

EDITOR'S COMMENTS

The COVID-19 Pandemic: Building Resilience with IS Research

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Over 5 million individuals have been infected by the COVID-19 novel coronavirus with over 361,000 reported to have lost their lives as of this writing.¹ As the pandemic moved from east to west, societies were paused, borders were sealed, hospitals were overwhelmed, and economies nose-dived. Governments and lending agencies such as the World Bank and the International Monetary Fund are injecting trillions of dollars in stimulus funding to replace lost incomes and prevent economies from falling apart. No crisis has caused so much upheaval, so broadly, and so quickly.

Confronted with existential threats and extraordinarily elevated economic uncertainty, the crisis has brought out the best in people. Frontline health professionals have put their lives at tremendous risk while working around the clock with make-shift personal protective equipment, with many making the ultimate sacrifice with their lives. Organizations quickly transitioned to remote work, and deployed crisis-inspired innovations in hours and days. Individuals, households, and communities coped with job loss and adapted to a surge in demands. Digital platforms and health agencies implemented novel methods and partnered to stem the infodemic related to COVID-19.

The crisis has also exposed dark sides and weaknesses, ranging from digital inequity disproportionately inflicting hazards on blue-collar workers and technology “have nots,” to life-costing awareness deficits, to lags in information flows crippling public health surveillance, to fragile supply chains, to a life-costing infodemic with fake news, hoaxes, and rumors.

In this editorial, I share some thoughts on opportunities for IS research to contribute toward building resilience to pandemics and extreme events. I focus on the role of IS in redesigning public health surveillance systems, transforming organizations, and empowering individuals and communities. My comments are illustrative as clearly there are other aspects where IS can play a major role.

Redesigning the Public Health System from Reactive to Proactive

The crisis has revealed the urgent need to develop and deploy surveillance innovations which will provide real-time information for proactive decision-making at the local, state, and national levels of public health systems. It has also brought to the fore the potential of contact tracing as a proactive strategy to contain the pandemic by stemming the transmission of infection.

Real-Time Surveillance Systems

Countries and local governments have pursued vastly dissimilar surveillance strategies to manage the public health risk. South Korea quickly deployed a proactive approach: identify and isolate infectious travelers, trace contacts of known cases, and test those people before they became symptomatic, while also making testing vastly available to identify asymptomatic cases with no known contacts with infected individuals. This process provided real-time information on how the disease was spreading within its borders, enabling the country to control the outbreak swiftly. Germany, also recognized for its swift and effective response, adopted a similar prevention approach. In contrast, several countries including the United States and Brazil have largely relied on an approach to test those people who become ill enough to seek treatment, which can take weeks after exposure, followed by lags in processing tests and sharing results with health agencies.²

¹Johns Hopkins Coronavirus Resource Center at <https://coronavirus.jhu.edu/map.html>.

²In mid-April 2020, Brazil had over 90,000 specimens waiting to be tested, while labs were idle due to shortages of testing reagents and inputs (<https://www.reuters.com/article/us-health-coronavirus-brazil-testing/as-brazils-covid-19-testing-lags-available-labs-go-unused-idUSKCN21X36V>).

From an IS perspective, a foundational aspect for a proactive strategy is a robust real-time public health surveillance system. Lags in information flow from hospitals, testing centers, and other organizations to public health agencies, as well as in and between these agencies, create an information void, thereby increasing uncertainty in estimates (e.g., case-fatality rate, infection-fatality rate) and establishing a ripe context for a deluge of misinformation. With lags of 3 to 6 weeks between implementing interventions like shelter-in-place and seeing beneficial impacts emerge in reduced transmission rates of the infection, the effectiveness of the sacrifices made is not immediately obvious to society and has contributed to vastly different assumptions and interpretations about the effectiveness of the interventions and the course of actions to be followed.

The Centers for Disease Control and Prevention (CDC) in the United States is undertaking a data modernization initiative to move from tracking public health risks to predicting them so effective preventive approaches can be taken. As per the CDC, "Getting real-time data for emergencies is why data modernization is so critical. Imagine if all 6,100 U.S. hospitals could send automatic, immediate coronavirus disease reports from the electronic health record to public health."³ Such syndromic surveillance will provide at-scale early alerts on health events and risk trajectories as well as timely feedback on the effectiveness of interventions so they can be adapted.⁴

Of course, radical shifts in decision-making processes and culture, alongside real-time information, will be required to transform public health systems from a flat-footed reactive approach to an agile preventive approach. Pandemics mandate bringing together depth of expertise across a breadth of areas. This requires integrating expertise from public health experts on testing to immunologists on antibody tests to data scientists on assumptions of predictive models to ethicists on values. Mobilizing and integrating such distributed expertise against rapidly changing uncertainty on multiple vectors is a key requirement for effective decision-making, safeguarding against overconfidence, and building public trust. How to leverage digital technologies and innovations to develop such capabilities for public health can be a major area for IS research to make a strong contribution.

Contact Tracing to Stem Transmission

Contact tracing is being made more comprehensive by novel mobile technologies to detect the possible transmission of the coronavirus by identifying individuals who have been in contact with those infected. Further infections can be contained by socially isolating these individuals that may be otherwise asymptomatic. Some countries like South Korea were early to deploy contact tracing to stem the spread of the infection. A number of countries from Bahrain to Bulgaria to Indonesia to India to China to Iceland have deployed contact tracing apps.⁵ The spate in contact tracing apps has revealed important design choices as well as societal and data governance issues for the effective deployment of the method.

Technology design: The apps vary in whether they run on a centralized data model (where the data are controlled by the government or health agency typically) or a decentralized data model (where the data are stored on a user's phone);⁶ they also vary in whether the tracking involves GPS data or Bluetooth. Companies and open source communities continue to introduce innovations in how privacy and anonymity considerations can be addressed while improving accuracy and coverage. As an example, Google and Apple are partnering on an opt-in app for contact tracing across both Android and iPhone platforms: individuals self-disclose their COVID-19 diagnosis, anonymous contact tracing is conducted using mobile devices; and privacy and anonymity are achieved by not collecting personally identifiable information or location data.⁷

Digital inequality: The link between tracing coverage level and digital inequality needs to be considered as we leverage digital technologies to stem the pandemic. In the United States, over 50% of people age 80 or older do not have a smartphone; this group is also at higher risk of death from COVID-19.⁸

In addition to building 5G mobile infrastructures, we need to consider how vulnerable and disadvantaged segments of populations will access and afford these resources. Overlooking these segments of society in app-based contact tracing creates the risk of the problem becoming exacerbated under the radar, contributing to the late discovery of infection and transmission.

³<https://www.cdc.gov/surveillance/surveillance-data-strategies/Modernizing-for-Threats.html>

⁴<https://www.cdc.gov/surveillance/projects/Connecting-Real-Time-Data.html>

⁵<https://privacy.org.nz/assets/2020-05-12-OPC-Comparison-of-COVID-19-Apps-colours.pdf>

⁶<https://tech.newstatesman.com/security/seven-in-ten-global-covid-19-contact-tracing-apps-run-on-a-centralised-model>

⁷<https://www.apple.com/covid19/contacttracing>

⁸<https://sloanreview.mit.edu/article/crisis-digital-business-technology-laggards/>

Data governance: The pandemic creates a short-term emergency need for surveillance and tracking to stem the spread of the infection and protect and save people's lives.

Yet, it is important to recognize key data governance issues including: risks of abuse of the troves of data that are collected to stem the pandemic, limits on the secondary use of this data, and sunset clauses on collecting and using such data.^{9, 10} Attending to these issues will be crucial to garner public support for these initiatives and safeguard against downsides.

Transforming Organizations

The pandemic has required organizations to quickly rethink their organizational and value-creation models for a vastly different context, where economic uncertainty is extraordinarily elevated and where assumptions on markets, human mobility, and co-locating break down. It has also revealed novel risks that will require creative resolutions.

Crisis-Driven Agility

With visionary leadership and all hands on deck, we have seen many organizations shine amid the crisis. They have reimagined how to organize, innovate, and serve customers and have implemented new models at record-breaking speed. What may have taken years in organizations has been achieved in days and weeks!

Remote work: Many organizations, big and small, quickly transitioned to remote work. They improvised with in-house and cloud services, with peer-to-peer knowledge sharing, and with quickly assembled dedicated support resources. Even in organizations where resistance may have been high in the pre-pandemic phase, the transition to remote work was achieved very rapidly.

Through learnings from this at-scale experimentation, it is likely that new models of work involving prominence of remote work will emerge. These models are likely to provide employees with greater flexibility to live further away from physical locations of work, and hence from major cities. It is unclear how this flexibility, combined with new public health considerations, will challenge agglomeration benefits and temper urbanization.

Scaling virtual contactless services: Digital platforms have partnered with service providers to adapt vital consumer services like ordering and delivering groceries and medications to be contactless, while dramatically scaling the volume of these services to meet the surge in demand.

Universities and schools worldwide, across all levels of education and types of programs, raced to transition to online course delivery. A wealth of experience has been rapidly accumulating among faculty, staff, and students on how to scale online instruction, combine synchronous and asynchronous technologies, and mix learning strategies.

With patients under lockdown and healthcare workers at risk of infection, there has been a dramatic spike in a range of virtual healthcare services.¹¹ Healthcare systems have deployed telemedicine using smartphones or webcam-enabled computers to care for patients and forward triage, while protecting patients, clinicians, and the community from exposure to infection.¹² Some have employed automated algorithms and integrated local epidemiologic information for screenings. Some have implemented electronic intensive care unit (e-ICU) monitoring, enabling nurses and physicians to remotely monitor sicker patients.

Swift deployment of grassroots innovation: Dyson designed a new ventilator in 10 days, Alibaba and Zhongbai, one of Hubei's biggest retailers, partnered to build an unmanned store in five hours at Wuhan's Huoshenshan hospital to provide daily necessities and disinfectant supplies, and Chick-fil-A made more than a dozen changes to its drive-through process to maximize both safety and efficiency in the face of skyrocketing demand for take-out food.¹³

⁹<https://www.nytimes.com/interactive/2019/12/19/opinion/location-tracking-cell-phone.html>

¹⁰<https://www.cnn.com/2020/02/26/tech/clearview-ai-hack/index.html>

¹¹[https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(20\)30818-7/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30818-7/fulltext)

¹²<https://www.nejm.org/doi/full/10.1056/NEJMp2003539>

¹³<https://hbr.org/2020/05/develop-agility-that-outlasts-the-pandemic>

Many of these innovations were achieved outside the frameworks of strategic plans and compensation systems, and were not controlled by project management offices and stage-gate processes. Typically, a small group of people spotted an urgent need, rallied attention so lower-priority activities could be dropped, and collaborated to develop solutions.

Crisis-Revealed Fragility

The pandemic shock has also exposed risks embedded in the design of organizations, cybersecurity, and decision-making processes, which will need to be considered in transformation initiatives.

Supply chains: Countless supply chains have undergone upheaval since the pandemic first disrupted supplies from locked-down regions in China. In healthcare, the surge in demand for essentials like ventilators and personal protective equipment could not be met, and the overwhelming demand for N95 masks created a fertile ground for counterfeits and scammers who made fake deals.

Digital technologies like blockchain can be pivotal in building resilient supply chains by establishing effective mechanisms for trust, transparency, and integrity in the flow of materials and products. Moving to such solutions will require transforming current practices, as most organizations rely on human-relayed anecdotes and conjectures from top-tier and select tier-2 suppliers to understand supply-chain dependencies and estimate risks.¹⁴

Cybersecurity: With the scale of employees working remotely and students learning virtually, the digital attack surface for malicious agents has expanded dramatically. Lack of cybersecurity readiness for a pandemic can manifest as misconfigured enterprise virtual private networks which can be exploited by attackers to steal sensitive information. Additionally, increases in the risk of phishing, malspam, ransomware, and denial of service can result. Security operations teams are also having to work remotely, which can impair the detection and response to attacks.

Human decision-making: Absent treatment protocols and confronted with the perplexing variability in how COVID-19 affects patients, clinicians have been thrust into making life-or-death decisions under intense stress, uncertainty, and fear. This affects their ability to process information and can befuddle causal attribution on whether interventions are working or not.¹⁵

AI readiness for decision-making: AI-based screeners have been deployed at hospital systems such as Partners HealthCare to facilitate pre-hospital self-triage by patients: the screeners differentiate between those who might be sick with COVID-19 and those who are likely dealing with less threatening conditions.¹⁶ The surge in cases at intensive care units during the pandemic has led to suggestions that AI could assist in more complex triage decisions, such as who gets access to a ventilator. While AI offers the potential to deliver care at unprecedented scale and can quickly learn from large troves of data, salient biases underlie data sets such as misdiagnosed heart disease for women and undertreated pain for black patients.¹⁷ Before we become more reliant on AI and robots during a pandemic, the issue of AI biases will need effective resolution.

In sum, we have seen ingenuity—empowered by digital technologies—enable organizations to meet a wide variety of needs created by the pandemic. How will the experiences with digital technologies in conducting remote work, scaling virtual services, and swiftly deploying grassroots innovation transform organizations? How can information systems be developed and deployed to mitigate risks in supply chains, cybersecurity, and decision-making processes? Such transformations by organizations will need to consider the macro-economic context involving heightened economic uncertainty, protracted job loss in certain sectors, the reallocation of economic activity with industries, and cross-industry and cross-region differences.

Empowering Individuals and Communities

The COVID-19 pandemic has surfaced how IT can empower individuals to adapt and cope, while revealing the poignant consequences of digital inequality. It has also illuminated that the accompanying infodemic creates untold damage, harming people and costing lives, and that IT can aid in stemming the infodemic and empowering individuals to discern fact from falsehood.

¹⁴Seventy percent of 300 respondents to a survey in late January and early February, following the COVID-19 outbreak in China, indicated they were still manually identifying which of their suppliers had a site in locked-down regions of China (<https://hbr.org/2020/03/coronavirus-is-a-wake-up-call-for-supply-chain-management>).

¹⁵<https://www.theatlantic.com/health/archive/2020/04/pandemic-confusing-uncertainty/610819/>

¹⁶<https://hbr.org/2020/04/how-hospitals-are-using-ai-to-battle-covid-19>

¹⁷<https://sloanreview.mit.edu/article/ai-robots-and-ethics-in-the-age-of-covid-19>

Adapting and Coping

Tens of millions have lost their jobs since the pandemic began, with a 14.7% unemployment rate in the U.S., the highest since the Great Depression.¹⁸ Individuals have had to contend with understanding the financial, health, and other risks of the pandemic and undertake protective measures for themselves and those they care about. With remote work and home schooling, work-life boundaries have blurred, leading in many cases to shorter blocks of time to work as one rotates through attending to various demands. There also has been loss of social interaction and a disruption of physical activity and recreational routines.

In a time of high fears and uncertainties, coping with extreme work and life demands is particularly stressful and threatens well-being. The need to cope has propelled grassroots experimentation on how using a medley of digital technologies can enable individuals and households to handle these demands: search for jobs on online platforms, stay at home and conduct Zoom calls for work, order groceries online, watch Netflix with friends to socially distance while not socially isolating, and much more. But, the pandemic has also surfaced the stark gap between white-collar and blue-collar workers and technology “haves” and “have-nots” in coping through this dramatic period of human history.

Stemming the Infodemic

High levels of fear and uncertainty have been a breeding ground for falsehoods on virtually every aspect related to the COVID-19 crisis, ranging from the origins of the virus to modes of transmission to prevention and cures to actions by governments and public health agencies. Racist, xenophobic, and stigmatizing content has been fabricated to capitalize on prejudices and biases. Whether the motives to circulate such malicious content are intentional, arising from personal, business, or political agendas, or are unintentional, arising from uncritically circulating dubious content, they affect emotions, attitudes, and behaviors, and they cost lives.

To contain the infodemic, UNESCO, the European Union, and Twitter have partnered to disseminate best practices on critically evaluating the overwhelming social content on the virus and help people #ThinkBeforeSharing. Fact-checking organizations have been working to debunk false information, while digital platforms are deploying a variety of approaches, including partnership with health agencies as sources for current, accurate content and AI for content moderation, among others.¹⁹

With these extensive experiences, there are important questions that need to be taken on to better equip us to deal with pandemics and other highly disruptive events. What are the insights on how IT can empower individuals, households, and communities to navigate extreme events where there are high fears and uncertainties, job loss, and a surge in job and personal demands? What are the learnings on how IT can be deployed by platforms and agencies to empower individuals and communities so truthful, potentially life-saving, content has wider prominence?

Concluding Remarks

While “preserve-the-past” schemes assume that economies, organizations, and social experiences can be placed in deep freeze and revived intact once the crisis wanes, the pandemic has starkly revealed the need to build resilience in ways that save lives and livelihoods. The pandemic has also created remarkable experiences, fueled large-scale experimentation, and inspired innovations, while revealing dark sides and weaknesses, across a breadth of contexts. Much of the response, good and bad, worldwide, has involved a salient role for digital technologies. The uncertainty in the future course and duration of the pandemic and in whether global pandemics will be oft-recurring, coupled with massively depressed economies and elevated economic uncertainty, make the ensuing transformative shifts uncertain. What seems quite clear is that the salient role of digital technologies and innovations presents an incredible opportunity for the IS scholarly community, with its diversity of perspectives and global footprint, to contribute to the existential need of building resilience to pandemics and extreme events.

¹⁸<https://www.forbes.com/sites/kenrapoza/2020/05/15/some-42-of-jobs-lost-in-pandemic-are-gone-for-good/#2344ff9f50ab>

¹⁹<https://misinfotrackingreport.com>

