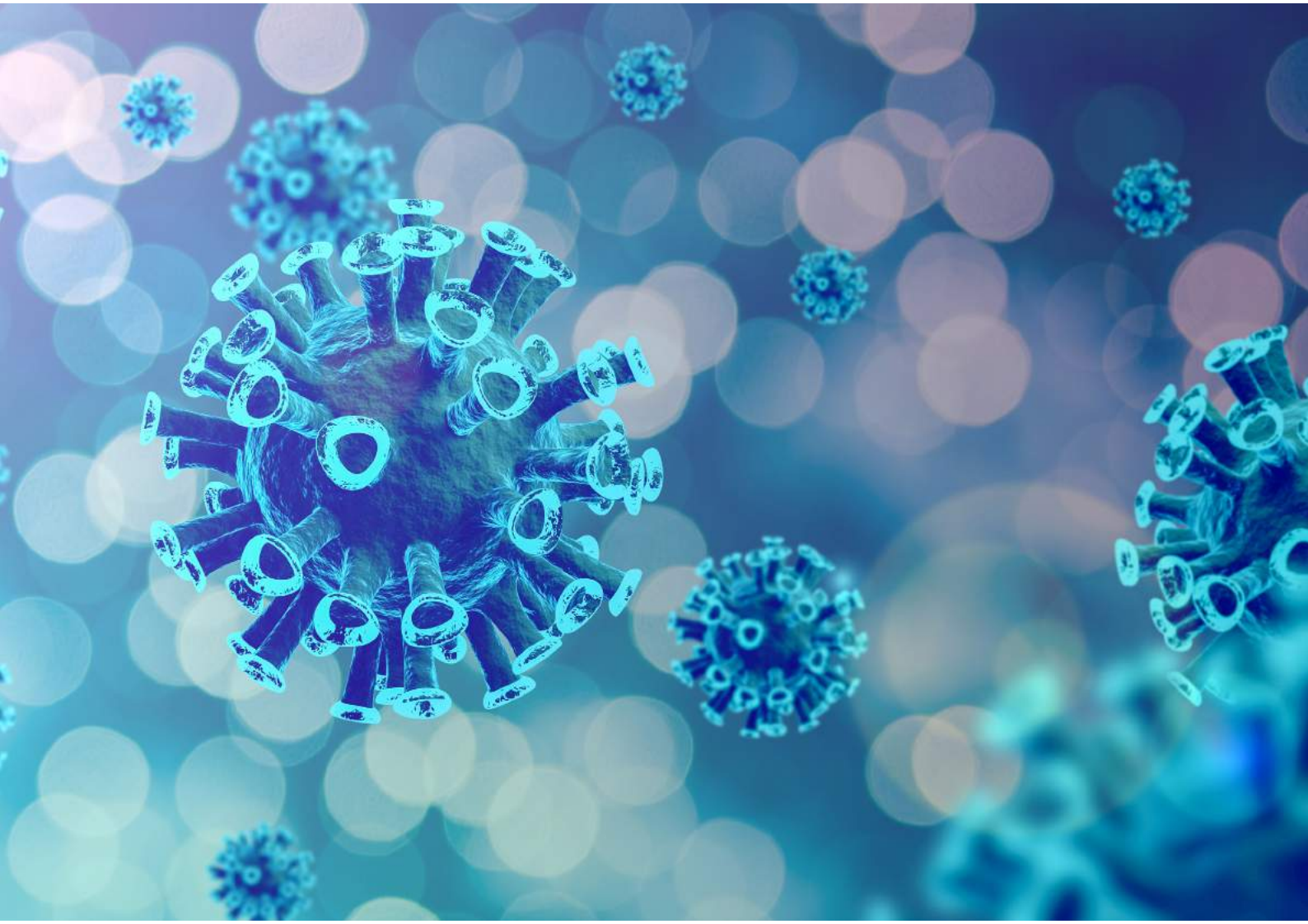
Working Group Report on Epidemic Management

Importance of ICT and Global Cooperation for Future Epidemic Management

Executive Summary

September 2021



BROADBAND COMMISSION
FOR SUSTAINABLE DEVELOPMENT

Working Group on Epidemic Management

Importance of ICT and Global Cooperation for Future Epidemic Management

September 2021

Disclaimer

The report is base on data and material accessible as of July 31, 2021 and may not reflect the circumstances thereafter owing to continuous updates in the COVID-19 situation.

Acknowledgments

This report has been developed through an iterative and collaborative process drawing on expertise from the members of the Broadband Commission Working Group on Epidemic Management, which was established by the Broadband Commission for Sustainable Development. The coordination of experts and the development of the content were provided under the supervision of Dr. Suk-Zoon Huh (KT). In addition, critical contributions were made by Dr. Dato' Ir. Lee Yee CHEONG from the International Science, Technology and Innovation Centre for South-South Cooperation under the auspices of UNESCO(ISTIC), Dr. Carlos M. Jarque from America Movil, Joseph Aylett-Bullock from the United Nations Global Pulse(UNGP), Doreen Bogdan Martin from the International Telecommunication Union(ITU), Prof. Jeffrey Sachs from Colombia University, Pekka Lundmark from Nokia, and H.E. Minister Roberto Sanchez from Ministry of economic affairs and Digital Transformation, Spain Research, analysis, external expert interviews, report formatting, and editorial support were conducted by Hyunpyo Bae and Sungmin Jin (KT). The author also wish to thank for the support of the Working Group of the Broadband Commission Secretariat at ITU.
The Working Group met online on a quarterly basis, reviewed material, exchanged insightful ideas and discussed the strategic trajectory of the report. The Views contained in this report do not necessarily reflect the position of the Broadband Commission, or the views of all Members of the Broadband Commission or their organizations. Special acknowledgments are due to the following individuals (listed by affiliation and surname alphabetically):

Broadband Commission members and the commissioners' focal points:

• Dr. Carlos M. Jarque (America Movil)
• Prof. Jeffrey Sachs (Colombia University, Lancet COVID-19 Commission)
• Dato' Ir. (Dr.) Lee Yee Chang (ISTIC of Malaysia)
• Doreen Bogdan Martin, Vanessa Gray, Hani Eskandar (ITU)
• Sunguk(Justin) Moon (Acting as a main Focal Point to the Working Group Chair), Hyoung Wook Kim, Suk-Zoon Huh, Sezoo Park, Yong Hun Lee, Haisung Lee, Youngjo Jung, Jung Jae Park, Ilbum Chun, Heidi Hyunseal Yang, Yoon Soo Oh, Hyunpyo Bae, Sungmin Jin, Sang-ick Moon, Woori Cho (KT)
• H.E. Mr Roberto Sanchez, Emilio Garcia Garcia (Ministry of economic affairs and Digital Transformation, Spain)
• Pekka Lundmark, Julia Jasinska (Nokia)
• Achim Steiner, Minerva Novero, Robert Opp (UNDP)
• Robert Kirkpatrick, Joseph Aylett-Bullock (UN Global Pulse)

A special thanks to the individuals who helped to put together this report:

• Dr. Haeng-Shin Lee (Korea Health Industry Development Institute)
• Prof. Hoon Sang Lee (Graduate School of Public Health Yonsei University)
• Prof. Jae Gap(Jacob) Lee (Department of Internal Medicine of Hallym University College of Medicine)
• Joanna Rubinstein (World Childhood Foundation)
• Prof. Taejun Lee (KDI School of Public Policy and Management)

Executive Summary

Background

Since its initial detection in December 2019, COVID-19 spread at an alarming pace, infecting 197 million and causing 4.2 million deaths worldwide at time of writing (August 3rd, 2021). Governments and cross-sections of society sought measures to control the spread of the virus, exploring Non-Pharmaceutical Interventions (NPIs) pending development of vaccines and treatment. NPIs are public health measures designed to control the spread of infectious diseases without the use of pharmaceutical drugs. They include a range of recommendations from the individual level (e.g. hygiene, hand-washing, mask-wearing) to the societal level (e.g. social distancing, closure of schools, banning social gatherings, lockdowns). NPIs also involve such measures as regular cleaning of public spaces using specific protocols, testing and contact tracing, quarantines, isolation of confirmed cases, etc.

NPIs adopted since March 2020, when COVID-19 was declared a pandemic by the World Health Organization (WHO), varied across countries and regions and many involved the use of information and communications technologies (ICTs, used in this Report to include Internet connectivity). The intent of this Report is not to assess the effectiveness of NPIs adopted by countries but to scan the approaches assisted or enabled by ICTs, to gain insights on how the technologies (particularly those leveraging connectivity) were used for pandemic management. This Report focuses only on select countries and does not provide an exhaustive list of ICT-based or ICT-enabled tools and approaches. It recognizes the crucial role of NPIs in pandemic response, particularly in the face of uneven vaccine roll-out and vaccine hesitancy in many parts, and looks into what might be most instructive to the global community as the pandemic continues as well as to contribute to knowledge that would be helpful in responding to future challenges.

Necessity of a pandemic response framework

The COVID-19 outbreak revealed some flaws of existing pandemic response systems and inefficiencies in the health and other systems. The Global Preparedness Monitoring Board (GPMB), co-convened by the WHO and the World Bank in response to the recommendations in 2017 of the UN Secretary General's Global Health Crises Task Force, focused its first annual report in 2019 on pandemics and epidemics and called attention to its central finding that "the world needs to proactively establish the systems needed to detect and control potential disease outbreaks."[1] It noted in its 2020 annual report a "collective failure" in prioritizing pandemic prevention, preparedness and response, and advocated for changes in the educational, social, and economic systems to make them more resilient.[2]

1. https://www.gpmb.org/annual-reports
2. Ibid

The 2018 report of the Epidemic Preparedness Working Group of the Broadband Commission for Sustainable Development also warned of increased risks of epidemics and highlighted the need for a global data sharing and monitoring system for pandemics, among others[3]

Preemptive consideration is necessary to ensure pandemic preparedness through new response systems and action plans. Proactive deployment of ICTs in particular will be a key factor in building a successful response system. Digital transformation can help countries in the detection, prevention, response, and recovery from COVID-19 (OECD, 2020). Efforts need to carefully guard against potentially increasing inequalities and address those that may arise by guaranteeing fair and affordable access to ICT for vulnerable groups and countries with weak capacities. The UN "Secretary-General's Roadmap for Digital Cooperation" issued in June 2020 emphasized the importance of digital inclusiveness, which is echoed by the Broadband Commission for Sustainable Development's "Agenda for Action," which recommends guaranteeing flexible, affordable, and safe access to online services.

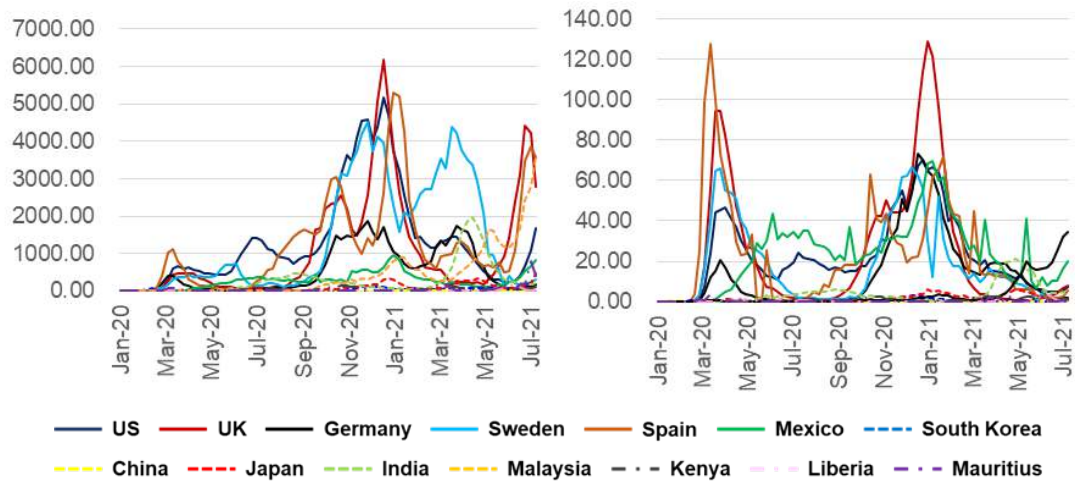
Digital technology is contributing significantly to the effectiveness of pandemic response strategies. Budd's paper, "Digital technologies used in the COVID-19 pandemic" (2020) mentioned that the potential use of ICT has been harnessed through technological developments including billions of mobile devices, large volume of online datasets, connected devices, low-power computing, machine learning, and natural language processing. The adoption of digital technologies was significantly increased during the pandemic.

National response strategies for COVID-19

Despite the global reach of COVID-19, its impact varies by country. This report looks at 14 countries- the U.S., UK, Germany, Sweden, Spain, Mexico, South Korea, China, Japan, India, Malaysia, Kenya, Liberia, and Mauritius - in terms of the characteristics and effect of their control and prevention measures. The countries were selected as comparative examples of both developed and developing countries in the Asian, European, American, and African regions, also taking into consideration the specificity of their policies.

3. https://broadbandcommission.org/publication/epidemic-preparedness/

Weekly COVID-19 cases (left) and deaths (right) per million people



Source : edited from Ourworldindata (2021)

The countries' figures for confirmed cases and deaths per million display similarities in seasonal patterns for sharp hikes, but show significant differences in the pandemic's outbreak between countries in Europe and the Americas and those in Asia and Africa. The pandemic's spread also shows huge disparities even between neighboring countries.

To understand the differentiated impact of the COVID-19 pandemic across regions, this report looked into the governance, legislation, control measures, policies to mitigate economic shocks, and public engagement levels in select countries. The approach involved analysis of news reports, government statements and press releases, reports on COVID-19 responses, statistical figures on COVID-19 cases and deaths, and socioeconomic indices,

① Governance

For governance, policy coordination between the response bodies was most important, with countries such as Germany, South Korea and China faring better than countries that lacked coordination. In terms of legislation, countries in Asia and Africa swiftly responded to the pandemic based on their existing legislation from previous epidemic responses, whereas countries in Europe and America struggled in the initial response stages. Some countries (e.g. South Korea and Malaysia) were able to take advantage of ICT services, such as social networks and text messaging, to deliver public health message.

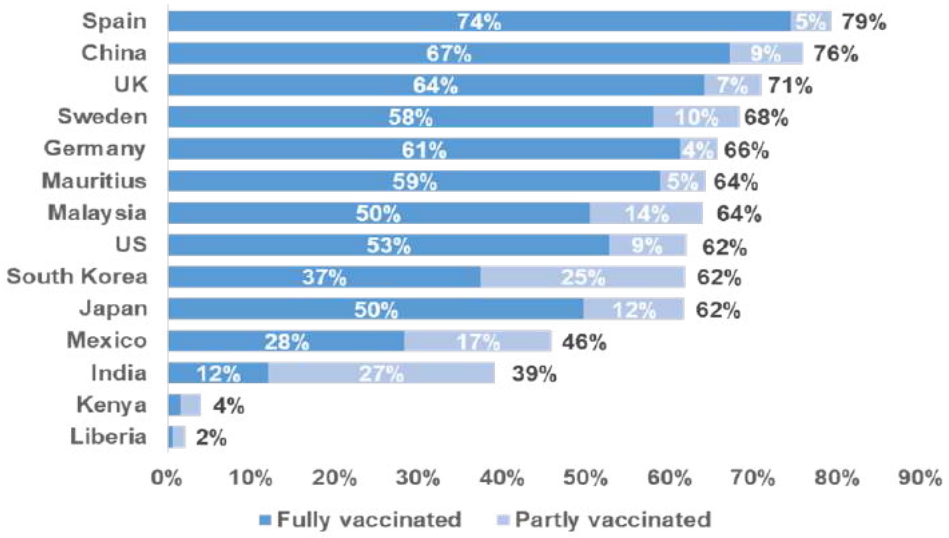
② NPI policies (3T, social distancing) and use of ICT

From the early stages of the pandemic, when no vaccine or treatment was available, countries responded with NPI policies such as the 3Ts (Test-Trace-Treatment) and social distancing to control the spread of the virus, and ICTs contributed immensely to the efficiency and efficacy of those policies. Of the 3Ts, the testing capacity however did not match the surging incidences in several countries during the early stages, which leading to further transmission from untested cases. When it comes to tracing, countries actively deploying digital tracing (e.g. South Korea and China) using mobile phone records from the initial phases of the pandemic are successfully containing the virus. Meanwhile, LMICs are struggling even just to introduce digital tracing, owing to the low penetration rate of digital devices such as smartphones. For treatment, South Korea classified their patients based on big data for insurance, whereas the U.S. relieved the burden on the health system through ICT (e.g. telemedicine). A common phenomenon observed in countries is that the effect of social distancing policies was weakened owing to public fatigue from its repetitive and sustained enforcement. Nonetheless, ICT services, such as online education, e-Commerce and virtual meetings, alleviated this weariness. LMICs struggled in maintaining social distancing policies as they lacked ICT infrastructures for related services.

③ Vaccination

Development of vaccines was led by countries that were hit the hardest from the pandemic - European countries, United States, China, and India - with vaccinations also being processed at a fast rate. LMICs in Africa faced constraints in securing vaccines. Although developed countries in Europe and America saw a rapid decrease in cases and deaths as their vaccination rates reached over 50% , this trend is being reversed due to stagnant vaccination rates and the emergence of the Delta variant.

National vaccination rates (Sep 8, 2021)



Source : edited from Ourworldindata (2021)

④ Fiscal and monetary policies

Countries executed various fiscal and monetary policies to mitigate the economic impact of social distancing. Countries with advanced economies and high credit ratings were able to implement large-scale fiscal policies whereas developing countries struggled with economic challenges. Mitigation measures included monetary policies, such as lower interest rates and large-scale quantitative easing, which also depended on the economic level of countries. Meanwhile, digital identification systems boosted the effectiveness of fiscal policies such as India's Aadhaar, which enabled efficient and effective deployment of government support.

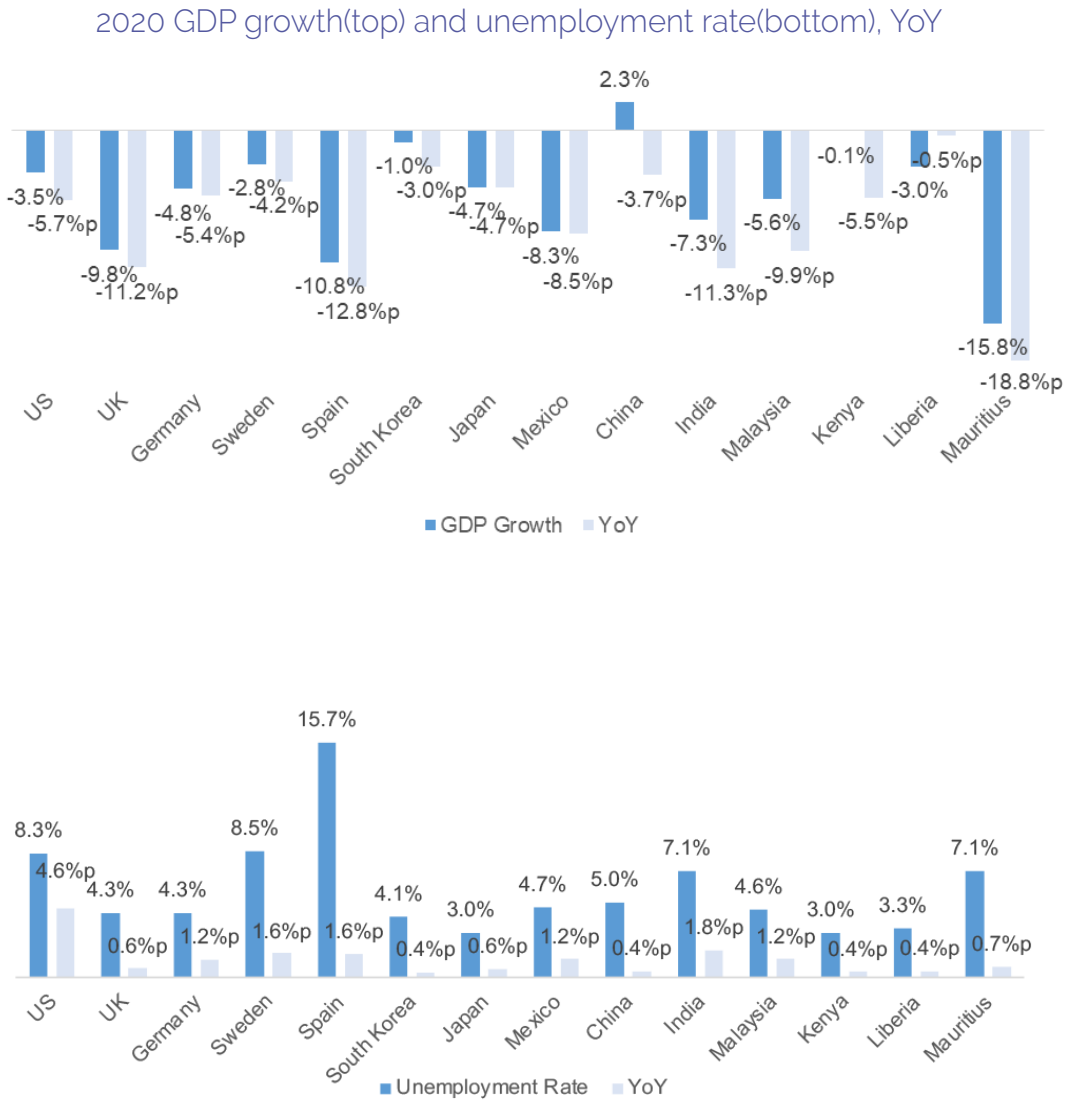
⑤ Approval level on disease control policies

As for the approval level on disease control policies, public opinion polls[4][5] on the policies indicate that most countries displayed better compliance to prevention rules in the early stages. The approval level fell from fall of 2020 owing to heightened fatigue, leading to protests and litigations on policies such as lockdowns that restricted movement and gatherings.

⑥ Socioeconomic impact of COVID-19

The socioeconomic impact of the COVID-19 pandemic played out differently between countries and income levels within countries. Countries analyzed in the report recorded negative GDP growth and high unemployment rates in 2020, but some countries in Asia able to control better the spread of the virus were less affected than advanced economies in Europe and the United States. Despite this trend, the economies of some LMICs experienced greater shocks despite having infection control performance surpassing that of advanced economies. As unemployment rates went up 1%p globally, the U.S. and India recorded the highest rates increase among surveyed countries, owing to their large share of the service industry.

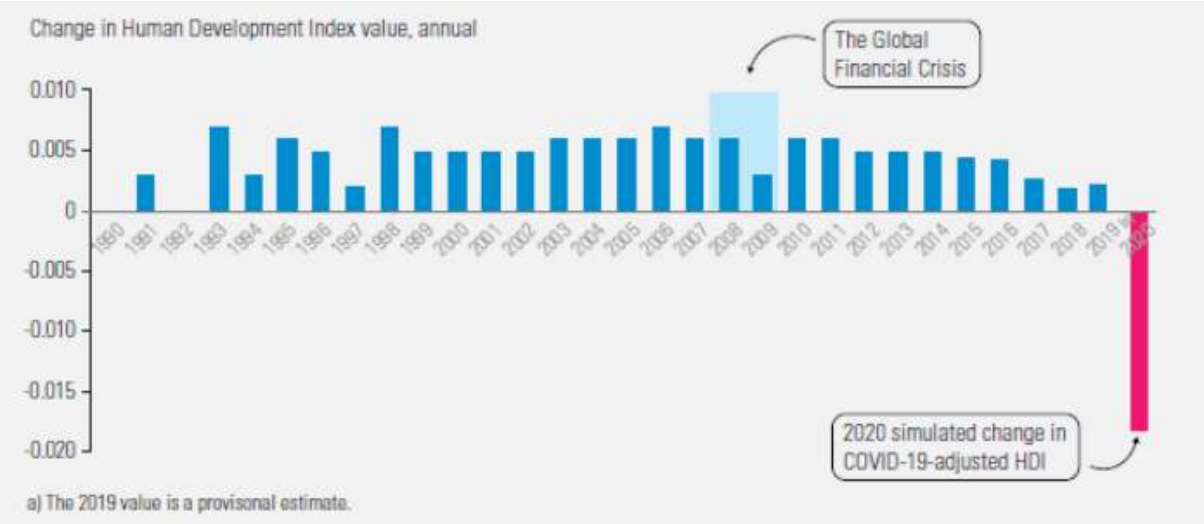
4. https://www.ipsos.com/ipsos-mori/en-uk/scottish-public-supports-tough-restrictions-wants-see-them-relaxed-christmas
5. https://www.yna.co.kr/view/AKR20200518072400017



Source : Growth rates from IMF (2021), Unemployment rates from ILO (2021)

Social distancing measures conditions for some groups and demonstrated the role of inequality in the degree of impact seen in countries. According to the "Enhancing Access to Opportunities (2020)" report released by the IMF and World Bank, social distancing measures and suspension of public services have hit disadvantaged groups the hardest. For instance low-skilled workers could not work from home and did not have proper access to the digital tools. Closure of schools also led to shocks in the education sector. The HDI (Human Development Index) fell at an unprecedented rate in the year 2020, offsetting its rise for over the past six years. Educational shocks spread unevenly as national income levels determined the accessibility to online education.

Sharp decline in HDI from COVID-19



Source : UNDP (2020)

There is also greater risk of hunger and malnutrition. UNDP's analysis in "Leaving No One Behind (2021)"[6] suggests that by 2030 an additional 12.8 million people could suffer from malnutrition due to COVID-19, with the number of malnourished children increasing by 1.6 million.

Global poverty increased for the first time in 20 years due to the COVID-19 pandemic. The World Bank estimated in 2020 that the, the number of people in extreme poverty increased by 97 million, with developing countries in South Asia and Sub-Saharan Africa most affected. The World Bank has estimated that this figure may reach 155 million in 2021.

Choices made now could alter this dire scenario, and changing course becomes harder as time passes with serious challenges left unaddressed. UNDP has identified an ambitious - but feasible - set of targeted investments in governance, social protection, green economy and digitalisation. Through this 'SDG Push', 100 million people in low and medium income countries could be lifted out of poverty by 2030.[7]

⑦ Sub-conclusion for the analysis of national response strategies

Review of national response policies and outcomes demonstrates the importance of early detection and containment, which in turn requires prior efforts to build an ICT-based response system. To this end, an ICT-based disease response system should be established in advance. Furthermore, LMICs and vulnerable groups lacking access to ICT suffered greater socioeconomic damages from the disease. As such, another important mission for future epidemic response would be to expand the ICT infrastructure for LMICs and vulnerable groups and to distribute a solution that is deployable even under relatively poor ICT conditions.

6. https://www.worldbank.org/en/news/press-release/2020/10/07/covid-19-to-add-as-many-as-150-million-extreme-poor-by-2021
7. https://data.undp.org/wp-content/uploads/2021/04/Leaving-No-One-Behind-COVID-impact-on-the-SDGs-second-flagship-2.pdf

COVID-19 response of international organizations

UN bodies, including the WHO, and international agencies such as the World Bank and the IMF, presented recommendations for the international community's effective response to COVID-19 and provided a wide range of support. The UN quickly deployed a comprehensive response with three pillars addressing health, humanitarian and socio-economic impact.[8] The health response is led by WHO and included health measures for controlling the virus, supporting the development of vaccines, diagnostics and treatment, and strengthening preparedness. The humanitarian pillar coordinated by OCHA focuses on multi-sectoral needs in over 50 vulnerable countries. The third pillar is focused on addressing the socio-economic impact of the pandemic, with UNDP serving as the UN system's technical lead. Efforts focus also on recovery process that pursues a better post-COVID world by addressing the climate crisis, inequalities, exclusion, gaps in social protection systems and the many other fragilities. Multilateral development banks and financial institutions (e.g. The World Bank and IMF) are offering emergency assistance to developing countries, and organizations (e.g. WEF and International Chamber of Commerce) are providing advisory services on COVID-19 response.

In terms of vaccine development and distribution, the WHO was engaged in the research and development, manufacturing, regulation, and evaluation of COVID-19 vaccines and the UN joined the ACT-Accelerator, launched in April 2020, to ensure access to vaccines for all, which includes the COVAX Facility - a program for group vaccine purchase. The IMF and World Bank created a fund for vaccine supply and the WTO offers policy support for vaccine distribution.

The ITU (International Telecommunication Union) is proactively deploying ICT in its COVID-19 responses and is engaged in the following efforts with the support of the WHO and UNICEF: sending text messages on COVID-19 infection control to people in countries lacking a proper telecommunications infrastructure; promoting the importance of digital solutions in disease response to the G20 Health Ministers; building a global network recovery platform to deal with the heavy increase in telecommunication demand; and supporting students without internet access who are unable to take part in online classes. In addition, the REG4COVID platform was built to share best practices in the digital response to COVID-19.

8. https://www.un.org/en/coronavirus/UN-response

Meanwhile, there is a need for a COVID-19 model tailored to LMICs to propose relevant containment strategies. The CoMo (COVID-19 Modeling) Consortium, created by researchers at the University of Oxford, endeavors to enhance the model's relevance through collaboration with local experts. The UN Global Pulse, a member of the Broadband Commission for Sustainable Development, contributed to the optimal simulation of NPI policies by conducting an epidemiological modeling of Cox's Bazar settlement in Bangladesh.

Importance of ICT in future epidemic response

ICT is instrumental in both NPI (e.g. 3T, social distancing) and pharmaceutical interventions (e.g. treatment, vaccines), which are measures to respond to new epidemics such as COVID-19. The key contribution areas of ICT include: digital epidemiological surveillance using AI; medical image analysis and screening candidates for vaccines and treatment; symptom questionnaires through apps; data extraction and visualization; contact tracing through mobile phone records and Bluetooth data; public communication through social networks; and telemedicine.

Budd (2020) proposes five frames for how ICT was used according to the level of disease response: digital epidemiological surveillance, rapid case identification, interruption of community transmission, public communication, and clinical care. They may be summarized as follows along with the use case of pharmaceutical intervention (PI).

ICT-based approaches in COVID-19 response by purpose

Purpose	Best Practices
Digital epidemiological surveillance	Prediction of infectious disease using AI and big data COVID-19 surveys through SNS
Rapid case identification	Analytics-based thermal detection solution Digital credentials to support safe and convenient travel Early diagnosis of COVID-19 through wearable
Interruption of community transmission	3T-based contact tracing ICT solutions
Public Communication	COVID-19 Emergency Alert Text Messages Online public education service e-Commerce
Clinical care	Telemedicine
Pharmaceutical Intervention	Development of vaccines and treatment using AI Digitalization of COVID-19 vaccine cold chains

Examples of approaches leveraging ICT in COVID-19 responses

This Report looked into ICT-based best practices that contributed to the COVID-19 response using the six frames above.

① Digital epidemiological surveillance

BlueDot, a Canadian start-up company, detected the new virus using AI on December 30, 2019 – nine days earlier than the official announcement by the WHO. The AI4I (AI for Impact) of GSMA helped LMICs such as the Democratic Republic of the Congo (DRC), Rwanda, Benin, and Burkina Faso, to come up with response policies based on the analysis of mobile big data (MBD). Meanwhile, Facebook teamed up with Carnegie Mellon University to help in collecting survey data on COVID-19.

② Rapid case identification

Nokia announced an automated, zero-touch elevated temperature detection solution designed to help spotting potential COVID-19 infection in facilities with thousands of people. KT developed an airport screening system app, Safe2Go, which offers a range of infection control services for the departure process to support free travel during the COVID-19 pandemic, taking into account the serious toll on the tourist industry. Meanwhile, Fitbit developed an algorithm to identify initial signs of COVID-19 through its wearables from joint research with the Scripps Research Institute and Stanford Medicine.

③ Interruption of community transmission

The KT GEPP (Global Epidemic Prevention Platform), South Korea's representative public-private project for pandemic response, features an app that is connected to the government's integrated disease information system and offers solutions to support the government's 3T response. The solutions include: a screening test management system allowing users to make real-time reservations for nearby screening centers and to receive test results and response guidelines; international tracing, which tracks cases from overseas using data roaming and provides disease-related information; and contact tracing which immediately brings up the route of confirmed cases for the past two weeks using their mobile data records. In addition, KT's call check-in service is a solution allowing visitor logs for restaurants and other public areas to be managed with just a phone call, solving systemic problems including credibility issues and risk of personal information leakage from manual entry logs, and the difficulty of information have-nots unaccustomed to smartphones in using QR code check-in services.

④ Public communication

ICT contributed to the accurate, fast, and transparent communication of epidemics information to the public, leading to higher approval levels in policies and screening of fake news. South Korea utilized its existing emergency alert text messages system to deliver updates on cases and outbreak locations, allowing people to take the necessary response measures such as testing. Many other countries also resorted to social network services, text messages, and the radio in their public communication of COVID-19 information.

In addition, non-face-to-face services on digital platforms such as online learning and e-Commerce allowed for uninterrupted essential services during social distancing and lockdowns. Suspension of public education became an issue as concerns over the spread of COVID-19 led to the complete or partial closure of public educational facilities. Online education serves as a means to overcome such. The ITU launched the Giga initiative with UNICEF to help solve the problem of inadequate access to online education in developing countries. Meanwhile, e-Commerce is playing a key role in supporting SMEs(Small and Medium Enterprises), providing essential food and products, and preventing unemployment during lockdowns. A key example is Jumia in Africa, which provides services for COVID-19 response in partnership with the UNDP for countries such as Uganda.

⑤ Clinical care

New York State declared a disaster emergency in March 2020 and relieved its regulations to expand its telemental health services to offer uninterrupted care to citizens suffering from isolation from the lockdown and patients who had being receiving psychiatric care. The U.S. government underwent deregulation efforts to promote telemedicine, such as allowing usage of universal applications (e.g. Facetime and Facebook Messenger), to lessen the burden on the healthcare system. The proportion of telemedicine users increased significantly from 11% to 46%.

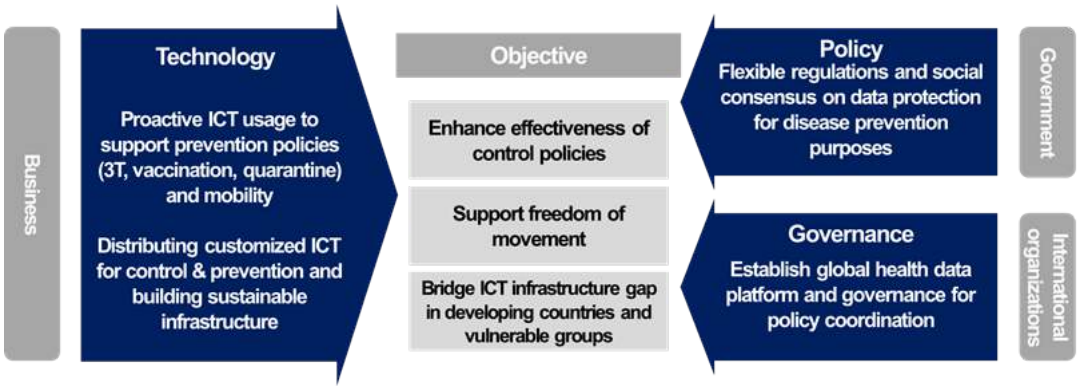
⑥ Pharmaceutical intervention

Technologies such as AI and Blockchain were deployed from the development to the vaccination stages of COVID-19 vaccines and treatment. Moderna used AI and cloud services to drastically reduce the time and money spent on new drug development, succeeding in developing the mRNA vaccine a year into the outbreak of COVID-19. Nokia contributed by providing its cloud resources for 5G software research and development to the World Community Grid, an initiative that supports humanitarian research to solve dilemmas faced by mankind. In addition, the cold chains for COVID-19 vaccines, requiring storage at ultra-low temperatures, are managed by smart barcodes based on cloud and blockchain technologies.

Implications and recommendations for future epidemic response

The aforementioned case examples indicate how ICT plays a decisive role in the preparedness and rapid response to a pandemic, which are the key factors for fast socioeconomic recovery, and how reinforcing the ICT infrastructure and preparing for related legislation are paramount. Meanwhile, international coordination in disease response succumbed to national priorities, resulting in greater socioeconomic damages for LMICs, which in turn could delay the end of the pandemic. Based on these lessons, we can suggest four recommendations. First, flexible regulations on digital data and internet should be considered for timely ICT-based pandemic responses. Second, investment should be made to expand the role of ICT in disease response. Third, we need to bridge the ICT infrastructure gap between countries to help the disadvantaged. Fourth, a global public-private governance for data sharing and policy coordination should be built to effectively respond to future pandemics.

Recommendations for future epidemic response



BROADBAND
COMMISSION
FOR SUSTAINABLE
DEVELOPMENT

broadbandcommission.org

Photo credits: TongRo Images