Information Communication Technologies used in managing the spread of dangerous viruses or diseases and how they are used to facilitate the Location Strategy, Supply chain, Inventory Management and Prediction during an epidemic. The Wake-Up Call during the COVID-19.

By

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1. Abstract

Enhancing the health of Individuals and Communities, and reinforcing health systems, the identification of diseases and Prevention is key to the Reduce the spread of new diseases. ICTs possess the Potential for near impact Every side of health Branch. As regards public health, managing information and Procedures for communication are Pivotal, and easy to use or Limited to existing ICTs. This paper is a literature analysis review on how the use of modern technologies help to curb the spread of new pandemics in respect to operations support, it gives a brief background and introduction of the concept, Problem statement, Objectives, Significance. And Looks at various literature that has been published on the topic. Gives a brief discussion based on literature analysis and concludes and recommends on the way forward on the usage of modern ICTs to enhance operations to curb the spread of New diseases.

2. Background

i) Introduction

Significant technological developments are being made across a number of fields, including ICT; artificial intelligence (AI), especially in machine learning and robotics; nanotechnology; space technology; biotechnology; and quantum computing, to name but a few. Such breakthroughs are supposed to be highly disruptive and bring about significant structural changes in how societies work. The technical developments at issue are driven by a digital revolution that started about four decades ago. Those developments concentrate on the collection, storage and analysis of large quantities of data from the information sciences with implications for countless research and development areas. Such innovations offer major social and economic benefits, improved efficiency, and increased productivity across a variety of industries (Kavanagh, 2019).

The use of ICT in health has many facets, ranging from the highly complex and innovative methodologies for developing "personalized medicine" for low-tech broadcasting. Advanced analyzes and advanced statistical methodologies are applied in the discussion of personalized medicine to vast sets of genetic, organizational, population and social media data where the scale and quality challenges of data are significant (Abbott & Barbosa, 2015).

ICT description, interest, ownership and utility are shifting rapidly into the hands of those who need it most. Individuals are becoming more motivated by receiving critical knowledge that can save their families and communities' lives. Communities are now able to take greater control over their destinies themselves, as information flows into places that have not had such exposure in the past. Frontline caregivers may use ICT to referral networks, continuing education, and their

patients on a single line. The liberated information can be used by public health professionals and officers to better prepare and provide fast and tailored responses in times of pandemics. ICT is not of course a panacea. It is simply a device which can support by bringing valued and critical information into the hands of those who matter in extraordinary ways (Abbott & Barbosa, 2015).

We are constantly learning about nature's unpredictable powers. It is nowhere truer than in the ongoing emergence of new infectious threats to human health that emerge out of the natural world most of times without warning. The world has already been painfully reminded in these first two decades of the 21st century, time after time, of the degree to which people in all countries and on all continents remain highly vulnerable to infectious diseases, both known and unknown (World Health Organization, 2018).

Technological advancement takes place entirely beyond the remit of governments. In certain cases, innovation rates outstrip the capacity of states to stay up to date with the latest innovations and their future societal impacts. And even if one or a handful of national governments develop strategies to address these consequences, the global scope of many emerging technologies and their impacts require new solutions to multilateral governance that are far harder to decide on. In order to introduce, form and enforce both technological and normative approaches, a greater number and variety of actors have to be involved (Kavanagh, 2019).

As the world is fighting against COVID-19's pandemic spread, the role of Information and Communications Technology (ICT) in raising public awareness and prevention, surveillance, diagnosis, care, and organizing response for COVID-19 has become more important. Therefore, ICT interventions can be viewed as one of the most successful, widely used, and common modes worldwide to counter the COVID-19 pandemic spread. A variety of ICT-based initiatives have been taken around the world, including the creation of a dashboard to provide updated Coronavirus statistical reports, digital interactive maps, awareness-raising measures and emergency contact information or hotline numbers. WHO has collaborated with various social media sites (e.g. Facebook, WhatsApp) to provide accurate information as well as health warning messaging service. China has introduced a range of robot and drone technologies to support software applications for medical personnel, thermal imaging and temperature control, and smart helmets to detect possible virus carrier. India, Australia, Canada, the United States and South Korea have

implemented a variety of ICT-based development initiatives to combat the Corona pandemic (Zaman et al., 2020).

Therefore, this paper will look into these technological innovations that have/would be used in managing the spread of dangerous viruses or diseases and how they are used to facilitate the following during an epidemic a. Location strategy b. Supply chain c. Inventory Management d. Prediction

ii) Problem statement

Determining appropriate concepts and values involves more than a common understanding of how scientific technologies develop, how they were built, and how they could be used. This moral contemplation often includes a strong understanding of the various values and principles retained by different societies around the world, as well as the means and actors by which those values and principles can be preserved. It also includes moving beyond simply articulating and proliferating concepts into concrete practice and understanding related obstacles and limitations (Kavanagh, 2019). In developing countries, a critical mass of ICT 's skilled and community health users has not yet been achieved. Most of the strategies employed are still in a fairly new phase of implementation, with insufficient research to assess their importance, applicability or cost effectiveness (Chetley et al., 2006).

iii) Significance of the study

The paper assesses the impact of Technological innovations and applications in the emerging epidemics, and advocates the need to leverage recent advances in digital technology to inform emerging threats and epidemic preparedness and rapid response in terms of Operations Management on Location strategy, Supply chain, Inventory Management, Prediction. It will also contribute to available literature to support use of ICTs in operations Management

iv) Study objectives.

1. To understand the concept of current ICTs usage on combating emerging diseases and pandemics.
2. To Look at the benefits of the new technological innovations in Operations Management in health sector.
3. To find out the key challenges faced by the health stakeholders in embracing ICTs and to isolate those that can be solved using ICTs.

3 Literature review

3.1 The concept of current ICTs usage on combating emerging diseases and pandemics.

ICTs help to promote successful surveillance and control strategies for outbreaks including but not limited to contact tracking, social mobilization, mapping, communication, surveillance and response. It can also assist national and international efforts to control disease spread, have played and continue to play a critical role in raising awareness, preventing disease spread, and promoting the role of frontline healthcare workers by providing better ways to communicate fast, trustworthy and accurate instructions and information. In these innovative approaches that combine biomedical and social sciences, that are community oriented, and that use modern technology that proactively forecasts / anticipates, identifies and reacts to current and emerging threats while providing coverage for all primary health care (E et al., 2017).

Modern ICTs usage on Combating emerging diseases and pandemics

Artificial Intelligence

Analytics have changed the way it monitors and handles disease outbreaks, thus saving lives. The global community is currently focusing on the novel coronavirus (Covid-19) pandemic which was first identified in Wuhan, China in 2019–2020. As it spreads, raising concerns of a global shutdown, international organizations and scientists have used artificial intelligence (AI) to monitor the outbreak in real time to predict where the virus would next appear and establish an effective response (Kritikos, 2020).

Artificial Intelligence includes many sub - categories including the processing of natural languages, computer inferences, computational machine learning and robotics. Some subdisciplines, like deep machine learning and Machine inferencing is often seen as points along a continuum that require progressively fewer people in complex decision-making. Some observers believe that will ultimately lead to General artificial intelligence or superintelligence which either achieves or exceeds human intelligence. Yet it is fiercely debated whether AI will ever actually achieve or exceed such capacities for cognition and abstract decision-making (Kavanagh, 2019).

In the case of Covid-19, AI was primarily used to help diagnose whether people have novel coronavirus by detecting Covid-19 visual signs on images taken from computerized tomography (CT) lung scans; to control changes in body temperature in real time by using wearable sensors;

and to provide an open-source data base to track disease transmission. AI will process large quantities of unstructured text data to forecast the number of possible new cases by region and which types of populations will be most at risk, and to analyze and refine strategies to monitor the spread of the disease. Many AI applications can supply drone medical supplies, and can clean patients houses and scans authorized drug repositories which may also function against Covid-19. AI technologies have been exploited to develop new molecules that could serve as potential medicines or even speed up the time taken to predict the secondary RNA structure of the virus (Kritikos, 2020).

Blockchain Technology

Recently Blockchain technology has emerged as a key technology in the critical epidemic management domain. Blockchain implementations could provide a reliable, open, and inexpensive means of promoting efficient decision-making and could result in quicker responses during these emergencies. Blockchain has the potential to become an integral part of the global response to coronavirus in the sense of this pandemic by monitoring disease transmission, controlling insurance payments and ensuring the viability of medical supply chains and donation monitoring pathways (Zaman et al., 2020).

Blockchain applications may track the spread of infectious diseases over time by building 'ledgers' which are both safe and updated hundreds of times a day. Furthermore, the use of blockchain will enhance diagnosis accuracy and treatment efficacy, streamline the rapid identification of clusters of cases, monitor drug supply chains and medical supplies, manage medical data and recognize trends of symptoms of the disease (Kritikos, 2020). In cases such as a virus outbreak, where large numbers of incoming real-time data are released, blockchain can enhance transparency and give computational confidence, and an integrated framework for recording and sharing accurate factual information among multiple parties. Beyond the utility of blockchain as a health data monitoring and tracking tool, health authorities can make use of authorized blockchain systems to tackle the health care interoperability problem, and help speed up medical testing by enabling data storage and sharing among researchers while ensuring the reliability of data collection and reporting in clinical trials.

A blockchain-based application has been introduced to allow organizations to discover demand and supply chains of medical supplies, given the scarcity of facial masks, and to address the

challenges of handling, allocating and donating relief supplies. It reviews, documents and monitors production, supplies and logistics related to materials used for disease prevention. In the sense of data monitoring for outbreaks, one blockchain-enabled app has a specialized portal to track diseases, deaths and recoveries globally in real time, ensuring that no single piece of information provided can be altered or changed (Kritikos, 2020).

Telehealth Technologies

Telehealth technologies allow doctors to monitor and treat patients virtually through an interactive two-way multimedia communication system, in real time. This includes video 'appointments' via computers, tablets, smartphones, chatbots and automated systems allowed by webcams. Remote distribution of health care facilities with multimedia conferencing technology provides a range of critical benefits (Kritikos, 2020; Zaman et al., 2020). Firstly, it helps hospitals to be kept open for reported cases; secondly, it decreases the rate of transmission of pathogens, because there is no chance of exposure to the pathogen; and thirdly, because it is available at any time, it can handle more patients than in-person treatment. Hospitals, public health agencies, and digital health companies around the world are currently deploying electronic symptom checkers to scan patients for Covid-19 signs and get comprehensive history of travel and exposure. Telemedicine is also interesting in that it can carry the expertise of infectious disease professionals to people who do not have access to such specialty treatment

Thus, alternative technologies, beneficial to self-quarantine, may give an important connection between doctors and patients, evading the need to go to overcrowded hospitals. Given the high transmission rates of the disease, particularly in hospitals, telehealth technologies can be a cost-effective means of slowing the spread of the virus and the burden on hospital resources by acting as a potential filter, keeping those with mild symptoms at home while transporting more serious cases into hospitals (Kritikos, 2020).

3-Dimesional Printing Technologies

Three-Dimensional printing production method in which structures are produced on the basis of digital models by joining or printing layer by layer. The key advantage of this technique is that parts that are required in only limited amounts can be manufactured at low cost, because only one form of manufacturing machine is required and the design functional prototypes, computer-aided

design (CAD) files, can be dispersed or reproduced at the expense of locally available materials. Because of its usability, practical nature, product testing and versatility, 3D printing is important when vital product supply chains are strained, as in the case of the Covid-19 pandemic, where hospitals and healthcare systems around the world are facing severe shortages of safe medical equipment supplies (Kritikos, 2020).

Due to the high level of exceeding the capacity of the health systems, including the availability of medical equipment (face masks, ventilators and breathing filters) for treating Covid-19 patients, governments around the world are taking increasingly drastic steps to improve production and maximize the supply of medical equipment needed. As the coronavirus continues to place strain on hospitals around the world, three-dimensional (3D) printing will play an important role as a new digital manufacturing tool in sustaining the efforts of hospital staff in the midst of this emergency and in keeping patients alive (Kamel Boulos & Geraghty, 2020; Kritikos, 2020; Zaman et al., 2020).

Nanotechnology

Nanotechnology is an emerging field which makes targeted use of nano-sized particles and devices for different applications, including diagnostics, delivering drugs and producing new therapeutic materials. Nanoparticles like gold and silver were used in biomedical and medical applications, for example for the identification of viral particles. It has been shown that nanotechnology helps in the treatment of viral infection using different mechanisms. Nanoparticles can function as an antiviral drug delivery applications; they can actually communicate and bind to a virus, thus preventing its attachment and entry into the cell wall; and they may be designed to demonstrate antiviral effects (Kritikos, 2020).

What is sadly missing is an antiviral drug agent to treat the infected and, promptly, to greatly reduce and transmit viral shedding. At present, Nano-based technologies are being produced and deployed for Covid-19 containment, diagnostic and treatment. The first vaccine conducted in a clinical trial has been an experimental nano-vaccine (Kritikos, 2020).

Ethically, data ownership, anonymity, data security, medical intervention and benefit-sharing are some of the key concerns when using nanotechnology for health-related applications. Although there is still a long way to go before a comprehensive regulatory structure for nanomedicines is

established, with the establishment of harmonized principles across the EU and the establishment of protocols for the characterization, assessment and process control of nanomedicines, nanotechnology could provide an effective response to this pandemic challenge (Kritikos, 2020; World Health Organization, 2018).

Drones and Robots

In the fight against the coronavirus pandemic drones and robots are deployed all over the world. With robots that clean entire hospitals, decontaminate public and private areas, treat hazardous waste pollution or supply food and medicines; Robotics technology is used to reduce the risk of peer to peer transmission particularly in pandemic hotspots as an intelligent solution to counter coronavirus to robots that take patient temperatures and serve as medical assistants (Kritikos, 2020).

Robots are also a modern technology that is being introduced to control the Covid-19 spread. Since the first coronavirus outbreak (Covid-19) in China to its spread all across world, robots are often used to deliver care and supports for those who are locked up or engaged in social distancing. Robotics engineers respond to public health issues and needs quickly, and the pandemic has rapidly monitored the 'testing' of robots and drones in general, with all stakeholders finding the most expedient and secure way to deal with the epidemic and restrict its further spread (Kamel Boulos & Geraghty, 2020; Kritikos, 2020).

The key benefit of using drones to control Covid-19 's spread, besides their ability to efficiently perform technological tasks, is their ability to reduce direct human contact to the virus by engaging less people in multiple operations. This may be vital to reducing infections by keeping some healthcare professionals out of hot zones and allowing medical personnel to detect new possible cases without having to contact others that could be contaminated. At the same time, the distribution by drone of goods and services and medical tests will ensure access to supplies for people in remote or quarantined areas, greatly reducing unwanted human contact (Kritikos, 2020).

3.2 The benefits of the new technological innovations in Operations Management in health sector

The harsh reality of today is that for most emerging diseases, there's no vaccine or treatment yet. It isn't as bleak as it would initially sound. WHO has established a Research & Development (R&D) framework for action on disease prevention: it is a global strategy and readiness plan that allows for the rapid activation of R&D activities during outbreaks. The goal is to rapidly track the availability of appropriate tests, vaccines and drugs that can be used to save lives and avoid large-scale crises. Public health strategies, however, will focus primarily on social-distancing steps to minimize human transmission and on managing the source of infection (e.g. by eliminating contaminated animals / reservoir elimination). Thus, ensuring early identification of a new pathogen and the initiation of human-to - human transmission is crucial to prevent the spread of emerging diseases. There is an active encouragement and pursuit of enhanced international knowledge and virus sharing among laboratories. That is important to allow countermeasures to be researched and developed. The outcomes of this interaction are Interventions which potentially save lives (World Health Organization, 2018).

Beneficiaries of ICTs cover multiple actors in key health institutions, and in developing world society as a whole. It is clear from the literature that there is a need for consistent identification of stakeholders at health institutions. It is necessary to examine individuals and groups as target beneficiaries of ICTs within key institutions of the health system, and to examine their capacities and needs, as well. The ability of ICTs to assist in the productivity and efficacy of the program at each point. These beneficiaries may include (Chetley et al., 2006)

Such as:

• International level: Donor organizations, foreign organizations (WHO, UNAIDS),

Nongovernmental International Organizations (NGOs).

• National level: European Union (EU) state bodies, Latest African Alliance

Growth (NEPAD), African Unity, national nongovernmental organisations.

• National and regional level: Ministries of government, national and regional NGOs

Regional legislatures, health authorities and regional hospitals.

• Local level: health center staff, health care professionals, physicians, traditional healers, civic members, patients and residents.

Health care beneficiaries range from client and community patient and health care staff associations to regional and foreign policy makers. Strategies which address the needs of the beneficiary and are extensively studied and investigated have the greatest potential for success. In comparison, approaches that are not rooted in simple and practical requirements, due to lack of engagement, recognition, capability and other enabling factors, are vulnerable to failure. Beneficiaries can also be viewed through an access and place perspective (World Health Organization, 2018).

Differential to urban / rural. ICTs may help to expand access to health care from urban to rural areas, linking people to treatment and information. This involves patients being able to access information about their own health care, and allowing remote health care staff to get advice and help from colleagues who have access to better facilities and sources of knowledge (Chetley et al., 2006).

4 Discussions

The information technology revolution has significant implications for all forms of biomedical science, medical care and teaching. In the medical application of physiological information, the noble willingness on the part of publicly funded organizations in handling disease to make their data accessible to the scientific community at large is of immense importance. The trio of public databases developed in Europe, the United States and Japan (the European Bioinformatics Institute, GenBank, and Japan's DNA Data Bank, respectively) have achieved this aim. On three continents the entire data set is securely held in triplicate. In both industrial and developing countries, the continued development and expansion of accessible databases will be of inestimable value to scientists. Electronic publishing of high-quality, linked articles (Weatherall et al., 2006).

Initiatives and further telepathology progress can help bind scientists in the developed and developing worlds. The growing availability of telemedicine training packages would help spread good practice. Realizing only these few examples of this field's enormous potential would require a major push to train and hire young scientists in information technology, especially in developing

countries, and financial support to get the basic equipment required (World Health Organization, 2018).

Stronger health systems are required to reduce the effects of epidemics, protect health care workers and ensure quality of health services during and after them. Epidemics and pandemics put big strain and stress on these processes. The rapid inflow of large numbers of sick people into health care facilities increases the capability and resources of the systems, even more so and more significantly where services are already limited (World Health Organization, 2018; Zaman et al., 2020). When an outbreak occurs and spreads it immediately draws the attention of most health workers and monopolizes the human and financial resources of the health system, as well as medical supplies and technologies.

People, efforts, and medical supplies all shift to the emergency response. That also results in the lack of important basic and routine health services. People with health conditions not linked to the epidemic find access to health care facilities more difficult. As a consequence, others can die, if the interruption overwhelms the health care system. Rates of mortality from other diseases for which people could not receive treatment could increase.

Information systems within the health care system – medical records, disease occurrence tracking, monitoring of medication stocks, management of product ordering systems, billing procedures all benefit from the use of ICTs. ICTs are the basis for designing and running information systems, which allow knowledge to be generated which implemented. Information systems function at many levels of complexity and sophistication — from very specific to very general (Chetley et al., 2006).

We often see shortages of medicines and equipment during public health crises of international concern. Shortages may have significant implications for manufacturers or retailers, such as hoarding and price gaging. Sometimes, the places affected are also supply centers for manufacturing, contributing to a decrease in production. Digital supply chain maps are essential to preparing and maintaining regional diversity of vendors, as well as aligning with delivery needs.

Residents of impacted areas can use applications that are publicly available to locate critical aid and resources. Apps and maps can display hospitality information and navigation with available beds, medical aid clinics along with current waiting times, open-ended grocery stores and

pharmacies, places to buy personal protective equipment, and more. This information could critically improve outcomes in heavily impacted cities and save lives (Kamel Boulos & Geraghty, 2020).

5 Conclusion

ICT has been instrumental in preventing the spread of infectious diseases, and there are many cases to support this. Pinpoint events Include the creation in the late 1990s of an Internet-based monitoring network and the detection of the path of epidemics transmitted by the use of big data and mobile devices during SARS and MERS outbreaks. Furthermore, predicting disease using AI and algorithm, advancing precision medicine, and forecasting and controlling epidemics by genetic analysis can play greater roles in the battle against epidemics when moving through the age of the 4th industrial revolution (Broadband Commission for Sustainable Development, 2018).

Among the Five earlier in this thread-mentioned data science innovations, genetic data analysis, mobile phone connectivity data analysis, and social network data analysis are the categorizations extracted from data source. Mobile data use resulting from ever-increasing smart device delivery, Increasing efforts are being made in the fight against epidemics to use not only medical data (epidemic data, genetic data) but also mobile data (cell phone mobility data , social media data) Scientific data, which we should call small data rather than big data, produces a synergistic impact when integrating it with mobile data, enabling us to tackle epidemics in full Big data. Mobile data including call data and roaming data are currently being used in areas requiring a high degree of instantaneity, such as tracking epidemic spread routes and identifying potential spread regions (E et al., 2017).

So, for effective Operations Management in the health sector to combat and prevent transmissions of new diseases and pandemics,

6 Recommendation.

The monitoring system for epidemics is an information area which is based on the 'information cycle' that encompasses information-data. The framework is at the very heart of the knowledge network, the ultimate cornerstone of Operations in managing epidemics. Knowledge is gaining even greater importance Looking ahead with the advancement of AI and Big Data ICTs, a very passive form of the past epidemic surveillance system where media institutes reported disease

outbreaks should transition to a more proactive monitoring system based on e-health records and broad data collected from various sources. Furthermore, the RODS (Real-time Outbreak and Disease Monitoring System) can be developed and used more effectively in epidemic combating.

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