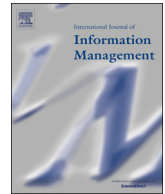




Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



## Opinion paper

## Impact of digital surge during Covid-19 pandemic: A viewpoint on research and practice

Rahul De<sup>a,\*</sup>, Neena Pandey<sup>b</sup>, Abhipsa Pal<sup>c</sup><sup>a</sup> Indian Institute of Management Bangalore, India<sup>b</sup> Indian Institute of Management Visakhapatnam, India<sup>c</sup> Indian Institute of Management Kozhikode, India

## ARTICLE INFO

## Keywords:

Digital surge  
Gig work  
Internet governance  
Digital payments  
Post-pandemic

## ABSTRACT

The Covid-19 pandemic has led to an inevitable surge in the use of digital technologies due to the social distancing norms and nationwide lockdowns. People and organizations all over the world have had to adjust to new ways of work and life. We explore possible scenarios of the digital surge and the research issues that arise.

An increase in digitalization is leading firms and educational institutions to shift to work-from-home (WFH). Blockchain technology will become important and will entail research on design and regulations. Gig workers and the gig economy is likely to increase in scale, raising questions of work allocation, collaboration, motivation, and aspects of work overload and presenteeism. Workplace monitoring and technostress issues will become prominent with an increase in digital presence. Online fraud is likely to grow, along with research on managing security. The regulation of the internet, a key resource, will be crucial post-pandemic.

Research may address the consequences and causes of the digital divide. Further, the issues of net neutrality and zero-rating plans will merit scrutiny. A key research issue will also be the impact and consequences of internet shutdowns, frequently resorted to by countries. Digital money, too, assumes importance in crisis situations and research will address their adoption, consequences, and mode. Aspects of surveillance and privacy gain importance with increased digital usage.

## 1. Introduction

By late May 2020, at the time of writing of this article, over 200 countries and territories in the world were affected by the Coronavirus pandemic. This included most urban clusters and even rural regions.

With the spread of the pandemic, almost all regions have implemented lockdowns, shutting down activities that require human gathering and interactions - including colleges, schools, malls, temples, offices, airports, and railway stations. The lockdown has resulted in most people taking to the internet and internet-based services to communicate, interact, and continue with their job responsibilities from home. Internet services have seen rises in usage from 40 % to 100 %, compared to pre-lockdown levels. Video-conferencing services like Zoom have seen a ten times increase in usage, and content delivery services like Akamai have seen a 30 % increase in content usage (Branscombe, 2020). Cities like Bangalore have seen a 100 % increase in internet traffic.

The lockdowns across countries have entailed a rise in the use of information systems and networks, with massive changes in usage

patterns and usage behaviour. Employees are adjusting to new "normals" - with meetings going completely online, office work shifting to the home, with new emerging patterns of work. These changes have come across most organizations, whether in business, society, or government. The changes have also come suddenly, with barely any time for organizations and people to plan for, prepare and implement new setups and arrangements; they have had to adjust, try, experiment, and find ways that did not exist before.

Though now, in late May 2020, the pandemic is receding and stabilized in certain countries, it is still on the increase in many others, and with serious threats. Experts in most countries are wary of the possibility of the disease spread re-emerging, and that lockdown norms may be relaxed carefully and slowly with social distancing at the core of the new normal.

It is in this context that we see the use of information systems to continue in the same vein for some time in the foreseeable future as during the lockdown. We examine the possible scenarios in this surge in information technology usage during and post the pandemic. Our estimation of these effects assumes that there was a digital transformation

\* Corresponding author.

E-mail addresses: [rahul@iimb.ac.in](mailto:rahul@iimb.ac.in) (R. De'), [neena@iimv.ac.in](mailto:neena@iimv.ac.in) (N. Pandey), [abhipsapal@iimk.ac.in](mailto:abhipsapal@iimk.ac.in) (A. Pal).

already underway, before the pandemic set in, and it will take certain forms owing to the impact of the lockdowns.

In the next section, we examine the impact of the Covid-19 pandemic on the use of digital technologies, where we discuss some possible scenarios and research issues of the post-pandemic world. The next section summarizes the implications for research and practice, and in the last section, we present our conclusions.

## 2. Scenarios and research issues of the digital surge

In this section, we discuss some of the most pressing issues regarding the post-pandemic digital surge. These themes reveal the multiple directions in which IS research can focus in relation to impacts on technology.

### 2.1. Increasing digitalization

As the use of video- and audio-conferencing tools increases significantly, organizations will ramp up their technology infrastructure to account for the surge. This will lead to increased investment in bandwidth expansion, network equipment, and software that leverages cloud services. With employees becoming acclimatized to the idea of work-from-home (WFH), meeting and transacting online, firms will shift to WFH as a norm rather than as an exception. This is being adopted by many firms (Akala, 2020; BBC News, 2020; Khetarpal, 2020), which have the digital infrastructure in place to handle the required load and bandwidth.

Education is another domain in which there a dramatic shift to the online mode of transacting. Since the beginning of the lockdown, schools, colleges, and universities around the world have shifted their classes to video conferencing platforms like Zoom and Google Meet. Along with these synchronous modes of teaching, asynchronous platforms like edX and Coursera have also seen an increase in enrolments (Shah, 2020). Some institutions are now shifting entirely to the online mode for the forthcoming academic year, with the exception of sessions that require a physical presence, such as the University of Cambridge in the UK and the California State system in the US (New York Times, 2020).

Digital transformation technologies such as Cloud, Internet-of-Things (IoT), Blockchain (BC), Artificial Intelligence (AI), and Machine Learning (ML), constitute a bulk of the of what is being adopted by organizations as part of their transformation effort.

Blockchain (BC) technology presents an opportunity to create secure and trusted information control mechanisms (Upadhyay, 2020). As education and healthcare services witnesses a shift to the digital domain, BCs enable a way to secure and authenticate certificates, health records, medical records, and prescriptions. Research on the design of such systems, along with maintaining their ease-of-use and usefulness will gain importance. Another issue is that of designing systems that work with smart contracts – how the contracts are authenticated, how these contracts will be designed in a complex chain of processes with many agents involved, and how arbitration related to contracts will be handled. Further, IS research may point to regulatory aspects of BCs with regard to what must be encrypted and shared (such as for authenticating news and information sources), and how security will be managed. For instance, government demand for access to private keys to view blocks for surveillance and monitoring, versus the requirements of privacy and protection from persecution.

### 2.2. Work-from-home and gig workers

The gig economy is driven by online platforms that hire workers on an ad hoc, short-contract, and mostly informal basis. Well-known examples of these include Uber and Airbnb globally and Ola and Swiggy in India. These platforms have grown immensely since the wide availability of smartphones from 2010 onwards. During the lockdown,

workers employed by these platforms have suffered heavily, as the demand for their services, taxi rides, rentals, or skill work, has disappeared (Bhattacharya, 2020). Further, since these workers had no guaranteed salaries, their incomes dropped dramatically.

In the post-pandemic scenario, there is likely to be, in the short term, a slow return of gig economy workers, as manufacturing and service firms return to their old activities. However, we anticipate that in the longer term as the threat of infection and spread recedes, the gig economy will thrive. This will also be driven by the WFH culture.

Work-from-home and gig work has received attention in IS research, through topics in telecommuting, digital nomads, and virtual teams. One key issue is that of work allocation and collaboration, across and inside teams, and across projects. This issue will face a rise in scale and importance in the post-pandemic world, as the numbers of WFH and gig workers increase. Research may focus on aspects of the design of work norms, work contracts, trust-building, and team-building, amongst others.

Research on telecommuting and virtual teams (Belanger, Collins, & Cheney, 2001; Morrison-Smith & Ruiz, 2020) has a long history in IS literature. Issues include the nature of “distance” whether temporal, spatial, or cultural, and the psychological needs of workers, the technological support and design for this kind of work, and many others. This research is important for the post-pandemic period.

We anticipate that the “dark side” of virtual teams and dispersed work also assumes importance in the post-pandemic world. Substantive issues related to technostress - particularly work overload and presenteeism arise in these situations. Research will have to address issues of design of collaborative work, evaluation, team performance and motivation, stress, and the issue of continuous learning.

### 2.3. Workplace monitoring and technostress

Another aspect of digital use by large sections of the working population is that of constant workplace monitoring and being on-the-job continuously. Those working from home using video conferencing technology find themselves under intense scrutiny and all interactions are “hyper-focused” (Kalia, 2020). Digital technology makes it easier for bosses and managers to call and locate subordinates at any time, knowing that they can be reached at all times. Though there is anecdotal early evidence that this has led to an increase in productivity, it has also led to increased technostress (Ayyagari, Grover, & Purvis, 2011; Tarafdar, Tu, Ragu-Nathan, & Ragu-Nathan, 2007) where employees must learn new technologies, be available for work at almost all times, stay with digital devices all the time, and cope with multi-tasking.

Post-pandemic, it is likely that workers' organizations will demand no-digital hours, where they will find refuge from the constant work pressure. Research may address the concerns of work equity, balance, and managing stress.

### 2.4. Online fraud

Along with the surge in the use of digital technologies, we are now witnessing a rise in online fraud, scams, intrusions, and security breaches. The pandemic has created a scenario of insecurity that is inviting fraudsters to exploit the crisis situation by extracting money or information or by creating vulnerabilities (Agarwal, Sengupta, Kulshrestha, Anand, & Guha, 2017) Many users are beginning to rely on digital resources extensively, some for the first time, and are becoming targets for fraud and scams. Organizations and governments are aware of this threat and are taking countermeasures – for instance, some governments took a strong stand against Zoom sessions for education, forcing the platform provider to upgrade security (Yu, 2020).

It is likely that these scams and frauds will increase in intensity after the pandemic. Organizations will implement massive security arrangements, along with extensive information campaigns by

government departments. Security innovations and firms that offer security services will rise. Research will likely focus on managing security, assess the causes of breaches, and the economic and social loss from them.

### 2.5. Internet access and digital divide

Information technology, and particularly the internet, will remain central to the post-pandemic scenario, where innovations will drive the surge in use. A key aspect of this surge will be the management and regulation of the internet itself. Though the internet is a global resource and no one country can control its protocols and features, its local access and availability remain an in-country issue. During the pandemic too some countries have restricted access to the internet (Chhibber, 2020), for certain reasons.

The regulation of the internet will become crucial after the pandemic as it will remain a policy tool for governments. They can intercede on aspects of monitoring, bandwidth control, surveillance, intermediary liability, and e-commerce.

The pandemic has brought the world to a situation where those not connected to the internet are facing total exclusion. With strict social and physical distancing measures in place, new routines require accessing the internet for most services. Hence, those on the wrong side of the digital divide are completely left out. Reasons for the divide are many: unaffordable device access, unaffordable Internet access, content relevance, access skills or government ordered Internet shutdowns (Armbrecht, 2016; Scheerder, van Deursen, & van Dijk, 2017). In developing countries, the condition is more serious. Thus, it becomes extremely important to explore the possibilities of ensuring connectivity. Although these issues have been researched and discussed earlier (Warschauer, 2004), COVID-19 has brought about a situation where internet access seems to have become necessary for survival. As a few studies have suggested, access or no-access to ICTs may reinforce societal inequalities (Ragnedda, 2017), where the post-pandemic situation may enhance this further. With substantial use of technology in accessing basic requirements like health and education, it is imperative to understand the impact of the digital divide on social equality. Therefore, it calls for researchers to examine the impact of connectivity to draw policymakers' interest and, perhaps, offer ways to enhance it towards better inclusion.

### 2.6. Internet governance: net neutrality and zero-rating

Heavy use of the internet during the pandemic, for various purposes, has raised people's data requirements. With a significant digital divide in societies, this surge in the Internet data requirement has revived the discussion on zero-rating plans.

Zero-rating plans enable firms to let users access data from their sites and services, without having to bear data charges. Usually, this is not strictly permitted as it violates the basic principles of net neutrality, where internet traffic has to have the same priority and cost.

India, for instance, had an exemplary record of regulating zero-rating plans. Although the government did not permit the implementation of such plans, in the aftermath of the pandemic, the telecom regulatory authority of India (TRAI) decided to allow waiving charges for data and voice for certain websites (; COAI, 2020). The list primarily consisted of the sites related to COVID-19 - such as the World Health Organisation and India's Ministry of Health and Family Welfare. The list also included some private players. The principal aim was to allow people, across all socio-economic levels, access COVID-19 related information.

Given that zero-rating plans can be useful in exceptional circumstances, as is evident from the example of India, research on the conditions on various parameters where allowing ZR plans may increase social welfare has enormous practical implications, both for firms as well as regulators. The existing literature on net-neutrality regulations

and zero-rating plans (Belli, 2017; Cho, Qiu, & Bandyopadhyay, 2016) forms the basis to enhance research in this aspect. Issues to be studied include: expanding telecom infrastructure, providing subsidized internet devices, free extra data, or waiving off users' subscription fees (Shashidhar, 2020)

### 2.7. Internet governance: shutdowns

In current times, when the productivity of people depends significantly on the internet, its shutdown can be extremely detrimental to societies (ISOC, 2019). However, internet shutdowns are not uncommon even in times like these. The internet was shutdown in Kashmir, a union territory in India, since August 5th, 2019 and continued till May 2020, making it the longest ever imposed in a democracy (Masih, Irfan, & Slater, 2019). Basic internet services, such as filing for driving licenses, were accessed by locals using the Internet Express, which is a train that shuttles Kashmiris to the nearest town where they can get online. The Kashmir Chamber of Commerce estimates \$1.4 billion in losses owing to the internet shutdown (Masih et al., 2019). Similar events are regularly noted across various other countries, Arab Spring being the significant starting point.

With the pandemic, when the internet has become the most important tool available to citizens, the impact of Internet shutdowns has become grimmer. Shutdowns lead to severe implications for all aspects of life, and there are many issues that require research in this regard. The impacts resulting from a climate of uncertainty can potentially discourage foreign investors and spill over to a wide range of sectors, including education, healthcare, press and news media, and e-commerce (Kathuria, Kedia, Verma, Bagchi, & Sekhani, 2018). It is important to understand the far-reaching human rights impact of internet shutdowns, which are exacerbated in the current scenario. Shutdowns have deep political reasons and in many cases the consequences are indeterminate. Research can focus on aspects of domino-effect consequences leading to grave political crises.

### 2.8. Digital money

Digital payments and digital currencies are likely to have a key role in the post-pandemic situation. As digital payments are contact-less they will be encouraged by governments, and will likely see a surge. This will also be boosted by the gig economy and WFH situations.

There are two distinct phenomena related to digital money that has aided the fight during the pandemic. First, banknotes and coins were suspected to be carrying the virus and digital payment was preferred to the 'dirty money' (Gardner, 2020; Samantha, 2020). Online delivery services were encouraging customers to make payments through digital payment systems like a credit/debit card or mobile payments, with mandates by the government in several parts of India (Bhandari, 2020). This is likely to result in a surge in digital payment usage, which will lead to work on the diffusion of digital payment technology. Second, during the lockdown, there was a loss of jobs, and governments provided aid through payment apps and digital payment modes. These are a convenient mode of fund transfer from donors to recipients, as seen in previous crisis relief cases as well (Pollach, Treiblmaier, & Floh, 2005). In various crisis and disaster events, where the mobility of civilians was restrained, many mobile payment service providers (e.g. Vodafone in Afghanistan, Safaricom in Kenya, and Orange in Africa) provided quick funds transfer of remittances from migrants to their homes, and relief aid from the government to victims (Aker, Boumnijel, McClelland, & Tierney, 2016; Pega, Liu, Walter, & Lhachimi, 2015; Wachanga, 2015). This is once again observed in the Covid-19 crisis and needs further examination.

### 2.9. Surveillance and privacy

Issues of surveillance and privacy are gaining prominence with

digital usage during lockdowns. Commentators, such as Yuval Harari, have written about the potential for state surveillance “under the skin” (Harari, 2020) as governments rely on digital means to monitor the spread of the pandemic. As many governments have started using apps on smartphones to monitor infected persons and trace their contacts, civil society organizations have raised privacy and state surveillance concerns (Pant & Lal, 2020). Post-pandemic, these measures of monitoring populations for epidemiological reasons with digital means are likely to continue and become prevalent. Though the concerns of privacy and surveillance are valid and have to be addressed, these digital platforms are the most reliable and efficient way of tracking disease spread.

“Surveillance is a distinctive product of the modern world” (Misa, Brey, & Feenberg, 2003, p. 161), and today we are living in a surveillance society where any internet-based activity using a mobile phone or other electronic gadgets can be monitored and accessed in unfathomable ways (Gilliom & Monahan, 2012; Lyon, 1994). This has resulted in a surge in IS research on implications of such web or app-based surveillance in applications including mobile health apps (Lupton, 2012), environment monitoring and pollution control apps (Castell et al., 2015), self-tracking apps (Barassi, 2017), and parental surveillance (Ghosh, Badillo-Urquiola, Guha, LaViola, & Wisniewski, 2018). Covid-19 has introduced a new application of surveillance for tracking citizens with the symptoms of the virus. This includes the Covid-19 tracker in China (Davidson, 2020), the Aarogya Setu app for tracking infectious citizens in India (Shahane, 2020), and contact tracking apps in the United States (Guyann, 2020). While these technologies are innovations for fighting the global pandemic today, the issue of government surveillance on citizens has evolved repeatedly. Research can focus on the multiple benefits of these apps, but also should not ignore the potential social complications that are possible to arise, including the historic problem of bureaucratic control by the government, using IT (Gandy, 1989).

Closely related to surveillance is the issue of privacy that mobile apps, including Covid-19 trackers, often tend to threaten users' personal information (Gu, (Calvin) Xu, Xu, Zhang, & Ling, 2017; Joy, 2020). For example, online classes during the pandemic lockdowns have suffered issues of ‘intrusion of privacy’ as students and teachers are on camera in the private spaces of their homes (Garcia, 2020). Privacy in the digital age has remained a research topic of high priority for IS researchers (Belanger et al., 2001; Smith, Dinev, & Xu, 2011). Privacy has also been considered by IS adoption and usage researchers, with privacy risk as a dominant and recurring factor in studies on mobile payments (e.g., Johnson, Kiser, Washington, & Torres, 2018; Luo, Li, Zhang, & Shim, 2010), location-based mobile services (Zhou, 2012), and social networking sites (Aghasian, Garg, Gao, Yu, & Montgomery, 2017; Youn & Hall, 2008). It would be interesting to examine the different privacy concerns of users while adapting both Covid-19 tracking apps, and online classroom applications. The risks involved in the breach of privacy by these two technologies are unlike and must be investigated with adequate contextual references.

### 3. Implications for research and practice

In this section, we revisit some of the key issues that are important for research and practice. Our discussion is based on the assumptions about the post-pandemic situation and the aspects of IS research presented above.

#### 3.1. Implications for research

- 1 While deploying security technologies like the blockchain, it will be important to understand the implications of smart contracts, their integration in workflows, and their effectiveness in complex resource-constrained settings, as in developing countries. Further, understanding the implications of secure and non-erasable

- technologies like blockchains will become relevant for regulation.
- 2 Many research issues arise with regard to work-from-home and gig work, which include aspects of trust, measurement of performance, communication effectiveness, and collaboration.
- 3 It can be expected that the dark side of virtual work and gig work, will raise questions of stress, presenteeism, work overload, surveillance, and monitoring. New and severe forms of digital surveillance will have to be understood and their implications gauged.
- 4 Though much work has been done in understanding the parameters and impact of the digital divide, it will be important to understand how those without access suffer more from the consequences of the pandemic when the world survives on digital communications and operations.
- 5 Management of the internet within countries is important, and aspects of enhancing networks include regulating zero-rating plans cautiously, seeing their implications for welfare, and how they can enhance access.
- 6 Internet shutdowns during and after a pandemic lead to severe difficulties for citizens, who have come to depend on these services. Research has to examine the direct, second-order, and third-order impacts of these shutdown measures.
- 7 Research on digital payments and their impact in crisis situations, for providing aid and subsidies to affected populations, and for disaster management.
- 8 Surveillance issues about the extent of data collection by contact tracing apps are important areas of research. Issues of persistence and elimination of data, the expanse of data collection, sharing of data between apps, and the multiple trade-offs involved.

#### 3.2. Implications for practice

- 1 Design of secure technologies, like blockchain-based applications, for the surge in online education and healthcare activities.
- 2 Policy for regulating digital infrastructure needed for increased digital transformation.
- 3 Design of technologies for managing secure online interactions – for education, healthcare, payments.
- 4 Design of apps for contract tracing and disease surveillance that balance privacy versus public health.
- 5 Managers will have to understand resistance to technology and ways to manage change, both among employees as well as customers.
- 6 Given the significant role which the internet is about to play in times to come, Internet intermediaries will work with government and civil society to address privacy and surveillance issues for better adoption of technology.

### 4. Conclusion

We understand that a pandemic can have severe consequences (Keys, 2000), including changing the political contour of the world, destroying empires, and creating nations. For the Covid-19 pandemic, we envisage a dramatic shift in digital usage with impacts on all aspects of work and life. How this change plays out remains largely dependent on our responses to and shaping of the emerging trends.

In this paper, we have outlined what we see as some key trends and research issues that need to be examined urgently. They will have substantial consequences in the future.

#### CRediT authorship contribution statement

**Rahul De'**: Conceptualization, Writing - original draft. **Neena Pandey**: Writing - original draft. **Abhipsa Pal**: Writing - review & editing.

## References

- Agarwal, S., Sengupta, D., Kulshrestha, A., Anand, S., & Guha, R. (2017). *Internet users to touch 420 million by June 2017: IAMAI report* May 2, Retrieved from. The Economic Times <https://economictimes.indiatimes.com/tech/internet/420-million-to-access-internet-on-mobile-in-india-by-june-iamai/articleshow/58475622.cms>.
- Aghasian, E., Garg, S., Gao, L., Yu, S., & Montgomery, J. (2017). Scoring users' privacy disclosure across multiple online social networks. *IEEE Access*, 5, 13118–13130 Presented at the IEEE Access.
- Akala, A. (2020). *More big employers are talking about permanent work-from-home positions*. May 1, Retrieved June 6, 2020, from CNBC <https://www.cnbc.com/2020/05/01/major-companies-talking-about-permanent-work-from-home-positions.html>.
- Aker, J. C., Boumijel, R., McClelland, A., & Tierney, N. (2016). Payment mechanisms and antipoverty programs: Evidence from a mobile money cash transfer experiment in Niger. *Economic Development and Cultural Change*, 65(1), 1–37.
- Armbrecht, A. (2016). *4 reasons 4 billion people are still offline*. February 23, Retrieved June 6, 2020, from World Economic Forum <https://www.weforum.org/agenda/2016/02/4-reasons-4-billion-people-are-still-offline/>.
- Ayyagari, R., Grover, V., & Purvis, R. (2011). Technostress: Technological antecedents and implications. *MIS Quarterly*, 35(4), 831–858 Society for Information Management and The Management Information Systems.
- Barassi, V. (2017). BabyVeillance? Expecting parents, online surveillance and the cultural specificity of pregnancy apps. *Social Media + Society*, 3(2), 2056305117707188 SAGE Publications Ltd.
- BBC News (2020). *Twitter allows staff to work from home "forever"*. May 13, Retrieved June 6, 2020, from BBC News <https://www.bbc.com/news/technology-52628119>.
- Belanger, F., Collins, R. W., & Cheney, P. H. (2001). Technology requirements and work group communication for telecommuters. *Information Systems Research*, 12(2), 155–176 INFORMS.
- Belli, L. (2017). Net neutrality, zero rating and the minitilisation of the internet. *Journal of Cyber Policy*, 2(1), 96–122 Taylor & Francis.
- Bhandari, S. (2020). *Ahmedabad says no to cash on delivery to stop spread of COVID-19*. May 11, Retrieved May 28, 2020, from India TV <https://www.indiatvnews.com/news/india/ahmedabad-digital-payments-mandatory-no-cash-on-delivery-to-stop-covid-19-616239>.
- Bhattacharya, A. (2020). *Coronavirus lockdown has exposed the serious flaws of India's gig economy*. April 28, Retrieved June 6, 2020, from Quartz India <https://qz.com/india/1843807/bigbasket-delivery-reveal-indias-gig-economy-problems/>.
- Branscombe, M. (2020). *The network impact of the global COVID-19 pandemic*. April 14, Retrieved June 6, 2020, from The New Stack <https://thenewstack.io/the-network-impact-of-the-global-covid-19-pandemic/>.
- Castell, N., Kobernus, M., Liu, H.-Y., Schneider, P., Lahoz, W., Berre, A. J., & Noll, J. (2015). Mobile technologies and services for environmental monitoring: The CitySense-MOB approach. *Urban Climate*, 14, 370–382.
- Chhibber, M. (2020). *Militancy in Kashmir peaked without 4G, but Modi gov't keeps forgetting this in court*. May 6, Retrieved June 6, 2020, from The Print <https://theprint.in/opinion/militancy-in-kashmir-peaked-without-4g-but-modi-govt-keeps-forgetting-this-in-court/415072/>.
- Cho, S., Qiu, L., & Bandyopadhyay, S. (2016). Less than zero? The economic impact of zero rating on content competition. *The Economic Impact of Zero Rating on Content Competition (September 30, 2016) NET Institute Working Paper*, (16–04).
- COAI (2020). *Request-for-Non-Charging-of-Data.pdf*. Retrieved June 6, 2020, from <https://www.medianama.com/wp-content/uploads/Request-for-Non-Charging-of-Data.pdf>.
- Davidson, H. (2020). *Chinese city plans to turn coronavirus app into permanent health tracker*. May 26, Retrieved May 28, 2020, from The Guardian <https://www.theguardian.com/world/2020/may/26/chinese-city-plans-to-turn-coronavirus-app-into-permanent-health-tracker>.
- Gandy, O. H. (1989). The surveillance society: Information technology and bureaucratic social control. *Journal of Communication*, 39(3), 61–76.
- Garcia, L. (2020). *"It's a new territory": Professors and students face struggle to adapt to online classes*. May 13, Retrieved May 28, 2020, from The Collegian <https://www.kstatecollegian.com/2020/05/13/its-a-new-territory-professors-and-students-face-struggle-to-adapt-to-online-classes/>.
- Gardner, B. (2020). *Dirty banknotes may be spreading the coronavirus, WHO suggests*. March 2, Retrieved May 16, 2020, from The Telegraph <https://www.telegraph.co.uk/news/2020/03/02/exclusive-dirty-banknotes-may-spreading-coronavirus-world-health/>.
- Ghosh, A. K., Badillo-Urquiola, K., Guha, S., LaViola, J. J., Jr, & Wisniewski, P. J. (2018). Safety vs. Surveillance: What children have to say about mobile apps for parental control. *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems—CHI' 18* (pp. 1–14). Retrieved May 28, 2020, from <http://dl.acm.org/citation.cfm?doid=3173574.3173698>.
- Gilliom, J., & Monahan, T. (2012). *SuperVision: An introduction to the surveillance society*. University of Chicago Press.
- Gu, J., (Calvin) Xu, Y., Xu, H., Zhang, C., & Ling, H. (2017). Privacy concerns for mobile app download: An elaboration likelihood model perspective. *Decision Support Systems*, 94, 19–28.
- Guynn, J. (2020). *Apple and Google release coronavirus contact tracing technology for public health mobile apps*. May 20, Retrieved May 28, 2020, from USA TODAY <https://www.usatoday.com/story/tech/2020/05/20/apple-and-google-release-coronavirus-contact-tracing-mobile-app-technology/52299556002/>.
- Harari, Y. N. (2020). *Yuval Noah Harari: The world after coronavirus | Free to read*. March 20, Retrieved June 6, 2020, from Financial Times <https://www.ft.com/content/19d90308-6858-11ea-a3c9-1fe6fedca75>.
- ISOC (2019). *Policy brief: Internet shutdowns*. Retrieved June 6, 2020, from Internet Society <https://www.internetsociety.org/policybriefs/internet-shutdowns/>.
- Johnson, V. L., Kiser, A., Washington, R., & Torres, R. (2018). Limitations to the rapid adoption of M-payment services: Understanding the impact of privacy risk on M-payment services. *Computers in Human Behavior*, 79, 111–122.
- Joy, S. (2020). *Coronavirus: Centre tones down mandatory clause on Aarogya Setu app*. May 18, Retrieved May 28, 2020, from Deccan Herald <https://www.deccanherald.com/national/coronavirus-centre-tones-down-mandatory-clause-on-aarogya-setu-app-838992.html>.
- Kalia, A. (2020). *The Zoom boom: How video-calling became a blessing – and a curse*. May 21, Retrieved June 6, 2020, from The Guardian <https://www.theguardian.com/technology/2020/may/21/the-zoom-boom-how-video-calling-became-a-blessing-and-a-curse>.
- Kathuria, R., Kedia, M., Verma, G., Bagchi, K., & Sekhani, R. (2018). *Anatomy of an Internet Blackout.pdf*. Indian Council for Research on International Economic Relations. Retrieved June 6, 2020, from [https://icrier.org/pdf/Anatomy\\_of\\_an\\_Internet\\_Blackout.pdf](https://icrier.org/pdf/Anatomy_of_an_Internet_Blackout.pdf).
- Keys, D. (2000). *Catastrophe: an investigation into the origins of the modern world*. Ballantine Books.
- Khetarpal, S. (2020). *Post-COVID, 75% of 4.5 lakh TCS employees to permanently work from home by '25; from 20%*. April 20, Retrieved June 6, 2020, from Business Today <https://www.businesstoday.in/current/corporate/post-coronavirus-75-percent-of-3-5-lakh-tcs-employees-permanently-work-from-home-up-from-20-percent/story/401981.html>.
- Luo, X., Li, H., Zhang, J., & Shim, J. P. (2010). Examining multi-dimensional trust and multi-faceted risk in initial acceptance of emerging technologies: An empirical study of mobile banking services. *Decision Support Systems*, 49(2), 222–234.
- Lupton, D. (2012). M-health and health promotion: The digital cyborg and surveillance society. *Social Theory & Health*, 10(3), 229–244.
- Lyon, D. (1994). *The electronic eye: The rise of surveillance society*. U of Minnesota Press.
- Masih, N., Irfan, S., & Slater, J. (2019). *India's Internet shutdown in Kashmir is the longest ever in a democracy*. December 16, Retrieved June 6, 2020, from Washington Post [https://www.washingtonpost.com/world/asia\\_pacific/indias-internet-shutdown-in-kashmir-is-now-the-longest-ever-in-a-democracy/2019/12/15/bb0693ea-1dfc-11ea-977a-15a6710ed6da\\_story.html](https://www.washingtonpost.com/world/asia_pacific/indias-internet-shutdown-in-kashmir-is-now-the-longest-ever-in-a-democracy/2019/12/15/bb0693ea-1dfc-11ea-977a-15a6710ed6da_story.html).
- Misa, T. J., Brey, P., & Feenberg, A. (2003). *Modernity and technology*. MIT Press.
- Morrison-Smith, S., & Ruiz, J. (2020). Challenges and barriers in virtual teams: A literature review. *SN Applied Sciences*, 2, 1–33 Springer.
- New York Times (2020). *Virus forces Cambridge to hold most classes online next year—The New York Times*. May 19, Retrieved June 6, 2020, from <https://www.nytimes.com/2020/05/19/world/coronavirus-news.html>.
- Pant, B., & Lal, A. (2020). *Aarogya Setu App: A tale of the complex challenges of a rights-based regime*. May 13, Retrieved June 6, 2020, from The Wire <https://thewire.in/tech/aarogya-setu-app-challenges-rights-based-regime>.
- Pega, F., Liu, S. Y., Walter, S., & Lhachimi, S. K. (2015). *Unconditional cash transfers for assistance in humanitarian disasters: Effect on use of health services and health outcomes in low- and middle-income countries*. 86.
- Pollach, I., Treiblmaier, H., & Floh, A. (2005). Online fundraising for environmental nonprofit organizations. *Th Hawaii International Conference on System Sciences*, 9.
- Ragnedda, M. (2017). *The third digital divide: A Weberian approach to digital inequalities*. Taylor & Francis.
- Samantha, M. K. (2020). *Dirty money: The case against using cash during the coronavirus outbreak*. March 7, Retrieved May 16, 2020, from CNN <https://www.cnn.com/2020/03/07/tech/mobile-payments-coronavirus/index.html>.
- Scheerder, A., van Deursen, A., & van Dijk, J. (2017). Determinants of Internet skills, uses and outcomes. A systematic review of the second and third-level digital divide. *Telematics and Informatics*, 34(8), 1607–1624 Elsevier.
- Shah, D. (2020). *MOOCWatch 23: Pandemic brings MOOCs back in the spotlight — Class Central* May 4, Retrieved June 6, 2020, from Class Central's MOOCReport <https://www.classcentral.com/report/moocwatch-23-moocs-back-in-the-spotlight/>.
- Shahane, G. (2020). *Opinion: Does Aarogya Setu really work?* May 28, Retrieved May 28, 2020, from Livemint <https://www.livemint.com/mint-lounge/features/opinion-does-aarogya-setu-really-work-11590636898864.html>.
- Shashidhar, K. J. (2020). *Net neutrality in the time of COVID-19*. April 28, Retrieved June 6, 2020, from ORF <https://www.orfonline.org/expert-speak/net-neutrality-in-the-time-of-covid-19-65290/>.
- Smith, H. J., Dinev, T., & Xu, H. (2011). Information privacy research: An interdisciplinary review. *MIS quarterly*, 35(4), 989–1016 Society for Information Management and The Management Information Systems.
- Tarafdar, M., Tu, Q., Ragu-Nathan, B. S., & Ragu-Nathan, T. (2007). The impact of technostress on role stress and productivity. *Journal of management information systems*, 24(1), 301–328 Taylor & Francis.
- Upadhyay, N. (2020). Demystifying blockchain: A critical analysis of challenges, applications and opportunities. *International Journal of Information Management*, 54, 102120.
- Wachanga, D. N. (2015). Ethnic differences vs nationhood in times of national crises: The role of social media and communication strategies. *Journal of African Media Studies*, 7(3), 281–299.
- Warschauer, M. (2004). *Technology and social inclusion: Rethinking the digital divide*. MIT press.
- Youn, S., & Hall, K. (2008). Gender and online privacy among teens: Risk perception, privacy concerns, and protection behaviors. *CyberPsychology & Behavior*, 11(6), 763–765 Mary Ann Liebert, Inc., publishers.
- Yu, E. (2020). *Singapore allows schools to resume zoom use for home-based learning*. April 13, Retrieved June 6, 2020, from ZDNet <https://www.zdnet.com/article/singapore-allows-schools-to-resume-zoom-use-for-home-based-learning/>.
- Zhou, T. (2012). Examining location-based services usage from the perspectives of unified theory of acceptance and use of technology and privacy risk. *Journal of Electronic Commerce Research*, 13(2).