



Outcomes, Objectives, and Recommendations for Dealing with the COVID-19 Pandemic with the Aid of Information Technology

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Abstract : Applications and innovation advances of all kinds have been developed to combat the Covid pandemic. The pandemic also makes recommendations for the design, development, and application of technological improvements. A deeper understanding of the roles that data systems and technology experts can play in this global pandemic is urgently needed. In this research, emerging innovations that have been employed to reduce COVID-19 risks and important challenges with innovation application, improvement, and planning are examined. Additionally, it offers examples and suggestions about how data scientists and innovators might fight the COVID-19 pandemic. The goal of this article is to advance future research and innovation development to produce better solutions for managing the COVID-19 pandemic and upcoming pandemics.

IndexTerms - COVID-19, Artificial intelligence, Big data, Block chain, Information systems, Human behavior, Digital divide, System integration.

I. INTRODUCTION

The COVID-19 pandemic has a significant impact on the economy, businesses, organizations, and medical clinic structures. To help society stop the spread of the Covid, telemedicine, telecommuting, and online training are becoming increasingly important. The pandemic has sparked a rapid interest in efforts to use creative innovations to counteract the negative effects of COVID-19 on our way of life. The pandemic has increased not only the freedoms to advance innovation-based arrangements but has also provided an exceptional opportunity to think about the study and practice of innovation, including data the executives, work methods, plan and use of innovations. The Covid threat has accelerated the development of telemedicine, telecommuting, and online education. This is a reminder that technological innovation has many benefits and can play a significant role in managing and reducing the risks associated with the lockdown both during and after the pandemic. It is noteworthy that data frameworks and data innovation (IS/IT) play a key role across the board in risk management, clinical decision support, crisis/emergency response, and medical services.

Many IS/IT professionals are working on various strategies to fight the pandemic, including developing tools to stop the virus, monitoring and anticipating its progress, and defending emergency clinics against cyberattacks. By drawing on their prior experience and knowledge of responding to emergencies, dynamic, remote working, leading virtual teams, dissecting vast informational indices, and other related topics, in-arrangement frameworks and innovation researchers should contribute to this global effort to combat COVID-19 and future pandemics. In order to combat the COVID-19, there are currently not enough exploration commitments in the IS data framework zones. The epidemic offers recommendations for the design, enhancement, and use of data frameworks and technological advancements.

Data framework experts and professionals can assist in directing an examination of the COVID-19 pandemic information and participating in potential research themes that may emerge, such as encouraging work while socially removing, contactless commerce, face recognition when wearing veils or in different emergencies, COVID-19 applications as far as security, publicly supporting, giving information, and following cases, mechanical technology and their impact on associations. Also identified a few opportunities for IS analysis to support enhancing adaptability to pandemics and extraordinary events, including (i) upgrading the general healthcare framework from reactive to proactive using ongoing observation frameworks and contact following tools to stem transmission, (ii) changing associations by improving emergency driven readiness and decreasing emergency uncovered delicacy, and (iii) enabling people and networks through IS analysis. Present an assessment of the fundamental challenges of COVID-19 using a data framework and novel perspective, and provide tid bits of information for investigation and suggestions taking into account the impact of COVID-19 on data the executive's examination and practice in altering training, employment, and life. [1] This paper attempts to minimize the cover by focusing on innovation joining from the information, system, and individual aspects to discuss how data frameworks and innovation researchers could provide knowledge and insights to assist fight the epidemic. Data frameworks and innovation researchers are in a fantastic position to use their experience and knowledge with data frameworks and other advances to improve existing frameworks and innovation practice and help the public become flexible to future enormous scope disturbances as data frameworks and advancements are becoming increasingly important to society

II. EXISTING IT SOLUTIONS

This study examines innovative COVID-19 pandemic relief strategies using the information human framework system. By focusing on the following three sections: (1) extraction, combination, and delivery of health information; (2) interoperability of frameworks; and (3) rules and interface to manage individuals' conduct, the information human framework structure illustrates a multidisciplinary guide for controlling and overseeing chronic illnesses. It is important to note that the initial information human framework structure was proposed for the constant infection the board, which requires further advancement to be proactive and evaluate the pandemic environment.

The COVID-19 pandemic has brought to light the urgent need to transform the general healthcare system from reactive to proactive, and to develop innovations that will provide continuous data to proactive dynamic at the local, state, and public levels of general healthcare systems. The corona virus is very contagious, can spread from person to person, and has a high mortality rate, making it different from ongoing diseases. Additionally, because COVID-19 is a new disease, research into the infection that causes it, clinical outcomes, and government and association initiatives continue to advance.

The impact of COVID-19 on people and society is evolving in ways that were previously unthinkable. Fighting the COVID-19 pandemic demands strong coordination of many resources because the existing pandemic situation and its results continue to produce excessive fluids. This paper adopts the information human framework structure to examine the current innovation solutions for combating the COVID-19 pandemic and to highlight their challenges and potential liberties for data frameworks and innovation scientists. This is done in light of the risks and dangers presented by COVID-19. In order to better understand the current data frameworks and innovation arrangements and the roles that they could play in this challenging pandemic season, we have conducted a thorough search using scholarly data sets and web crawlers with a variety of questions identified with innovation, Covid, and COVID-19. This search included the connected conversations in papers, news sites, websites, white papers, professional sites, dark writing, or scholarly writing.

Recently, some innovative applications have been developed to combat this pandemic, such as flexible COVID-19 contact following applications and visit bots. By putting these solutions into practise, we can lessen the impact that the Covid epidemic has on people, groups, and society as a whole. Utilizing new technologies effectively and creatively can aid in identifying the localised spread of COVID, screening the health of individuals who have been exposed, improving their care, and aiding in the development of therapeutic medications and vaccines. This section evaluates these innovation applications based on the Bardhan et al. information human framework structure. Artificial intelligence (AI)-driven developments including machine learning, image recognition, and deep learning computations can be used for early disease detection and analysis as well as for more rapid drug discovery for developing new medications. A few companies have also adapted AI frameworks that were previously designed for different fields to support social distancing need and agreement after.

Face coverings and other Personal Protective Equipment (PPE) for healthcare workers can be produced with the use of 3D printing technology. In order to offer 3D printed rayon wrapped nasopharyngeal (NP) swabs for COVID-19 testing, Markforged has partnered with Neurophotometrics. The swabs can collect virus particles far more quickly and can be made in under three minutes. Large Data Analytics can be used to identify people who require isolation based on their mobility history, anticipate the COVID-19 bend, hasten the development of antiviral drugs and antibodies, and advance understanding of the COVID-19 spread in both reality and theory. Large-scale information analysis has been successfully used in Taiwan to identify COVID-19 cases and generate ongoing warnings by looking into clinical visits, travel history, and clinical signs. In order to develop novel drugs and antibodies, HPC frameworks and supercomputers are expected to handle complicated logical problems and interact with big datasets in a shorter amount of time. The COVID-19 High-Performance Computing Consortium was sent to make use of the US supercomputers and processing resources. 16 public and private entities, including the US Department of Energy (DoE), IBM, and other academic and business trailblazers, are part of the partnership.

By using cutting-edge mobile phones and video conferencing equipment, versatile applications can be used to track social trends, prepare people for visiting COVID-19 tourist destinations, help medical professionals diagnose patients through video services and telemedicine/telehealth, and support people with online shopping, e-learning, online meetings, and telecommuting. To assist medical service workers and regular people in this emergency, many telephone and organisation managed applications have been developed. For instance, the U.S. Public Science Foundation funded a grant to assist Princeton University researchers in developing a system to transmit a firmware upgrade to mobile devices, enabling closeness following capability to healthcare authorities. The access code for the closeness information would be hidden on the actual phone and would only need to be accessed when the owner knowingly gave the phone to health officials. Let's say someone tests positive for an infection like COVID-19. All things considered, health officials might use the system to identify any other wireless users who were within a certain range of the infected person for a certain period of time.

Depending on the knowledge of the ailment, health officials could restrict the time and distance. Medical care departments can get in touch with those who might have been exposed, inform them about the openness, and instruct them on how to get tested for the illness and self-isolate as needed. To combat the Covid incident, robots have been employed. For instance, without having a direct human relationship with the patients, clinics use robots as emotionally supporting networks to deliver food and medication, clean rooms, and diverse areas of interest. According to a CNN news article, medical professionals in Seattle have treated the initially confirmed understanding who tests positive for Covid in the country using a telepresence robot. Additionally, robots are used to provide medical supplies, monitor public areas, and track resistance to isolate orders. In order to stop the spread of the Covid virus, the Internet of Things (IoT) can be used to identify people who have been exposed to it. IoT is divided into a few practical components, including information gathering, movement, analysis, and capacity. IoT sensors installed on smartphones, robotics, or health monitors can be used to collect data. The sensor data would then be sent away from the cloud worker for handling, research, and dynamic. IoT, for instance, enables the verification of patient adherence to isolation requirements. IoT can also be used to take faraway patients' temperatures and relay the data to medical professionals via cell phones so they can monitor, track, and issue warnings while reducing the likelihood of Covid emphases.

Additional uses of IoT technologies include the use of dazzling wearable technology for COVID-19 response during early detection, isolation, and recovery. Block chain is a distributed ledger technology that keeps track of internet transactions. It is obtained through cryptography and is managed by an agreement mechanism. To fight the Covid epidemic, for instance, a smartphone application that influences block chain innovation and AI was developed. The use of block chain technology enables

the application to grant each user a "computerized character" that is bound by a private key and provides access to a modernised version of paper testaments provided by the public authority. These enable the confirmed healthy individuals to leave their homes to go shopping or to work.

Additionally, block chain has been used to prevent unauthorised parties from controlling the data. During the incident, a Chinese payment processor and financial services company tested a safer and more dependable method for case preparation and payouts by using block chain technology. The strain and trust concerns between maintaining protection and attending to general welfare demands, such as monitoring infected patients in the fight against COVID-19, have been investigated using block chain innovation. The confluence of information, people, and frameworks is necessary for all of the aforementioned advances. We carefully divide them into three classes based on their crucial focus and distinctive plan goal for future use. The information-driven developments for combating COVID-19 include AI/deep learning, massive information analysis, and HPC architecture. Robotics and 3D printing technology are examples of human-driven innovations that are used to improve patient care and protect healthy people from contamination with the help of specific systems. The Internet of Things, Block Chain, and other framework-driven innovations such as computerized contact following apps are included in the framework-driven advancements.

III. CHALLENGES

To do checks on patients and stop healthy persons from contracting Covid. Some of these developments might move outside their respective categories as they aid in managing the epidemic, depending on how inventively individuals implement them in other circumstances. Large data analysis that decides who needs quarantining, for instance, could have framework driven or person driven viewpoints according to the goals and uses by various government departments, health experts, medical clinics, and associations. [2] The COVID-19 pandemic has shown the flaws in current general health frameworks. The use of innovations in the pandemic fight creates challenges from a variety of perspectives. The specific concept of the COVID-19 pandemic necessitates strong coordination of related data, people, and frameworks to promote total cooperation in the fight against it. In general, general health offices and healthcare partners have not used comparable frameworks, information arrangements, or rules, which has hampered our ability to detect trends and develop countermeasures to the pandemic.

To better understand the growing pandemic and make collective decisions on responding to this disaster, general health analysts, disease transmission specialists, and government authorities should be connected through integrated frameworks with related information. As individuals play a significant role in the fight against the COVID-19, it is essential to connect, coordinate, and support many partners through innovative and integrated ideas. [3]

IV. CONNECTING SYSTEMS TO INTEGRATE TECHNOLOGIES

Emerging technologies like the IoT, big data analysis, AI, and block chain can be combined to create clever solutions for addressing immediate Covid-related problems. For instance, Facebook has made use of man-made consciousness and significant information advancements to exploit satellite symbolism and enumeration data to create maps that show population density, socioeconomics, and go examples to aid in deciding where to send supplies or how to lessen the spread. Disease transmission experts can track persistent zero and identify close contacts of the infected patients with the use of extensive information analysis of geographic data frameworks (GIS) and IoT sensor data collected from sick patients.

Recently, the U.S. Public Science Foundation funded a RAPID award that examines the capacities and capability of incorporating web-based media large information, geospatial information, and AI innovations to empower and change spatial the exploration of disease transmission and danger correspondence. For addressing the problems of trust and security in general wellbeing, the emerging marriage of block chain, the IoT, and AI holds enormous promise. For instance, data from medical devices and non-personal sensor data collected by IoT can be stored and shared on block chains.

Due to security regulations, such as the GDPR, patients' personal information can still be stored in the emergency clinics' project frameworks. On-chain and off-chain information can be analysed and visualized using simulated intelligence and significant information advancements, and relevant partners can receive frequent analysis and recommendations through customized dashboards. The majority of systems and programmers currently being used to combat the pandemic are inefficiently interconnected since they were developed by diverse government agencies, health organizations, and associations. In the global response to pandemic problems, there are no effective structures or tools to achieve methodical integration across many breakthroughs. Rules and effective efforts are required to organise the variety of a lot of valuable facts associated with Covid situations in order to include these numerous developments. General health departments and medical clinics must provide a lot of reliable and high-quality information in order for AI calculations and the design of demanding large information examination to work. The combination of various information hotspots to advance interoperability is testing due to a lack of norms. While certain information sources may be thoroughly arranged, others may not be. Additionally, standardised protocols must be developed to promote communication across systems without compromising information security. To define the norm, conventions, information configurations and types, etc., governments, driving tech companies, health associations, and other major partners need to collaborate effectively and sufficiently.

Researchers in data frameworks and innovation have been examining framework coordination in large-scale business or authority settings for many years. Researchers who study data frameworks and innovation have also looked at data frameworks' role in crisis, disaster, and emergency response. Scientists working on data frameworks and innovation should seize the opportunity to demonstrate their skills in framework coordination and crisis or emergency response frameworks, and to offer suggestions and methodologies to help designers with various framework and innovation joining projects. [4].

V. CONNECTING DATA TO SHARE BEST PRACTICES

As the World Health Organization advises, greater collaboration and information sharing are anticipated to bring targeted solutions through a deliberate effort to support nations facing phases of this epidemic differently and at various times. In order to combat the Covid, nations must work together to share knowledge, data, resources, practical methods, and techniques. Furthermore, to organize the sharing and use of knowledge and information to address the problems we encountered during this pandemic, cooperation on a global scale between important parties, including associations and governments, would be essential.

For instance, China took extraordinary steps to shut down Wuhan, a sizable city with a sizable population, in order to stop the spread of the Covid. For other countries considering similar approaches, useful experience and exercises relating to their suitability as a control measure may be important. Web-based interfaces, information warehouses, and online training networks are just a few examples of the advancements in information mix and knowledge management (KM) that may be used to engage information associations with influence assets more effectively and profitably at a reduced cost.

In a pandemic emergency, information-based frameworks such as master frameworks and astute decision tools have been used to assist healthcare workers in identifying and diagnosing patients as well as providing active support to relevant medical care partners and chiefs. As the Covid flare-up keeps growing, information mining and representation breakthroughs have been used to identify and image information development across time and places. To inform healthcare professionals, patients, and other partners about COVID-19, indications, and the efficacy of treatments, online health networks have been established.

However, these frameworks typically function as a storehouse, and the knowledge, information, and data stored in their frameworks are rarely shared. We need to create an environment that encourages people across nations to exchange information rather than hoarding or holding it in order to allow various frameworks and partners in various networks of training to do so within and across their individual territories. In the event of a Covid flare-up, procedures might be developed to assess the information's nature and assist frameworks in identifying information storage areas that hinder communication and information sharing.

In order to promote knowledge and best practises sharing among partners, conduct issues should also be addressed. There have been numerous requests for data frameworks and innovation experts to consider the unforeseen or undesirable effects of advancements over the long term. IT professionals are rushing to create frameworks, programmes, and administrations for contact following, following, and isolated observing. Some of these innovations are portable for brief usage, while others are unavoidable and intrusive. For instance, many scientists agree that the use of sophisticated contact following and wellbeing code software can help to stop the transmission of disease.

Some people are concerned that current solutions, including watching contaminated persons through an app, could lead to a long-lasting state of reconnaissance by the public authorities. The effectiveness of computerised contact following is debatable since, if not implemented with proper security checks and encryption, it may lead to regrettable effects. For instance, some experts are discussing how mysterious the information is and whether it can be anonymized successfully to identify or gather the unique characteristics of infected individuals.

Sound professionals may misuse or manipulate the data they gleaned from sophisticated following diverse apps for lengthy and various goals. Many people are concerned about whether it is safe to use these Covid combating applications, how they will preserve their privacy, and what steps should be taken to prevent abuse. These concerns are probably going to undermine public confidence and affect people's decisions on emerging breakthroughs. There is also a need for more research to examine moral, ethical, and security concerns related to the achievements made to combat this epidemic.

It is crucial to consider COVID openings if you want to stop the spread of COVID-19. Governments all across the world are introducing technologies, such as flexible software to allow health authorities follow contacts of people who have recently been exposed to the Covid. These flexible applications function by keeping track of who a person approaches and then warning those people if the person agrees. COVID-19. Australia declared it illegal for non-health authorities to access information obtained on Smartphone programming to trace the spread of the Covid in order to secure people's protection and reduce people's fear about expanded observation.

In order to reduce security and privacy issues, the European Data Protection Board (EDPB) has released instructions for using location information and contact-following devices. A sequence of modifications, including more solid security assurances and precision to their COVID-19 contact subsequent activities, were disclosed by Apple and Google.

However, some analysts believe that it is justified to temporarily relax security controls for such inventions in the hopes of potentially saving lives, benefiting the public, and ensuring overall wellness in pandemic situations. Since sharing such data benefits the general good, many people have been preoccupied with self-revelation using web-based media to disclose individual data, such as wellbeing status and preventive practises (e.g., wearing veils and buying cleaning supplies). Some researchers believe that the benefit of innovation in ensuring overall wellbeing should not be diminished by security concerns. They believe that such advancements were not created with the intention of continuously advancing society.

The lack of agreement on security insurance in COVID-19 innovations demonstrates the critical need for developing best practise guidelines to reassure citizens regarding information gathering. People's acceptance of various innovations, such as sharing their information to address the problems caused by this pandemic, depends on public confidence and clarity. Currently, the decision of

In western countries, computerised contact-following programmes are intentional. It has been suggested that Western countries with a culture of independence, like Europe and the U.S., discuss these problems more than those with a culture of community.

In any case, for such applications to be effective, 60 percent of people with advanced cells would need to choose in. A test is the most efficient way to increase the number of clients who use these applications. Regarding the Covid pandemic, which has resulted in a high death toll, data frameworks and innovation researchers can assist in evaluating the use of advanced information and advancements that incorporate AI-related calculations in a thoughtful manner, provide oversight to client-related information, develop methods to encourage clients to share critical information on an individual basis, and assist in developing systems to ensure that innovation plan and use are guided by moral standards to ensure class.

Researchers in data frameworks and innovation may also assist in identifying best practises for reliable information gathering and information preparation and achieve a balance between protection and utility of the proposed enhancements. [5].

VI. CONNECTING PEOPLE WITH ENHANCED COLLABORATIVE TOOLS AND IT INFRASTRUCTURES

The COVID-19 episode is drastically altering the workplace. Through teleworking, a large number of people are relocating their workplaces to their homes. As information workers learn to work independently, telecommute, and use cloud services to measure and preserve records, many businesses gain. During this pandemic, we are observing a wider acceptance of internet services by people and many types of enterprises. There is a widespread understanding of the importance of IT

foundation in enabling online activities such as e-government, internet business, web-based learning, and teleworking. A record number of employees are turning out remotely for an extended period of time due to the pandemic, which generates heavy traffic for remote availability businesses.

In order to manage the effects of COVID-19 and upcoming public health emergencies, society must continue investing in IT infrastructure and speed up computerized transformation efforts.

Organizations must increase their investments in tools like video conferencing and social support networks for group decision-making in order to enable employees and conveyed groups to collaborate effectively while working remotely. However, prices for IT infrastructure are exploding as employees engage in teleworking and students enrol in online courses in light of the COVID-19 incident. It's critical to understand how rising demand is causing a rise in the hard costs of IT infrastructure.

IT underpinnings must be enhanced as the pandemic spreads in order for workers to carry out their duties securely and effectively. There may be some simple tasks that cannot be completed from home, but there are solutions available. It is crucial to understand the factors that influence the cost of meeting the increased demand brought on by teleworking, such as the price of additional licences for support items, cloud worker fees, and the price of video conferencing. Additionally, existing foundations like Google Cloud, Azure, AWS, or Salesforce should be used to access cloud services. Methodologies should be developed to maintain basic capabilities and services.

CIOs need to think about adapting the current to the new needs or creating new frameworks for the new situations. Last but not least, the state and adaptability of sophisticated infrastructure are also important areas to research. Indecisive situations with a lot of vulnerability and time constraints frequently call for cooperative decision-making. Data frameworks and innovation researchers can share their expertise with cooperative decision-making networks that are emotionally supportive in order to help them build consensus, aggregate dynamic regarding the spreading pandemic, and support governments, health professionals, associations, and the general public in making socially acceptable and delicate decisions regarding contamination recognition, disease expectation, and disease aetiology.

Frameworks for data and innovation In order to utilize the skills and experience of many partners, researchers can also assist in the formation of cooperative data frameworks, locally based data frameworks, abilities, and volunteer groups. For instance, a wastewater COVID-19 early warning discovery framework is a creative use. The detection of COVID-19 in wastewater could improve clinical diagnostics and serve as an early warning system for neighborhood monitoring and response. Continued wastewater-based testing could alert public health authorities as to if the Covid is still circulating in the area.

The wastewater COVID-19 early admonition recognition mechanism will need a lot of volunteers to work effectively. Data frameworks and innovation researchers can contribute by offering their skills to the public authority, specialists, and neighborhood networks in order to plan and build up a volunteer organization in order to connect with and organize a large number of volunteers, as well as by helping to create a community data framework in order to deliver a public programme there. As it draws attention to, prompt sending of grassroots advancement could produce swift solutions to meet urgent problems. [6]

VII. CONCLUSION

All in all, the COVID-19 pandemic has an impact on people, organisations, and society. The programme also offers recommendations on the design, creation, and use of innovations. The severity of the Covid pandemic's impact on people, groups, and society can be lessened with advancements. However, using modern technology to combat the epidemic creates issues with security, protection, predispositions, morals, and the digital partition. The COVID-19 pandemic is a specific notion that this study evaluates the innovative applications based on the information human framework structure and suggests necessitates solid coordination for connected information, individuals, and frameworks to stimulate overall cooperation.

There will likely be more pandemics in the future. While it's unlikely that data frameworks and innovation researchers will be able to directly contribute to the logical process of developing vaccination and treatment, we can still offer our knowledge, experiences, and time to help society better prepare for upcoming pandemics. It was suggested that a global regular information space be established for utterly unstoppable diseases in order to reduce costs associated with upcoming pandemics and increase information exchange during global health catastrophes. Due to several factors, including specialised, international, and moral barriers, it is difficult to create a global basic information space for the sharing of health-related information. Nevertheless, we support this need due to its promised benefits and greater social good.

At this point, researchers in data frameworks and innovation can still support and put together a public normal information space or wellbeing data frameworks for exchanging general wellbeing information.

REFERENCES

- [1] Agbo, C.C. Mahmoud, Q.H. & Eklund, J.M. (2019). Block chain technology in healthcare: A systematic review. Healthcare (Vol. 7, No. 2, p. 56).Multidisciplinary Digital Publishing Institute.
- [2] Agerfalk, P., Conboy, K., & Myers, M. (2020). The European journal of information systems call for papers: Special communications on information systems in the age of pandemics. Available at : <https://techjournals.wixsite.com/techjournals/ejis-is-pandemics>.
- [3] Brohi, S. N., Jhanjhi, N. Z., Brohi, N. N., & Brohi, M. N. (2020).Key applications of state-of- the-Art technologies to mitigate and eliminate COVID-19. Available at: https://www.techrxiv.org/articles/Key_Applications_of_State-of-the-Art_Technologies_to_Mitigate_and_Eliminate_COVID-19_pdf/12115596.
- [4] Pham, Q., Nguyen, D. C., Huynh-The, T., Hwang, W., & Pathirana, P. N. (2020). Artificial Intelligence (AI) and Big Data for Coronavirus (COVID-19) Pandemic: A Survey on the State-of-the-Arts. Preprints, 2020, Article 2020040383.<https://doi.org/10.20944/preprints202004.0383.v1>).
- [5] Young, J. (2020). Scenes from college classes forced online by COVID-19. Available at <https://www.edsurge.com/news/2020-03-26-scenes-from-college-classes-forced-online-by-COVID-19>.
- [6] Woo, T. (2020). Cloud players and research groups join the fight against COVID-19 with high-performance computing. Forrest. Available at <https://go.forrester.com/blogs/cloud-players-and-research-groups-join-the-fight-against-covid-19-with-high-perfor-mance-computing/>.
- [7] Thomas, K., & Bertsch, P. (2020). Australian researchers trace sewage for early warning COVID-19 spread. Available at <https://www.uq.edu.au/news/article/2020/04/australian-researchers-trace-sewage-early-warning-covid-19-spread>.