

## Vital Role of ICT for COVID-19 Response

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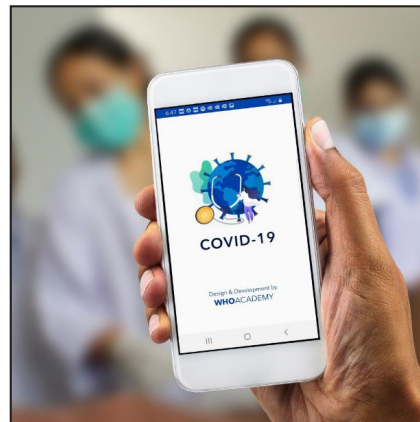


For thousands of years, pandemics of infectious diseases such as small pox, leprosy and tuberculosis have infected human beings. The deadliest pandemic on record was Black Death which caused deaths of up to 25-200 million people in the late Middle Ages, while diseases such as influenza, tuberculosis, smallpox, and leprosy were also responsible for some of the other most widespread outbreaks.

The current corona virus pandemic continues to spread in all parts of the world, after it was first identified in Wuhan, China in December 2019. The spread of the pandemic in terms of cases and deaths have forced countries to impose strict physical distancing and lockdown measures. All social and economic sectors are currently experiencing the devastating effects of the pandemic. Moreover, the health and livelihood of workers and employers are being threatened every day. Across the world, losses in terms of production and unemployment have forced some countries to recession, while poverty levels in developing countries are also on the rise. In order to keep the vital functions

of the society operational, information and communication technology (ICT) is increasingly used. In addition, new technological trends are emerging to build resilient societies, better health services, business solutions, and education of the future.

### Remote Work

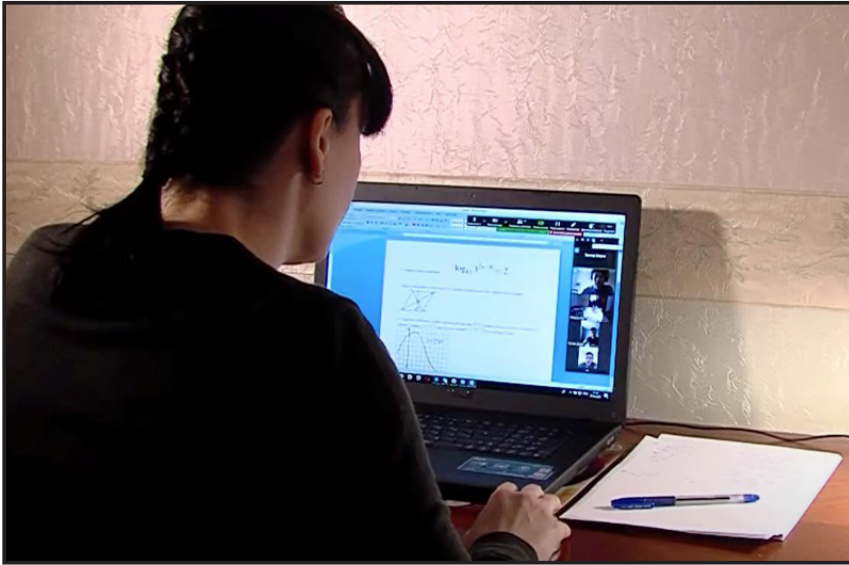


**Figure 01 : Mobile phone apps help the fight against the pandemic in many ways**

In the past, working from home was rare, and was confined to special cases. On the other hand, recent events have forced many business establishments to permit their staff to work remotely. However, at present most

businesses are not technologically geared to support distance work programmes, and therefore, this evolving trend has created new productivity concerns. Further, survey polls have revealed that issues such as poor internet connectivity, lack of good quality devices, as well as cyber security, have negatively affected the ability of employees to work from home. There are also coordination issues, since the modern workforce is increasingly mobile, comprising multi-generations that span across industries, and involving international connectivity. Continuous developments made in the field of communication technology will play a pivotal role to make effective remote working, a true reality in the foreseeable future. To this end, solutions enabled by 5G wireless connectivity, virtual private networks (VPNs), cloud computing and video conferencing tools will allow employees in different locations to actively collaborate and meet deadlines efficiently.

### Online Shopping, Digital and Contactless Payments



**Figure 02 : A mathematics distance lesson during the COVID-19 pandemic in Russia**

For some years now, digital payment methods such as credit cards, electronic wallets, smart cards that allow people to pay for goods and services have been popular. The pandemic conditions have caused this trend to accelerate, and for reasons such as fear of touching cash and reducing person-to-person contact, COVID-19 crisis has presented an impetus for the rapid worldwide transition into digital payments. It is important to develop robust identification systems and access to the internet, to enable digital payments. Today, more than three billion people own a smartphone. Smartphone applications allow customers to easily and securely pay and grant access to mobile banking services. Pandemic situation has offered new opportunities to develop contactless systems through innovations in areas such as facial recognition, quick response (QR) codes, block chain technology and near-field communications.

### Distant Learning

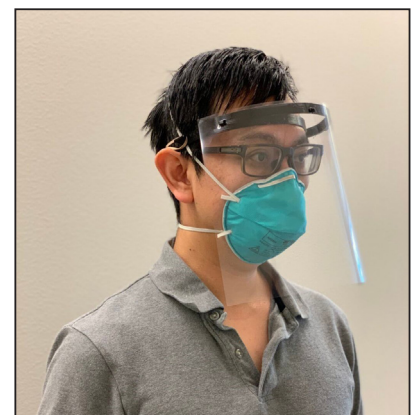
The COVID-19 crisis has also

caused significant disruptions to the provision of education and training. Due to school closures, many children have been forced to learn from home for a prolonged period now. ICT helps to remove barriers in education. Recently, many online learning applications, digital platforms and resources that connect administrators, teachers and students have emerged. Such systems allow documentation, tracking, reporting of student learning activities to create an effective learning environment. There are also Massive Open Online Course (MOOC) platforms that promote distance learning on a wide variety of subjects. Experts have identified Artificial Intelligence (AI) as a tool in education. Coupled with image/video processing, AI for example, can be used to identify the level of attentiveness of students when learning. Further, AI can be used to deliver personalized education content for individual students by understanding their study habits. Additionally, big data storage technologies and processing techniques are increasingly used

to deal with the huge amount of information that online educational systems generate.

### Telehealth

Traditionally, telemedicine has concentrated on doctor-patient interactions using audio and video communications. Today, ICT continues to massively transform the extended field of telehealth. ICT-based solutions have allowed hospitals to deliver better healthcare services, training and information dissemination since the beginning of the pandemic. Wireless technologies help doctors, patients, and families of patients to communicate at ease without direct contact. They also allow doctors to extend their consultancy to other under-staffed or heavily loaded hospitals promoting high efficiency. Governments across the world have launched cellular broadcasting services and mobile phone apps to alert the public about infection hotspots, COVID-19 screening centers and broadcast emergency information. Smart phone apps can also perform contact tracing and self-diagnosis of coronavirus symptoms to automate the process of identifying infected people. Internet of Things (IoT) and asset tracking technologies also help to keep a record of location and condition of hospital equipment.



**Figure 03 : 3D printed face shield**

Visible light communications (VLC) show promise to deliver high speed data rates; operate inside electromagnetic sensitive hospital areas and implement indoor localization systems. For individuals at home, telehealth applications provide a convenient way of accessing comprehensive quality healthcare services. For example, ICT-based solutions will allow patient data to be transferred to hospital servers on a daily basis to run diagnostic tests. Fully automated AI empowered systems will analyze these test results and recommend medication in case of a minor illness or call upon clinicians to analyze the conditions further. Moreover, bio-medical engineering, signal processing and advanced electronics have led to the design and development of implantable sensors that can function inside the human body and transmit data to outside. Real-time health data will facilitate the rapid investigation of situations and attend to emergencies without delays.

### Robotics and Drones

The highly infectious nature of the coronavirus has forced robots to be used as contactless alternatives. Robots have been used to decontaminate hospitals and public places with ultraviolet (UV) light. Further, robots work in hospital rooms allow doctors



**Figure 05 : Medical experts holding consultations at a telemedicine center in China**

to take measurements from patients remotely. Assistive robots also help to deliver supplies, for example, medicine in hospitals and food to quarantined people in hotels and elder care homes. Research institutions worldwide are continuously developing robots capable of executing complicated tasks with minimal human intervention; remotely taking blood samples, ultrasounds, listening to organ sounds of patients and performing mouth swabs. ICT allows these robots to operate as a swarm to coordinate their activities efficiently. Further, robots can connect with technologies such as cellular or Wi-Fi to transfer data so that medical laboratories can carry out further investigations. Flying robots or popularly known as drones have also been deployed during the pandemic. Drones can deliver test samples to laboratories and monitor crowds to determine whether violations of physical distancing rules occur. Drones can also be fitted with powerful on-board cameras and thermal imaging equipment so that they can zoom in on a person to collect temperature, heart rate information, detect coughing and sneezing etc. They are also useful to sanitize hard to reach surfaces and areas. The limited on-board energy of current drones severely limits their flying times and ability to do advanced processing. However, drones continue to benefit from advances in low-power electronics, and emerging paradigms such as mobile edge computing that enable them to offload computationally heavy tasks to nearby devices and cloud platforms.

### 3D Printing

3D printing is a technology useful to develop new products for the



**Figure 04 : Ultraviolet disinfection robots**

coronavirus pandemic. Students, engineers, and doctors have designed and produced a wide range of 3D printed products such as face shields, ventilator parts, hands-free door openers, wrist attachments etc. Some inventors have uploaded relevant design files into the internet so that anyone in need can freely download and manufacture at a rapid rate. For example, the Prusa face shield (<https://www.prusaprinters.org/>) takes merely 1 hour and 35 minutes to make and almost 200,000 of them have been donated to medics in the Czech Republic. In countries hit hard by coronavirus infections such as Italy, companies have come forward to print a large number of face masks and other medical components. When it comes to the rapid production of components in need, 3D printing offers new advantages over traditional manufacturing processes. Designers can manufacture, test and customize products in rapid time with 3D printing. Despite the attractive features of 3D printing, there are also complications. Medical equipment should be properly sterilized. However, one of the popular materials used in desktop 3D printing called Polylactic Acid or PLA is unable to withstand the high temperatures used in sterilization. Moreover, as the number of available products

increase, it is important to establish good quality assurance programs that help to build trust among caregivers.

### Big Data

Medical big data, advanced analytics combined with AI are imported for fighting the current pandemic. In order to control the transmission of the coronavirus, mass testing should be conducted to identify the positive cases and others who came in close contact with them. Tests produce a wealth of data and big data analytics has the potential to uncover information valuable to the doctors. The Allplex 2019-nCoV Assay, a test developed by the in-vitro diagnostics company, Seegene, Inc. (<http://www.seegene.com/>) uses a proprietary AI-based big data system. Moreover, contact tracing is an effective tool to rapidly predict the spread of a disease. Once a positive case is discovered, contact tracing technology works backward by using past locations and other information in mobile phones to isolate others who might have been infected, or to forecast the progression of the virus in communities. Tracing becomes accurate when large amounts of data due to multiple sources are merged, and big data analytics is increasingly applied to handle the data processing complexity. On the path to map the virus structure at atomic scale, big data analytics is also a valuable tool for medical researchers across the world. 3D visualization of the virus structure is convenient to understand the function and evolution of the coronavirus as well as to target potential vaccine development.

### 5G and IoT

5G network deployments continue to grow rapidly across the world since they were switched on in 2019. 5G will connect users and devices at an unprecedented scale and power innovation in the areas such as IoT, AI and virtual reality. 5G will also significantly minimize the end-to-end delays of communication to support new use cases; namely, intelligent transportation, industrial automation, positioning etc. In



**Figure 06 : Drone technology is being deployed to monitor crowded places and social distancing**

the fight against the pandemic, 5G provides crucial communication support. First, 5G live broadcast services are useful to carry out news delivery related to the pandemic reliably. In China, 5G remote consultation systems have been implemented, so that medical experts can interact with patients without ever entering the isolation wards. 5G communication systems also allow experts to carry out diagnosis of critical patients in rural areas where access to proper medical services are limited. 5G supported unmanned driving technologies can be used for disinfection, cargo transportation and broadcasting pandemic information to the public. Medical robots too can benefit from reliable and low latency 5G links

to carry out tasks such as cleaning, delivery of medical equipment, and disinfection.

In conclusion, digital technologies continue to reshape the evolution of every sector in our societies. The outbreak of COVID-19 has given an excellent opportunity to adopt existing and emerging ICT solutions, firstly to fight against the pandemic, and secondly to enable the post COVID socio-economic development. Today, telecommunication operators hold a wealth of customer data in the world. Data science in association with AI will support ICT to develop automated processes that will be efficient and cost-effective when serving the society. There is no doubt that widespread use of ICT comes at the price of key issues such as cyber security, misinformation, and digital divide. All such issues should be addressed through policy development, tailor-made strategies and technological advancements, such that the power of ICT can be harnessed to fight the pandemic, and transform the future society positively.



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