9	0	291	2
Nasarawa	370	0	223	0	8	0	139	1

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Bayelsa	346	0	311	8	21	0	14	3
Jigawa	322	0	308	0	11	0	3	25
Akwa Ibom	235	0	197	0	8	0	30	2
Niger	226	0	165	0	12	0	49	6
Adamawa	185	0	90	4	12	0	83	3
Ekiti	182	4	77	0	2	0	103	0
Sokoto	154	0	138	0	16	0	0	16
Anambra	142	0	119	0	18	0	5	5
Kebbi	90	0	82	0	8	0	0	20
Zamfara	77	0	71	0	5	0	1	23
Taraba	75	0	55	0	4	0	16	1
Cross River	73	5	42	0	8	0	23	0
Yobe	67	0	57	0	8	0	2	11
Kogi	5	0	3	0	2	0	0	38
Total	46,867	290	33,346	160	950	5	12,571	

Source: [32]