Challenges and Opportunities for Information Systems Research During and After Coronavirus

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Abstract

The COVID-19 pandemic has affected world-wide business and management immensely. Furthermore, challenges and opportunities for information systems research during and after coronavirus have emerged. To better understand the impacts of COVID-19 pandemic in the field of information systems (IS), and also as a part of the 2020 AIS SIG-ISAP Workshop on Information Systems in Asia Pacific (ISAP) being held prior ICIS-2020, we organized a panel to address this important issue with three distinguished information systems researchers. The panelists identified and discussed the challenges and opportunities for information systems research during and after Coronavirus. In addition, constructive suggestions for aspiring young scholars who aim to publish their works in top-tier IS journals have been proposed, which may benefit the IS community in large.

Keywords: Information Systems Research, Coronavirus, Discussion, Report.

Introduction and Background

To date, the COVID-19 pandemic has led to a dramatic loss of human life, with over 80 million patients and close to 2 million deaths worldwide (Cheema et al., 2020). The economic and social disruption caused by the pandemic is also devastating; as tens of millions of people are at risk of falling into extreme poverty, unemployment ratio has reached the highest level, the social network inequality has been magnified absurdly, and many other societal issues have been provoked (Ågerfalk et al., 2020; Dwivedi et al., 2020; Venkatesh, 2020). In this unprecedented once-in-a-century era amid the COVID-19 pandemic and many other disrupting co-occurrences, the landscape of the society, industry, and academy has been and will be reshaped entirely. Considering that the coronavirus pandemic has changed almost most of the habits that exist, such as how to interact and work, information technologies have taken an unprecedented important role in our lives (Sakurai & Chughtai, 2020). Many companies, such as Facebook, Twitter, Square, and Shopify, have allowed employees to work from home (McLean, 2020). Online doctor appointments and virtual worship have become a new norm. Virtual reality technology is starting to become popular. For instance, HMD-based VR could positively support autistic individuals in tackling education, employment, and anxiety problems that resulted from COVID-19. Autistic people must familiarize themselves with new rules and routines in a post-COVID-19 world. VR technology can play a role in helping autistic people reduce the pressure and anxiety of dealing with the "unknown" and "unexpected." Due to the immersive nature of VR technology, it provides an environment where autistic people find interacting with various activities comfortable and safe (Newbutt et al., 2020). The use of information technologies and information systems enables our society under social distancing to continue to function and also helps cut the spread and transmission of the coronavirus, which in turn can reduce the number of infected patients (Asadzadeh et al., 2020; Ågerfalk et al., 2020; Bunker, 2020; Dolyle & Conboy, 2020; Fagherazzi et al., 2020; Gong et al., 2020; Zhang et al., 2020).

As workers commute using the Internet and online education has become the preferred choice, our society will clearly undergo a major transformation, thereby raising a number of questions for information systems and information technology (IS/IT) researchers, e.g. how can information systems/technologies reduce social disparity in the time of pandemic, what are the information systems research topics/opportunities related to the pandemic, etc. To address those important questions, we organized a panel with three distinguished information systems researchers as a part of the 2020 AIS SIG-ISAP Workshop on Information Systems in Asia Pacific (ISAP). The three panelists in the presentation order included: Dr. Zhengrui (Jeffrey) Jiang, Professor of Information Systems in the School of Business, Nanjing University, Nanjing, China; Dr. Anol Bhattacherjee, the Exide Professor of Business Ethics and professor in the School of Information Systems and Management at University of South Florida; and Dr. Xiao Fang, the JPMorgan Chase Fellow and professor in Management Information Systems at the Alfred Lerner College of Business and Economics, University of Delaware. We recorded all the discussions and summarized their ideas below.

Dr. Jiang

Covid-19 has brought many challenges in our lives and affected the ways we teach. It could have been much worse if it happened a decade ago when E-commerce was not widely adopted, and the internet speed was much slower than it is today. I do not think the physical and IT infrastructure can support online classes similar to those today.

However, business in technology sectors has thrived during the pandemic. The NASDAQ index and stock prices of tech companies have reached new record-high, which will likely continue in the future. Technology plays a significant role in our society, thereby creating opportunities in the IT sector. People have started to study and work remotely and maybe will continue doing so even when the pandemic ends.

Covid-19 has undoubtedly built a much stronger case for the business value of IT and IS. We could study how Information Systems and IT are enabling societies to address the pandemic challenges and keep the life and economy progressing. Research opportunities lie in areas, such as case tracking (transportation, mobile phone calling record), health code, and the impact of the pandemic on businesses and work–life. We should also leverage the pandemic to develop new theories and cases and investigate the special issues raised.

For young scholars in the Asian-Pacific region, they could compare how the Asian-Pacific countries (mainly Eastern Asian countries) have managed the pandemic with the rest of the world. For instance, they could explore reasons why the Asian-Pacific region (Eastern Asian) might manage the pandemic more effectively than other countries. Several causes may include culture, governance, or IT. By collecting first-hand data, researchers can build a more convincing case.

Young scholars have faced a challenging academic job market before 2005, during which productive scholars have been undervalued. After that, they were able to move up the ladder with quality work. My pieces of advice to young scholars include: do not give up lower-ranked schools if they would like to stay in academia, and do not give up preparing for high-quality papers.

Dr. Bhattacharjee

Three broad domains exist in IS research: design, use, and impacts. The oldest domain of research is the "use" research, such as adoption, continued and routinized use, adaptation, etc. Around 1990, a newer stream of research emerged, which is the "impact" research that primarily studies economic, personal, organizational, and societal impact. The latest stream of research is IS design, a little disconnected from other streams with lots of promise. Apart from the three domains, the interface offers many research opportunities. For example, the interface design and use and IT affordances. Other possible research includes the interface between the design and impact or use as well.

Covid-19 provides us a once in a lifetime opportunity to study a pandemic. Though it is a negative thing, we should view it as a positive to contemplate all the possible research opportunities. In terms of IT design, we can look at tools for collecting, processing, and disseminating information related to the Covid-19. We can discuss tools for contact tracing apps and designing science work concerning the data organization framework. We can also see a lot going on about tools used to combat the spread of disinformation during the Covid-19.

In the "use" domain, we can consider understanding the spread of information and disinformation in a pandemic. How does information spread? How can we compare valid and true information? What is the comparing and contrast between true and false information? We can look at the contact tracing app, which is relevant to the Covid-19 right now, but we see user resistance due to Covid-19, and we might want to examine factors contributing to the resistance of COVID-19 tracing and how to overcome barriers. People trying to cope with Covid-19 are experiencing anxiety, depression, medical condition, and death in their families. During a pandemic, people cope differently. Thus, understanding how people cope with the pandemic would be an interesting research area.

About "impact," we can look at predicting disease spread, hospitalization, or death using a prediction model or machine learning. Many works have been conducted in this direction. An area that is not quite as well studied is the economic impacts of COVID-19. For instance, what is the impact on unemployment, income inequality, and the closure of small businesses? We can also see the social impacts of COVID-19, which includes an emerging mental health crisis going on around the world. We can also look at the policies the government has implemented

and how to mitigate these impacts with policies. Again, the pandemic is once in a lifetime. I would encourage you to conduct a COVID-19-related research rather than the typical type of research.

However, we face research challenges because the Covid-19 is outside our wheelhouse. We should collaborate with epidemiologists, technologists, and experts outside our domain. A huge part of solving the problems is understanding them. The COVID-19 problem is more of a healthcare problem than an IS problem. Thus, we have to work with other experts to create a useful value out of it. We have to think outside the box, that is, bringing in new theories, ideas, metrics, methods, or any combinations is important so we can create interesting research. Much of our previous body of knowledge may not be applied. We have to perform tons of experimentation. Much of the research we do may or may not work, but even if it does not work, we should take it positively and learn from that failure. Publishing requires not just hard work but the clarity of thinking, planning, and writing. This area, in which young scholars would have to struggle, is important when working with other people.

Dr. Fang

My area of research belongs to the design domain of IS research, mainly computational data science research. I design novel and rigorous machine learning algorithms to solve critical and challenging business and societal problems. I will talk about this research opportunity from the perspective of Covid-19. Right after people have detected the novel coronavirus in the City of Wuhan, China, who is the first batch of researchers conducting research related to Covid-19? They are not information system researchers but epidemiologists who studied the diffusion of pandemic and infectious diseases, as well as how to control the disease.

This paper is pretty much the first paper published discussing Covid-19. It was published in March 2020 and has been accepted online. It gives us a description of 425 Covid-19 cases collected from the city of Wuhan, highlighting the descriptive side. To understand and control the diffusion of Covid-19, we need to know its basic characteristics. Thus, what are the basic epidemiological characteristics of Covid-19? First is the infection size: how many people have been infected? Another is the reproduction number: for any single infection, how many other infective cases can these infections infect? Problems exist to determine the true infection size and reproduction number in Wuhan. One is the under-reporting problem, which means the official numbers of infections may be lower than the true number of infections. Factors, such as an insufficient amount of virus tests and the shortage of hospital beds, could cause the under-reporting.

A common approach to address this issue is to use the official number of infected cases exported from Wuhan to infer the true number of infections within Wuhan, assuming that, outside Wuhan, the official number is close to the true number. Two groups of researchers have adopted this approach, one from the Hong Kong University that published their paper in Lancet and another from Northeastern University in the United States that published their work on travel restrictions on the spread of Covid-19 outbreak. This early research has stimulated us to research the true infection size and true reproduction number in the city of Wuhan in the early days. Besides, how government, policies, and counter-pandemic measures could affect the number of infections? Then, we have our research paper --- Dynamic Estimation of Epidemiological Parameters of Covid-19 Outbreak and Effects of Interventions on its Spread, which was completed in April. Early studies are based on exported cases. However, after January 23, China locked down the city, and no exported cases after January 27 were reported. Therefore, the objective of this research is to discover ways to estimate the epidemiological characteristics of Covid-19 after January 23.

We designed a Bayesian estimation model based on the epidemiological model. Our data inputs officially reported the number of infections and the number of people who are actually

in the hospital. Then, we used a transformation function to transform the official number into the true number, and we need to estimate the parameters of this transformation function. Simply put, the results indicated that if everyone stays at home for two weeks, the pandemic will be under control. We also examined the effect of intervention policies. The result showed that the first policy, transportation suspension, has prevented 33719 people. The second policy, large-scale hospitalization, has prevented 90072 people from getting infected. My story above is one opportunity from my own experience related to Covid-19. I think there are also many other opportunities to explore the impact of Covid-19.

Q&A Session

Thank you for your speech! You are all on the editorial board for the top tier journals. Shortly, is there any special issue proposed by the top journals?

Dr. Bhattacharjee

In MISQ, a special issue is forthcoming for coronavirus. It just had the call for papers recently. I don't know the dates...

Dr. Fang

I think the call for papers has closed. The deadline is November 30th. MISQ is going to have a special issue on digital resilience about Covid-19. IS research might have the opportunity on special issues coming out soon.

In the United States, underrepresented people are strongly affected by the Covid-19 but rich people seem to be doing fine. If in any way that IS research can help with improving social welfare?

Dr. Bhattacharjee

Definitely. We do not pay attention to income equality and so forth. However, they are very useful and relevant research topics for other disciplines. I think this is an opportunity for us to explore those areas and perhaps consider research projects in those domains. As you clearly said, it is the poor people that were laid off from their jobs, and they have suffered economically as well as medically. So certainly, more research needs to be done. In the past, we have had research and society issues, such as the digital divide between the rich and the poor people. I think this issue is more like the Covid-19 divide if you will. So, this might be a very interesting opportunity.

Is there a specific research opportunity for scholars in the Asia Pacific? Cleary, the Covid-19 demonstrates the cultural difference between the west and east. Do you think there is a particular research opportunity or challenge for researchers from the Asia Pacific? What is your advice to them?

Dr. Bhattacharjee

First of all, the cultural context between the west and the east is different, but I do not think that should matter much. You could design a study that considers the research issues related to impacts or design or use in the Chinese context or the Asia Pacific. I think journals would be receptive to that kind of work. I do see a lot of people coming out of China who published in MISQ and I don't think that's going to be an issue. And if you want to do a study that compares the cultural differences between the United States and Asia and how they have handled the Covid-19 differently, that's possible as a research topic.

However, I think just that cultural difference may not be enough. You may have to go deeper into it. Differences in behavior, privacy concerns, and societal norms exist. I think you have to explore a depth in a very systematic manner. What are the differences between these two cultures　? How do they impact COVID-19 outcomes?

Jeffery, since you have the experience and know the difference between the US and China, I have a question for you. We know that the IS policy in China is doing well. They have recently published many papers in top-tier journals. What's your advice to young aspiring scholars who are looking forward to publishing their works in top journals?

Dr. Jiang (Jeffery)

To increase their chance to get accepted, as we have mentioned, they need to work on not just the topic, the quality of execution, but also the clarity of writing. It's also good to work with experienced researchers. I used to tell people that they should consider three dimensions: rigor, novelty, and presentation. They have to have a very rigorous methodology and sufficient depth. Novelty is to bring about new topics and methods, which generate research opportunities independently. Of course, the quality of presentation, the writing, and exposition remain vital. Besides, do not underestimate the importance of working with experienced professionals. It is very difficult for young scholars to publish their work in top journals by themselves. Therefore, more experienced peers and experts are essential.

Dr. Fang

Many young scholars in China aim to publish their works in the top IS or business journals. I also worked with some young scholars in mainland China and we have managed to publish some good papers. They have insightful opinions but might not identify good research problems. If we can help them find a good research problem, young scholars have no problem providing a state-of-the-art solution because of their solid technical background. Additionally, writing a logical, cohesive, and clear paper is another issue. So, Jeffery has great suggestions. Maybe they can first collaborate with scholars in the US, but eventually, I want them to be independent.

Conclusion

Overall, the panelists have shed light onto their own perspectives on the challenges and opportunities for the information systems research in the era amid covid-19 and charted the way for future research directions in this domain. Dr. Jiang comments that the Covid-19 has undoubtedly built a stronger case for the business value of IT and IS, with research opportunities in areas, such as case tracking, health code, and the impact of the pandemic on businesses and work–life. He also encouraged young scholars to continue to conduct high-quality research and stay in academia, although the faculty job market is hit hard this year. Dr. Bhattacharjee presented reach opportunities from the perspective of three broad domains existing in IS research (i.e., design, use, & impacts). He pointed out that Covid-19 provides us a once in a lifetime opportunity to study a pandemic. Despite its negativity, we should view it positively to contemplate all the possible research opportunities. Dr. Fang presented a real case of conducting a COVID-themed IS research by introducing his recent project of applying machine learning algorithms to understand the diffusion of pandemic and infectious diseases, as well as how to control the disease. Through the example, young scholars learned the whole process of conducting high-quality COVID-related research.

Table 1 - Summary of Panel Discussion	
Important Challenges	**Advices to Young IS Researchers**
What are promising/important IS/IT research topics amid the pandemic?	There are many important research topics related to COVID-19, e.g., the use of IT for collecting, processing, and disseminating information related to the Covid-19, machine learning algorithms for predicting the spread of the pandemic, the value of IT and work efficiency in the remote working environment, and the cultural difference in adopting IT during the pandemic.
How to maintain an academic career while the job market is being significantly impacted by the pandemic?	Do not give up lower-ranked schools if they would like to stay in academia, aim for high-quality papers, and collaborate with experienced researchers.
How to utilize information systems/technologies to reduce social disparities that were worsened by Covid-19?	Integrate information systems/technologies with other disciplines, such as economics, public policy, ethics, management, and collaborate with experts from other domains, to tackle the issue.
How to conduct high-quality IS research?	Identify a novel and important research problem, develop a state-of-art solution with rigor and write a paper that is logical, cohesive, and clear. Collaborate with experienced scholars to get started and eventually learn to be independent.

Together, opportunities and changes for information systems research for COVID-19 were examined and discussed thoroughly. We learned how information systems and technology research can evolve to assist in our work and lives during and after the pandemic and understood the vulnerabilities of the current information systems and technologies, such as information privacy and social network inequality. A follow-up discussion was conducted at the end of the panel. The participation of the audience attests to the potential, importance, and impact of this research domain. Hence, we call for more research in this domain.

For ease of reading, we summarize the important questions and advice to young researchers in Table 1.

Our panelists:

Dr. Zhengrui (Jeffrey) Jiang is a Professor of Information Systems in the School of Business, Nanjing University, Nanjing, China. Before joining Nanjing University, he was the Thome Professor in Business and Professor of Information Systems and Business Analytics at the Ivy College of Business, Iowa State University. Dr. Jiang currently serves as an associate editor for Information Systems Research and a senior editor for Production and Operations Management.

Dr. Anol Bhattacherjee is the Exide Professor of Business Ethics and professor in the School of Information Systems and Management at the University of South Florida. Dr. Bhattacherjee has published more than 65 refereed journal papers that have received more than 25,000 citations on Google Scholar. He served on the editorial boards of MIS Quarterly and the Journal of the AIS.

Dr. Xiao Fang is a JPMorgan Chase Fellow and professor in Management Information Systems at the Alfred Lerner College of Business and Economics, University of Delaware. His research has appeared in leading academic journals, including MIS Quarterly, Information Systems Research, Operations Research, and IEEE Transactions on Knowledge and Data Engineering. Dr. Fang currently serves as an associate editor for MIS Quarterly and on the editorial board for Journal of Business Analytic.

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References

Ågerfalk, P.J., Conboy, K., & Myers, M.D. (2020). Information systems in the age of pandemics: COVID-19 and beyond. *European Journal of Information Systems*, *29*(3), 203-207.

Asadzadeh, A., Pakkhoo, S., Saeidabad, M.M., KHEZRI, H., & Ferdousi, R. (2020). Information technology in emergency management of COVID-19 outbreak. *Informatics in Medicine Unlocked, 21*, 100475.

Bunker, D. (2020). Who do you trust? The digital destruction of shared situational awareness and the COVID-19 infodemic. *International Journal of Information Management, 55*, 102201.

Cheema, S., Ameduri, M., Abraham, A., Doraiswamy, S., & Mamtani, R. (2020). The COVID-19 pandemic: The public health reality. *Epidemiology & Infection 148*, e223, 1-4.

Dwivedi, Y.K., Hughes, D.L., Coombs, C., Constantiou, I., Duan, Y., Edwards, J.S., Gupta, B., Lal, B., Misra, S., Prashant, P., Raman, R., Rana, N.P., Sharma, S.K., & Upadhyay, N. (2020). Impact of COVID-19 pandemic on information management research and practice: Transforming education, work and life. *International Journal of Information Management, 55*, 102211.

Doyle, R., & Conboy, K. (2020). The role of IS in the covid-19 pandemic: A liquid-modern perspective. *International Journal of Information Management, 55*, 102184.

Fagherazzi, G., Goetzinger, C., Rashid, M.A., Aguayo, G.A., & Huiart, L. (2020). Digital health strategies to fight COVID-19 worldwide: Challenges, recommendations, and a call for papers. *Journal of Medical Internet Research, 22*(6), e19284.

Gong, M., Liu, L., Sun, X., Yang, Y., Wang, S. & Zhu, H. (2020). Cloud-based system for effective surveillance and control of COVID-19: Useful experiences from Hubei, China. *Journal of Medical Internet Research, 22*(4), e18948.

McLean, R. (2020). These companies plan to make working from home the new normal. As in forever. *CNN Business, retrieved from https://edition.cnn.com/2020/05/22/tech/work-from-home-companies/index.html*

Newbutt, N., Schmidt, M. M., Riva, G., & Schmidt, C. (2020). The possibility and importance of immersive technologies during COVID-19 for autistic people. *Journal of Enabling Technologies, 24*(3), 187-199.

Sakurai, M., & Chughtai, H. (2020). Resilience against crises: COVID-19 and lessons from natural disasters. *European Journal of Information Systems, 29*(5), 585-594.

Venkatesh, V. (2020). Impacts of COVID-19: A research agenda to support people in their fight. *International Journal of Information Management, 55*, 102197.

Zhang, D., Zhou, L., & Lim, J. (2020). From networking to mitigation: The role of social media and analytics in combating the COVID-19 pandemic. *Information Systems Management, 37*(4), 318-326.

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