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THE ROLE OF BIG DATA ANALYTICS AND ARTIFICIAL INTELLIGENCE IN COVID-19 GLOBAL PANDEMIC–LESSONS FOR NIGERIA

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Abstract

The world has continued to witness the new normal because of the global pandemic called COVID-19, previously known as novel coronavirus, first identified in Wuhan, China, in late December 2019. The virus has spread exponentially worldwide, infecting more than 233,479,934 people and 4,777,581 deaths as of 30th September 2021. This development prompted China, Taiwan, and South Korea to employ Big Data Analytics (BDA) and Artificial Intelligence (A.I.) at the initial stage to identify patterns, detect individuals with fever, track movements, and recognise faces of those infected before the use of vaccines. The study reviewed BDA and A.I.'s role in the COVID-19 global pandemic and lessons Nigeria and Nigerians can draw. Finally, the paper recommends that the legislative arm of government should ensure the introduction of legislation that stimulates continued innovation and data security.

Keywords: *Big Data Analytic, Artificial Intelligence, COVID-19, Pandemic.*

1. Introduction

Since the COVID-19 pandemic (SARS-CoV-2) outbreak in December 2019, countries have taken stringent measures to issue lockdown, shut down borders, restrict movement, forced citizens to observe social distancing, and quarantine when the need arises. In addition, governments worldwide are inoculating their citizens to prevent the spread of the virus. However, despite these measures, the number of deaths and those infected by the virus increases by the hours. Moreso, as the number of COVID-19 infected cases increases, new variants keep emerging out of the blues and have created cause for concern. For example, the Delta variants, which fall under Variants of Concern (VOC), is hitting hard and causing panic worldwide (Banerjee, 2021).

However, despite the fear that the pandemic has created, institutions are using their powerful analytics software each day to captures real-time data, any time, anywhere, and analyses collected data, thus controlling and tracking the virus. For example, the John Hopkins University and Medicines, through the instrumentality of Big Data Analytics (BDA) and Artificial Intelligence (A.I), is using its analytical dashboard to track reported virus cases worldwide. Therefore, the role BDA and A.I. are playing has proven to be effective in capturing, tracking maps and controlling the spread of the virus. In addition, BDA and A.I. are vital tools in building the knowledge required in making decisions and preventive measures against the pandemic.

Thus, according to (Najafabadi et al., 2015), BDA is data that surmount conventional databases' storage and computing capacity. As a result, BDA has the power for modelling supports predictions for future COVID-19 pandemics due to the ability of BDA to aggregate and store large amounts of data. On the other hand, (Ziyad 2019) defined A.I. as replacing humans with machines contrary to intelligence displayed by humans and other animals. Thus, with time, it has proven to play a vital role in understanding and managing the development of the COVID-19 pandemic mimicking human intelligence.

Countries all over have used the BDA and A.I. to manage the COVID-19 pandemic during the early stages. Israel, for instance, deployed geolocation data to identify COVID-19 patients. Another example is Wuhan, China, where we had the first case; the country devised a model that mitigated the effects of COVID-19 to a significant extent and profiled people at risk using BDA and A.I. For example, identifying patterns detects individuals with fever, tracks movements, and recognises those infected faces. In the same vein, Taiwan Province demonstrated its prowess in responding to the COVID-19 outbreak using A.I., BDA, and other technologies to establish an intelligent health care system (Huang & Chang, 2020).

The Republic of Korea in East Asia successfully contained COVID without shutting down its economy using A.I. So far, AI. and BDA have proven effective in handling the virus. However, COVID-19 threw the United States, United Kingdom, France, amongst others, into a state of confusion because of the increase in COVID-19 cases.

At the initial stage, because of improper data management, Most African states could not trace those affected by the virus. Prompted by this development, the United Nations Economic Commission for Africa (ECA) strengthened Africa's ability to use data in the fight against

COVID-19, launched in April 2020 to promote data sharing, virus tracking, contact tracing citizen-generated data for symptom reporting. The initiative has the statistical capacity to obtain quality health data and aid decision making in Nigeria, Sierra Leone, South Sudan, Zambia, Burkina Faso, and the Democratic Republic of Congo (Nakweya, 2020).

So far, the world has recorded 233,479,934 people infected by the virus and 4,777,581 deaths (JHU,2021). Africa has confirmed cases of 8,305,528 and 211,153 fatalities recorded as of 30th September 2021 (ACDC,2021). However, Nigeria is not left out, with confirmed cases of 205,484 and 2,702 deaths as of 30th September 2021(NCDC,2021). According to JHU, about 6,220,806,201 people have taken the vaccine as of 30th September (JHU, 2021). Despite the global vaccination with approved vaccines authorised by the World Health Organisation (WHO), the European Medicines Agency (EMA), there were reports of the death of some persons in the United Kingdom and a few other countries shortly after taking the vaccines. The Medicines Healthcare products and Regulations Authority (MHRA) claimed older people are more subtle to the disease. Also, the media reported cases of a rare blood clot connected to both the Oxford-AstraZeneca and the Johnson and Johnson coronavirus vaccine

With so many uncertainties associated with vaccines, A.I. and BDA are viable tools to predict future pandemics. Based on research, Scientists have used A.I. tools to examine the effectiveness of the COVID-19 vaccines. In addition, Public Health experts have used BDA to develop a COVID-19 mortality risk calculator, which could inform public health policies around preventive resources, like N-95 masks (Kent, 2021).

On this note, the study reviewed the role of BDA and A.I. and identified lessons that Nigeria may learn from the role BDA and A.I. are playing in the fight against COVID-19. In the cause of the study, the author found that no prior academic studies have been made in the role that big data analytics and Artificial intelligence can play in Nigeria. However, the study also discovered that beyond filling a knowledge gap in this respect, the study might also contribute lessons for Nigeria that may boast the understanding of BDA. and A.I. in Nigeria.

2. Methodology

The study utilised qualitative content analysis using qualitative methods to draw inferences from data collected from professionals in A.I. and Big Data analytics using open-ended questions. In addition, the study focused on deep analytical thinking on findings generated from

the interviews conducted to investigate Big Data Analytics and A.I.'s role in the fight against COVID-19.

3. Review of Literature

A.I. and Big data analytics are tools to support the fight against COVID-19; scholars have written extensively on the importance of these tools. In this review, the study will discuss some literary works relevant to this paper. Neha Tyagi et al. (2020) opines that with the aid of A.I. and BDA, the Linear Regression Model can predict future pandemics using the Prediction Module and implement the Whale improvement rule for patients to choose options. In an attempt to explain the effectiveness of A.I. analytics on COVID-19, Quoc-Viet Pham et al. (2020) leveraged the centric modelling, classification and estimation from ML and DL, learning-based techniques. Finally, in enhancing the performance of detecting and predicting the COVID-19 cases, Agbehadji et al.(2020) focused on BDA, A.I. and nature-inspired computing (NIC) by reviewing the computing models.

Other scholars like (Leesa & Zhiyuan, 2020) have seen the likelihood of using technologies like BDA and A.I. in combating COVID-19 because of the modelling efforts that predict a pandemic's flow. Similarly, using BDA tools for COVID-19 (Shikah et al., 2020) predicted the risk score and diagnosis. In addition, they provided insights on the challenges that might hinder the use of data analytics tools for COVID-19. Finally, experts used A.I. to mitigate the impact of the COVID-19 with the help of BDA to track the virus. Thereby, these authors spelt out leveraging big data for spatial analysis methods and Geographic Information Systems (GIS) technology that facilitates data acquisition and the integration of heterogeneous data Quoc-Viet (Pham et al., 2020).

To prevent and control the COVID-19 pandemic, (Jun Wu et al.,2020) focused their research on early warning signs, monitoring, and managing the virus.

The American Association for the Advancement of Science (AAAS) gave an overview of the multiple ways experts utilised A.I. as a tool for the COVID-19 pandemic. From the preceding, authors have discussed the relevance of using A.I. and BDA in the fight against the ongoing C0VID-19 pandemic. However, these authors have not shared lessons that the developing nations can take from the successes experienced in Asian countries. Therefore it is essential to provide a performance evaluation of BDA and A.I. in combating COVID-19 and recommend lessons for Nigeria, a developing nation in the global south.

4. Theoretical Framework

Scholars have used several theories to discuss the ongoing COVID-19 pandemic. However, to understand the nature of the virus, control it, and contain its spread and proffer lessons for Nigeria, the paper will restrict itself to the pandemic management theory (PMT) and the Theory management theory because of the significant threat that the pandemic poses. Marcus Stueck describes PMT as a psychological theory based on the biocentric health management approach, using data obtained in a study to define an outer first circle.

The above author described the six phases of coping with the burden of the lockdown, such as the orientation phase with load interpretations, acute and chronic phases of negative load consequences and phases with positive outcomes. Furthermore, it describes a stage with a biocentric sustainable change in ethical attitudes to protect life during pandemics. The COVID-19 crisis is an existential and collective identity crisis that describes the biopsychosocial and biocentric aspects of identity and relationship to others and nature.

(Pyszczynski et al., 2015) explained that Terror Management Theory (TMT) creates awareness in humankind that death is inevitable, thus managing the potential for anxiety inherent in understanding the inevitability of death by maintaining faith in their cultural worldviews, self-esteem, and close interpersonal relationships. Whereas (Goldenberg & Arndt, 2008) proffered ways through which people can manage terror in the face of the pandemic. The authors gave the proximal and distal defenses to health-related behaviour. While the former deals with the attempts to remove the thoughts of death from the subconscious mind by suppressing such thoughts, denying the threat, or engaging in behaviour to reduce one's vulnerability. The latter focused on how people react to the ideas of death, channelling their energy on maximising self-esteem rather than focusing on the potential consequences of the virus.

However, when put into perspective, millions of people worldwide have lost their lives due to COVID-19, and the death tolls keep increasing by the day. At the initial stage when the pandemic started, there was fear imbibed in the heart of millions over how they will survive the virus; some citizens fell into depression because of the fear of death, while others committed suicide. This idea by Pyszczynski et al. brings to the fore what he was explaining about managing anxiety inherent in man. While some citizens could not manage the news of the pandemic, others were able to handle it well due to the relationship they kept. In the face of a pandemic like the COVID-19, BDA and A.I. intelligence have proven to effectively manage

patient anxiety levels through the use of AI-powered chatbots to improve patient experiences and better outcomes.

4.1. Relationship Between BDA And A.I.

It is essential to define both concepts before we look at how they relate to each other. Elgendy and Elragal referred to BDA as 'big and high' datasets in volume, variety and velocity. In the words of (Russom 2011), he defined Big Data Analytics as the application of advanced analytical tools, including those based on predictive analytics, data mining, statistics, artificial intelligence, natural language processing, and so on. Implies that big data exist in massive amounts of detailed information where advanced analytic techniques operate.

High-Level Expert Group defined A.I. as a soft & hardware system designed by humans with a complex goal. They act in the physical or digital dimension by perceiving their environment through data acquisition and interpreting the collected structured or unstructured data. They also reason on knowledge or process information derived from this data and decide the best action(s) to achieve the given goal. A.I. systems can either use symbolic rules or learn a numeric model.

(Patrizio 2018) believes that BDA and A.I. are closely interconnected and that the greater availability of data empowers artificial intelligence. Whereas A.I. is a form of computing that allows machines to perform cognitive functions, such as input, analyse and interpret data, and solve or address the issue based on those interpretations. While Big data provides large sets of data structured (transactional in a rational database) and unstructured (images, email and sensor data) needed to train the learning algorithms, A.I. is about using such data to build intelligence to make an informed decision.

(Kelvin 2019) explained that BDA and A.I. as reciprocal because the latter depends on the formal to succeed. Furthermore, A.I. allows users of BDA to work intelligently without having it becoming highly labour intensive and time-consuming if performed by humans. In the words of (Straus 2018), he opines that ''BDA. and A.I. meet halfway whereby the boundaries in between are relatively blurry; however, BDA and its algorithms displace A.I. as the modality by which computing, seen to shape society: a paradigm of semantics, of understanding, is becoming a paradigm of pragmatics, of search". Thus, BDA is paving the way for A.I. technology.

Also, (Stephen 2018). put it this way that BDA and A.I. enjoy a symbiotic relationship. Without the former, the latter would have nothing to train on; and, without A.I., insights locked inside large datasets would remain undiscovered. The relationship between A.I. and BDA, seen in (Garg 2020) interpretation of A.I. and BDA helping to transform ideas into substance, making full use of visuals, graphs, and multimedia to give the targeted audience a great experience. Thus, the combination of A.I. and BDA gives you accessibility to relevant, accurate information significantly when predicting pandemics. Therefore, BDA and A.I. have a symbiotic relationship and have proven effective tools to combat the COVID-19 pandemic with time.

4.2. BDA And A.I. In The Management Of Covid-19

The difficulties experienced during the early stage of COVID-19 made countries turn to innovative technologies in combating the virus. For example, BDA tools and A.I. played vital roles in patients' diagnostic methods, which helped build the knowledge required in making decisions and preventive measures. In addition, the volume of data generated during the pandemic increases dramatically, requiring BDA tools and A.I. techniques to make sense of the pandemic and control its spread on time. The velocity at which governments in countries like the United States, Brazil, and India generated citizens' data badly affected by the pandemic requires specific data experts to coordinate the daily number of cases.

The variety of data (structured and unstructured) generated by experts helped improve personalised healthcare sector services and performance. (Wang et al., 2014). For example, diagnosis, estimate or predict risk score, healthcare decision-making, evaluating the need for ventilators, medical staff distribution mechanism, and pharmaceutical industry. In addition, these data are for a genetic study that involves DNA bioinformatics, analyses of the structure, the function of genomes and drug discovery, clinical research, amongst others.

During the heat of the pandemic, health experts experienced difficulties in differentiating between the COVID-19 and viral chest diseases. Thus (Stojanovic et al., 2020) suggested A.I. detect COVID-19 cases. Scientists designed a medical device that used both flexible and low-cost headphones to track the symptoms of COVID-19 patients while using a mobile phone to detect breathing problems.

(Mishra et al., 2020) described in their paper how scientists utilise smartwatches in COVID-19 pre-symptomatic detection. The scholars analysed the physiological and activity data collected

from smartwatches of the infected COVID-19 cases. As a result, they concluded that this method could detect 63% of COVID-19 cases.

(Lan et al., 2020) described how mobile phones served their purpose for the COVID-19 PCR test. In their paper, (Richardson et al., 2020) carried out a study to determine the clinical characteristics and outcomes of 5700 hospitalised patients with COVID-19 in New York. These authors surveyed to separate a COVID-19 cough sound from other respiratory sounds using crowdsourcing data using a website and Android app to analyse about 7000 unique users. (Brown et al., 2020) employed Logistic Regression (L.R.), Gradient Boosting Trees, and Support Vector Machines (SVMs) classifiers to distinguish the cough sound.

(Kricke et al., 2020) also developed a monitoring program that allows COVID-19 patients to check symptoms electronically daily through a mobile phone and gives advice and reminders via text messages and providing care by phone. Furthermore, as COVID-19 travelled across borders, countries like China, South Korea, and Taiwan took drastic steps to curb the spread of the virus.

4.3. China Management Of Covid-19

Mainland China was the first country to experience lockdown, restricting its citizen from travelling and staying indoors to contain the spread. In addition, the government of China leveraged BDA and A.I. to monitor, trace, and control the spread of the virus. The author described how companies in China made their algorithms an essential tool for gene testing, research and development institution available to help support COVID-19 testing and improve efficiency in research. Using the algorithm was to help improve the speed of predicting and accurately detect virus mutations.

China also uses A.I. in public places such as train stations and subway stations. There was a high concentration of people using temperature measurement technology based on computer vision and infrared technology. Once a person's temperature exceeds the threshold, such person is quickly and accurately located (Xiaoxia, 2020).

(Goldman 2020) opines that the Chinese government used A.I. algorithms to estimate the probability that a given neighbourhood or even an individual has exposure to Covid-19 by matching the location of smartphones to known areas of infected individuals or groups. The authorities then use this information directing tests for the virus to high-risk subjects identified;

since all smartphones in China have no privacy constraints, telecom providers can use the locational data. China also uses electronic records of medicine purchases to identify sick individuals who attempted to flee quarantine.

According to (Wong et al.,2019), China did not stop using A.I.; they also used the analytical tool of BDAcalled "Big Data Migration Map" to predict and analyse the flow of the Chinese people accessible through a mobile phone or computers. Thus, A.I. and BDA handled the vast, unprecedented amount of data derived from public health surveillance.

The Blue Dot, a Toronto-based start-up, was the first to use an AI-enhanced surveillance system to detect the epidemic outbreak, well ahead of the Chinese authorities and other international institutions and agencies. BDA also helps Chinese authorities establish the chain of transmission of the virus. However, Western countries cannot compare China's success in containing Covid-19 that lacks political controls and access to individuals' data (McCall, 2020). In addition, Chinese Telecom launched over 70 applications with over 700,000 users within a month for cloud conferencing service that requires remote applications for speed and agility.

China could contain, suppress, and control the virus via early warning, contact tracing, personal tracking systems in the post epidemic period. Made possible through essential data information from the significant areas of medical institutions, telecommunication operators, internet companies, government departments, commercial companies, and A.I. equipment (Gunther et al. (2020).

Big data and A.I. played an essential role in monitoring and evaluating the performance of COVID-19 Vaccines in China. China has administered almost 1.4 billion doses of its Covid-19 vaccines, a key milestone in the world's largest inoculation drive. China has shipped its vaccines to countries worldwide; this includes Brazil, the United Arab Emirates, Malaysia and parts of Africa. However, U.S. and European health authorities have not authorised Chinese vaccines for emergency use (Kharpal, 2021).

4.4 South Korea Management Of Covid-19

The Republic of Korea reported its first case of COVID-19 on 20th January 2020, and the number escalated to 326 between 19-20 February due to patient "31", a Chinese woman who attended a church gathering (Eunhae 2021). However, South Korea successfully flattened the

pandemic curve without shutting down its economy using three mechanisms: containment, detection, and treatment.

In terms of detection, the country developed a COVID-19 testing kit in just three weeks targeted mainly at the high-risk groups, with its testing capacity reaching 15,000 to 20,000 tests per day. In a webinar, Dr Lee told the audience that the South Korean government put a quarantine information system after the MERS outbreak in 2015 (ITU News, 2020).

South Korean government built temporary hospitals and recruited about 2,400 health workers in areas with a large cluster of infection treatment. In addition, the government purchased personal protective equipment (PPE) in hospitals where there were shortages. The government also integrated A.I. and Big Data analytics into the daily lives of its citizens for improving diagnosis efficiency and patient classification. For example, "Aria", the intelligent voice-activated device speaker released by South Korea Telecom, can serve medical emergencies. In addition, South Korea use location data generated from phones to locate infected persons (Sikhakhane, 2020).

A.I. and BDA used the VUNO Chest X-Ray A.I. Image Support Decision Tool, an AI-powered chest X-ray diagnostic solution produced by South Korea as an instrument for solving COVID-19 cases. This algorithm identified abnormal chest x-rays and classified intensive care patients using X-ray images to examine the lung within three seconds.

The JLK inspection developed an all-in-one medical platform called AiHub for disease diagnosis, which uses A.I. and big data technology from various imaging devices to examine lung disease within seconds using an A.I. technique. For example, the JLK produced an AI-based, hand-held chest X-ray camera that can scan the chest in just three seconds and visualise the abnormal lesion's heatmap. Prof Chung, in the webinar, also explained that a public chat robot using A.I. techniques is used to inform on ways of responding to coronavirus, and another AI-based voice robot automatically calls people who need attention (ITN Image Technology News, 2021).

The President of South Korea, in May 2020, announced an agreement with the United States for vaccine partnership. Today, the government of South Korea has vaccinated more than 19.9m of its citizens, made possible through collaboration with the scientific community.

4.5. Taiwan Management Of Covid-19

Taiwan, an island with about 24 million people, was able to manage COVID -19 successfully, with less than 20 deaths recorded in the country despite its proximity to mainland China. You may recall the first case of COVD-19, identified in a 50years -old-woman who worked in Wuhan, China, who arrived at Taiwan Taoyuan International Airport and presented herself for quarantine (Shao-Chung et al., 2019). Before now, Taiwan had SARS in 2003, and that experience made them established a public health response mechanism to enable rapid action in case of an outbreak.

(Wang et al., 2020) opine that Taiwan leveraged its national health insurance database and integrated it with its immigration and customs database. In creating big data for analytics, the health authorities generated real-time alerts on passengers based on travel history. For example, Q.R. code scanning reports passengers' travel history online and health symptoms to classify travellers' infectious risks based on their travel history in the past 14 days.

Moreso, Taiwan authorities enhanced COVID-19 case finding by proactively seeking outpatients with severe respiratory symptoms (based on the National Health Insurance [NHI] database). Any citizens who had tested negative for influenza and retested them for COVID-19 with the help of A.I. Labs, a private research organisation that works closely with academia, government, and industry. The government uses AI-based solutions to combat COVID-19 with the help of its visual aid, which shows around 5,000 images of patients infected with SARS-CoV-2 (Nan-Yao Lee et al. 2020).

The government of Taiwan launched a drug screening model that tests the efficacy of possible COVID-19 treatments. The government also collaborated with the Industrial Technology Research Institute (ITRI) and National Applied Research Laboratories to work out a prediction model to test different approaches to "flattening the curve", reducing the number of infections in a population. This technology helped analyse mask-wearing, social distancing, quarantining, and others to determine which is most effective in curbing the virus' spread with over a 3.12million citizens vaccinated (Taiwan Business Topic, 2020).

4.6. The Analytical Method Applied In The Covid-19 Pandemic

John Hopkins University was able to visualise the spreading of the virus in real-time to reconstruct the early epidemiological story of the outbreak. Similarly, the authors performed a

population-level observational study, monitoring healthcare-related websites, social networks, and news reports in mainland China between 13th January and 31st January 2020 (Sun et al. 2020).

The Authors concluded that non-classical datasets could help researchers understand the spreading of an outbreak regarding health literacy, healthcare-seeking behaviours, and utilisation of health resources. Similarly, another author exploited Big Data to predict the number of new COVID-19 cases, either suspected or confirmed. Again, the authors explained the Social media search indexes" (SMSI).

(Yang et al., 2020) used A.I. and Big Data to track the virus's spread in real-time through the "Susceptible-Exposed-Infectious-Removed" (SEIR) model, combined with an A.I. approach, trained on the SARS data, to predict the COVID-19 pandemic curve. The authors exploited big data analytic and A.I. and classical surveillance for data analysis and interpretation and uncovered hidden trends and patterns used to build predictive models. The authors believe that despite the initial delay from Chinese authorities in responding to the outbreak, the Chinese government recorded successes in managing the virus. Moreover, it is evident from the preceding that A.I. and BDA appear to have enormous potential for managing COVID-19 and other emergencies.

5. Discussion

Swot Analysis

The study used the SWOT analysis to discuss Big Data Analytics and A.I.'s role in the COVID-19 global pandemic.

Strengths

During this pandemic, China, Taiwan and South Korea incorporated Big Data Analytics and A.I. in their systems. For example, Xing, 2020 explained how A.I. and Big Data Analytics was used to support government policy decisions, customer's feedback, monitor the number of people infected and gain insights into the location of people.

The demand for BDA and A.I. was extremely high during the lockdown. For example, South Africa used robots manufactured by Double Robotics, a start-up company. It was manufactured

to function as a person's double or telepresence robot that drives you around, interacts with people, and attends meetings remotely. (Nuade, 2020).

The built-in microphone and zoom in robots enable communication between the patient and doctor. In Italy, robot nurses were mobilised as medical teams to treat patients suffering from COVID-19 and give food to quarantine people. In addition, a robot specialist can control a robot from anywhere (Trafton, 2021).

Weaknesses

One of the weaknesses of BDA is the inconsistency in data collection, especially with tools used to gather Big Data Sets. An example is the Lancet report withdrawn due to inconsistencies. During the trials of drugs for the fight against COVID-19, the University of Oxford concluded that chloroquine and hydroxychloroquine do not cure COVID-19, disclosed by the drug trial chiefs (Boseley,2020). However, before these findings, 140 scientists petition the report by the Lancet on its validity. According to Dave, 2018, one of A.I.'s weaknesses is that it is less than ideal for accommodating unexpected problems because a preprogrammed machine is suitable for tasks with slight variation. Still, emotional intelligence is way out for A.I. tasks. Another weakness he raised is the inability of A.I. to answer the "Why" question even though it can answer questions of "why" and "how" more than humans.

Opportunities

During the pandemic, Big Data Analytics and A.I. had growing demand from countries to make more informed decisions. Thus, it increased investment by government and intelligence (G&I) and healthcare sectors to manage the pandemic. When you look at China's approaches, Taiwan and South Korea took by allowing BDA and A.I. incorporated into governance, making it possible for these countries to tackle the virus outbreak. For example, robots' introduction to many tasks such as cleaning and sterilising, groceries, medicines, and food delivery helped reduce human-to-human contact (Agbehadji et al. 2020).

Taiwan, South Korea, and China's innovative, sophisticated technologies like the surveillance system, temperature detection software, amongst others, are used to facially recognise and identify people who might have a fever and are more likely to have the virus. For example, the Chinese government developed a health code monitoring system that uses big data to identify and assess each individual's risk based on travel history (Marr, 2020). Finally, the ongoing

pandemic allows organisations to determine their I.T. infrastructure and the need to look at robust and advanced cybersecurity solutions.

Threats

The higher the collection of data during this pandemic, the higher the risk of data misuse. Hackers are now leveraging on the COVID -19 pandemic to launch cyber-attacks with various viruses in the forms of ransomware, data stealers or banking malware such as Mustang Panda, Kimsuky and many others. In addition, the unstructured nature of some data may constitute threats as the need to spend resources to clean and "scrub" data is required before any processing can be completed (Kass, 2020). A single wrong code sent by hackers could affect A.I. in which cause a dangerous task to be performed or even a never-ending loop; therefore, all possible outcomes should be covered, appropriately checked in the system before you execute the code. A UN Special Rapporteur highlighted the risks involved in 'closed' datasets with 'open' ones. (Cannataci, 2017) Nature is producing a 'data exhaust' that invariably has consequences.

6. Lesson For Nigeria

Before the world started experiencing the new normal, Nigeria had deficiencies in data collection and management. As a result of the low COVID-19 figures recorded in Nigeria, the initial government responses were slow to the number of reported cases rather than confronting them in real-time.

Interestingly, COVID-19 is still much around. Nigeria needs to focus on using these technologies to combat this virus, not entirely on the vaccines, which does not guarantee a cure. Various respondents interviewed believe that with the more innovative use of digital technologies like BDA and A.I., the NCDC can probe pharmacological and genomic databases to retrieve knowledge on the virus.

It is expedient that Nigeria considers a comprehensive central database that can aid contact tracing. However, Nigeria may not be able to replicate the successes of the Asian countries in the fight against COVID-19 due to inadequate funding in the technological sectors.

7. Conclusion

The study comprehensively reviewed and analysed BDA and A.I.'s role in combating the pandemic and how the Asian countries successfully streamlined cases. Scientists used these tools to predict, prevent, and control the spread of the virus. These analytics tools help scientists comprehensively look at the cause, analyse the virus' genetic information, the speed and helped them develop and test vaccines. The study explained how China used these tools to recognise the characteristics of COVID-19. Also how the South Korean government developed a COVID-19 testing kit in just three weeks targeted mainly at the high-risk groups.

At the same time, Taiwan leveraged its national health insurance database and integrated it with its immigration and customs database. Finally, using the SWOT analysis, the study explained how China, Taiwan and South Korea used BDA and A.I. to support government policy decisions, monitor the number of people infected and gain insights into the location of people.

The study concluded that Nigeria, though it cannot replicate the successes of the Asian countries, however, with the help of the private sectors and due diligence, can succeed in using Big data analytics and A.I. in combating this pandemic and future diseases.

The study thus made the following recommendations:

- Nigeria can prevent the virus through containment strategies by vigilance in data protection to provide a legal framework and technical capacities.
- The Federal Government should improve universities and special research centres by leveraging the Deposit Money Banks (DMBs) and financial holding companies operating in Nigeria.
- The Federal Government should create a Central Comprehensive Database used to trace contacts.
- The legislative arm of government should ensure the introduction of legislation that stimulates continued innovation and data security.

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