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To cite this article: Huaxiong Jiang, Haozhi Pan, Yanliu Lin & Stan Geertman (2023) Hacking Corporate Smart Cities Under COVID-19: Towards a Smart Governance Approach, Journal of Urban Technology, 30:4, 71-81, DOI: [10.1080/10630732.2023.2255122](https://doi.org/10.1080/10630732.2023.2255122)

To link to this article: <https://doi.org/10.1080/10630732.2023.2255122>



Published online: 13 Nov 2023.



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COMMENTARY



Hacking Corporate Smart Cities Under COVID-19: Towards a Smart Governance Approach

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ABSTRACT

The COVID-19 pandemic has imposed huge challenges on smart cities, requiring a reimagining and transformation of their governance structures. This viewpoint argues that a smart governance approach should be applied to remodel the uniform, often technocratic and corporate-led way of coping with COVID-19 in the smart city context. There is a need to develop more technology-enabled collaborative actions across sectors and among various actors to recover better from the pandemic. A far-sighted view is also needed to build citizen-centric open governance capacities—the emergent character of mass participation in cities—for readiness, responsiveness, and long-term resilience. The need for a robust communication policy is highlighted to transmit well-timed and critical information to a range of actors interested in smart city transformation.



KEYWORDS

COVID-19; information and communication technology; smart city governance; transformation; urban resilience

Smart City Operations During the COVID-19 Pandemic

The COVID-19 pandemic has significantly affected cities, overwhelming healthcare systems, disrupting urban life through lockdowns, and causing severe economic repercussions (Sharifi 2022; Jiang, 2022). Marginalized communities have been disproportionately affected, revealing existing inequalities. This crisis underscores the need for innovative approaches to address urban vulnerabilities and strengthen infrastructure and governance systems (Jiang 2022; Pan et al., 2022).

Across the globe, smart city applications have been widely harnessed and leveraged to develop and implement innovative solutions aimed at the prevention, mitigation, and control of the COVID-19 pandemic (Das and Zhang, 2021). By capitalizing on the capabilities of smart technologies, such as Internet of Things (IoT), artificial intelligence (AI), and data analytics, cities have embarked on comprehensive initiatives to enhance public health surveillance, facilitate contact tracing, monitor crowd density, and optimize resource allocation. For instance, a number of contract tracing apps were developed in China, Singapore, and South Korea (Jiang, 2022). Web portals, social media, and mobile applications were widely used in Western countries to engage local governments, firms, volunteers, and

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This article has been corrected with minor changes. These changes do not impact the academic content of the article.

specialists to co-produce public services, such as access to medication, online education, and e-payment (Criado et al., 2020; Rajan et al., 2020). Smart mobility solutions, exemplified by initiatives like Singapore's TraceTogether and Safe Entry, provide contactless payment options and real-time transit information, effectively minimizing physical interactions and bolstering the overall safety and efficiency of transportation networks (Das and Zhang, 2021). These smart city interventions have demonstrated promising potential in augmenting the pandemic response efforts, enabling authorities to make data-driven decisions, and empowering citizens with real-time information to promote adherence to health guidelines. By implementing these innovative technologies, cities can ensure seamless and secure movement while mitigating the risk of virus transmission. Nevertheless, the overly technology-oriented bias has caused the potential negative effects of smart city applications upon the public and society and raised critical concerns (Popa, 2020).

A first concern is corporatization, privatization, and neo-liberalization of smart city applications in handling COVID-19. Informed governance for COVID-19 largely relies on the role of private big tech corporations or startups in developing and providing technological solutions for public services. By doing this, corporations gain influence in defining and maneuvering policymaking. A well-known example is the Health QR Code created by Alibaba (Lei et al., 2020) that exposed the private information of millions of citizens and diminished personal freedom through massive surveillance by a mega-corporation.

A second concern is the worsened one-sidedness and marginalization caused by the digital divide and inequality (Mathrani et al., 2020). Technocratic insights generated via "big data" approaches leave little room for other urban actors to engage in policy initiatives even when they are conducive for the COVID-19 response (Sharifi et al., 2021). An over-emphasis on smart city technologies creates barriers for disadvantaged persons to achieve their well-being, especially those with disabilities in movement, cognition, vision, and hearing (Zheng and Walsham, 2021). Besides, as cities rely increasingly on digital technologies for communication, remote work, and accessing essential services, marginalized communities and underserved populations face barriers in accessing the necessary smart devices and Internet connectivity. This digital divide widens existing social inequalities, leaving disadvantaged individuals at a further disadvantage in benefiting from the full potential of smart city initiatives. For instance, the digital divide in India exacerbated the inequitable access to smart devices and reliable Internet connectivity, hindering marginalized communities from fully engaging with the city's smart city response to COVID-19 (Jiang, 2022). Thus, bridging the digital divide is crucial for an inclusive smart city response to urban emergencies like COVID-19, necessitating targeted efforts to provide affordable devices, Internet access, and digital literacy programs to marginalized communities.

As a part of smart cities, many scholars highlight that the implementation of innovative concepts and governance processes within smart governance presents a valuable opportunity to gain fresh perspectives on the transformation and advancement of smart cities. Here, smart governance "is about using new technologies to develop innovative governance arrangements" (Meijer et al., 2019: 73), aimed at obtaining more collaborative, democratic, and transparent urban outcomes. This approach is closely linked to the objective of improving democratic and responsive processes and transforming the delivery of public services. However, currently, few scholars have explored the connection between the two and elucidated the potential value of smart governance in facilitating the transformation and development of smart cities in (post-)COVID conditions.

Interestingly, the pandemic itself presents a unique opportunity to gain a deeper understanding of the necessary actions to reshape the trajectory of smart city growth towards a resilient urban future. This viewpoint argues for the application of a smart governance approach to restructure the often technocratic and corporate-dominated response to COVID-19 within the smart city context. Adding to the previous literature on how collaboration and citizen-centeredness can be incorporated in smart governance (Lin 2022; Webster and Leleux, 2018; Meijer et al., 2019), the present study constructs a conceptual framework of typology of smart governance and the pathways to its realization using real-world smart technology applications post-COVID that aim to provide timely insights into the strategic transformation of smart city growth and offer recommendations for policymakers and practitioners to foster collaborative, democratic, and transparent smart city solutions that promote resilience, inclusivity, and sustainability in urban environments in the post-pandemic recovery of cities.

This study starts with a theoretical development of three types of smart governance (state-centric, collaborative, citizen-centric) that have been recognized by previous literature and illustrated by updated COVID-19 coping cases identified for each type. Then, three pathways and recommendations are posed for smart city transformation towards smart cities, with best practices of smart governance identified during COVID-19. Finally, this study concludes with the main findings and arguments.

Theoretical Development: Why Smart Governance Mattered during COVID-19?

The seminal works of Meijer and Bolívar (2016) and Jiang et al. (2020) provide valuable insights into the multifaceted nature of smart governance. Their research, supported by empirical evidence and theoretical frameworks, explores the integration of ICT in governance and its impact on smart cities. Drawing upon their research, we have categorized the modes of smart governance to encompass the diverse and evolving landscape of governance models in today's urban contexts. Through an analysis of the roles undertaken by different urban actors, including the state, the private sector, and citizens, as well as a consideration of the potential advantages stemming from ICT implementation in governance processes, we have discerned three distinct modes of smart governance, including state-centric smart governance, collaborative smart governance, and citizen-centric open governance.

In this section, our primary objective is to demonstrate how smart governance can offer innovative approaches and transformative thinking to address challenges faced by smart cities during the COVID-19 pandemic. By harnessing the power of ICT and leveraging the strengths of state-centric smart governance, collaborative smart governance, and citizen-centric open governance, we can unlock new possibilities for effective governance, urban resilience, and citizen engagement.

State-Centric Smart Governance

State-centric smart governance is defined as the use of ICT to improve government decision-making and the implementation of those decisions (Jiang et al., 2020). It focuses on reorganizing government-internal administrative structures and improving

the effectiveness and quality of their services. Then, by gathering various data and information from sensors, web portals, and other digital tools, governments can have access to a better understanding of the issues of public administration and services, and thereby making smart decisions. Process management, coordinated leadership, and partnerships are important for an integrated approach that crosses different sectors and combines political, infrastructural, technological, and social systems (Tomor et al., 2019).

During the COVID-19 pandemic, local governments employed state-centric smart governance approaches to facilitate informed decision-making and responsive policy implementation. A notable example is seen in China, where advanced AI tools and urban data analytics were leveraged to effectively identify and map the distribution of suspected and infected COVID-19 cases. This application of state-centric smart governance greatly enhanced the government's ability to make rational decisions in managing the crisis (Meijer and Bolívar, 2016). By utilizing these technologies, authorities were able to gather crucial insights and timely information, enabling them to implement targeted measures and allocate resources efficiently. In South Korea, disease management systems were transformed into a large-capacity healthcare system to promote the production of test kits. In the Netherlands, the Minister of Health, Welfare, and Sport (VWS) launched the CoronaCheck application and the *coronacheck.nl* website for people to generate a certificate, also called the coronavirus entry pass, in the form of a QR code. By using the QR code, people were able to prove whether they had been vaccinated, or had tested negative, or already had coronavirus (*CoronaCheck, n.d.*).

Collaborative Smart Governance

In this conceptualization, smart governance indicates collaborative arrangements between government, civil society, and the private sector to facilitate more interactive governance for collective problem solving. Various social media sites, apps, planning support systems, smart platforms and digital infrastructure have been used by cities in many countries to build a variety of collaborative spaces such as crowdsourcing space, gamification, living labs, fablabs and maker spaces, and smart urban/citizens labs (Lin, 2022; Webster and Leleux, 2018). These collaborative spaces enable the interaction and communication between different actors and facilitate the sharing of information and knowledge. They may lead to the co-production of solutions to solve urban challenges.

Concerning COVID response, the first government-hosted crisis hackathon—#WeVsVirus or #WirVsVirus—was launched, for instance, in Germany during COVID-19 to provide valuable technical solutions and facilitate the interpersonal information exchange and learning processes (Chandra et al., 2021). The pandemic also fostered more collaboration between public and private parties in mobility innovations such as smart mobility policy (e.g., SUMP Resilient Topic Guidelines at the EU level), data sharing between local governments and mobility service providers, and shared solutions (Tsvetkova et al., 2022). Collaborative smart governance helped policy makers and practitioners to frame smart city solutions and engage individuals, communities, and cities in handling the COVID emergency. It may also stimulate long-term innovations and new development. However, it remains a challenge to educate citizens, stimulate citizen awareness, and integrate the outputs of citizen participation in this kind of collaborative governance that is mainly based on public-private partnerships.

Citizen-Centric Open Governance

According to Meijer et al. (2019), citizen-centric open governance is the emergent, pop-up, ICT-enabled massive individualized collective action in cities. The field of crisis management is often the domain in which citizen-centric open governance operates. Instead of highlighting the importance of citizen-government relationship, citizen relations are central to open governance. In this process, technology acts as collaboration infrastructure that enables different stakeholders, especially voluntary citizens, to provide public services in a co-production (co-creation) model.

During the COVID-19 pandemic, citizen-centric smart governance initiatives emerged, showcasing the power of grassroots efforts and individual contributions. One notable example is the establishment of community-led food distribution networks, where local groups and volunteers organized to collect and distribute food to vulnerable populations affected by the pandemic (Kumar et al., 2021). These initiatives employed technology and social media platforms to coordinate resources, mobilize volunteers, and ensure efficient delivery of essential supplies, empowering individuals and communities to address food insecurity and support those in need. Another illustration is the emergence of mutual aid networks connecting neighbors and community members to provide various forms of assistance, such as grocery shopping for the elderly and delivering medication (Jiang et al., 2021). Technology platforms, including social media groups and dedicated websites, facilitated effective collaboration and mutual support among participants.

Furthermore, following the outbreak, technology-enabled connections and decentralized forms of intelligence facilitated the exchange of large-scale, connected, and distributed data, leading to individualized solutions in response to the pandemic's impact (Jiang, 2022). For instance, a software developer from Arlington, Massachusetts, voluntarily developed the website-based platform *Macovidvaccines.com* to make vaccine information more accessible to the public (Zdanowicz, 2021). This self-created platform consolidated vaccination programs from across the state, providing free vaccine information and services to the public. These examples exemplify the potential of citizen-centric smart governance to foster community resilience and address critical needs during challenging times.

Smart City Transformation from a Smart Governance Perspective

By reviewing the need for innovative, ICT-enabled governance across cities and countries during the epidemic, this section further answers how smart governance is capable of providing a new pathway for smart city transformation.

To Reinforce the Digital Capability of Local Governments to Govern During COVID-19

The need for short-term, smart city transformation comes from the effects of COVID-19 on the health and welfare of individuals, communities, and cities. Short-term transformation in smart cities mainly involved innovating urban devices and improving ICT-based city infrastructure in response to COVID-19. In many Global South cities, there was a need for smart cities to center on investing in *digital technologies as potential solutions* to the pandemic. In those cities, there was a lack of efficient technological capabilities

Table 1. Smart governance modes

Types of Smart Governance	Actors	Technology Functions	Examples
State-centric smart governance	Government	<ul style="list-style-type: none"> - Use of ICT to improve decision-making and implementation - Reorganization of administrative structures for improved service effectiveness - The gathering of data for better understanding of public administration and services 	<ul style="list-style-type: none"> - AI tools and urban data analytics in China to track COVID-19 cases - Transformation of a disease management system into large-capacity healthcare system in South Korea - Launch of <i>CoronaCheck</i> application and website in the Netherlands for COVID-19 certification
Collaborative smart governance	Government, civil society, private sector	<ul style="list-style-type: none"> - Utilization of digital platforms and infrastructure for collaboration and information sharing - Facilitation of interaction and communication between different actors - Co-production of solutions to urban challenges 	<ul style="list-style-type: none"> - Government-hosted crisis hackathons like #WeVsVirus in Germany - Collaboration between public and private parties in mobility innovations and shared solutions
Citizen-centric open governance	Non-state actors such as voluntary citizens	<ul style="list-style-type: none"> - ICT-enabled collaboration infrastructure for individualized collective action - Co-production of public services by citizens 	<ul style="list-style-type: none"> - Connections and distributed data exchange for individualized solutions during COVID-19 - Development of a simplified vaccine sign-up website-based platform in Massachusetts

to curb the spread of COVID-19, so it was a top priority of short-term public policy to improve the availability of smart city infrastructures for COVID-19 control (Nurwaesari, 2021; VNA, 2020). In China, the government was trying to promote the use of robots and telemedicine as supplemental to basic infection prevention measures across the whole country (e.g., promoting telemedicine systems to improve hospital capabilities) (Hornyak, 2020; Sharma, 2020).

There were efforts in many cities are tried to integrate COVID-19-related data gathered from various sources (e.g., city sensors, governmental portals, individual-based social media) to develop COVID-19 dashboards and maps. Via visualized information, citizens were alerted and gained access to public health advice. In New York City and Mumbai, India, for instance, customizable COVID-19 dashboards were created that were able to allow for the comparison of COVID-19 statistics in communities and counties to better understand the COVID risks in different parts of the city (Unqork, 2020).

To Promoting Technology-Enabled Collaborative Actions for to Improve Recovery from the Pandemic

Medium-term transformation in smart cities aimed to ensure vigorous ICT-enabled collaboration between government and citizens. It indicated that translocal and cross-department collaboration were critically needed. For instance, in Beijing, a plan was initiated to build a blockchain-based unified framework for digital governance, aimed at facilitating data-sharing between agencies and businesses (Dutta, 2020). The Vietnamese Government Office worked with the US Agency for International Development (USAID) to improve Vietnam's inter-sectoral coordination and accelerate administrative

reforms (VNA, 2020). Even in Saudi Arabia, an authoritarian state with strong government control and surveillance (Khoury, 2020), was expected to expand digital connectivity and leverage multiple stakeholders’ interests and engagement to fulfill citizen and business needs and expectations.

Building Open Governance Capacities for Resilience, in Particular for Future Pandemic Threats

A long-term policy priority to improve the sustainability and resilience of smart city systems need reducing social exclusion and promoting citizen-centric open governance and a whole-of-society approach (Lakshane, 2020). In this process, long-range transformation in smart cities requires “pointing toward not only a wide variety of digitally connected actors but also to a fundamentally different and more invisible role of government in these arrangements” (Meijer et al., 2019: 1). It relies more on self-organized platforms encouraging forms of self-organization and self-governance. This is because when facing complex urban system changes, a radically deconcentrated form of intelligence is more capable of disclosing and handling emergent information. ICT-enabled links and contacts then are required to prevent a state of disorder due to absence or nonrecognition of authority in a radically deconcentrated system.

For instance, many Indian cities are facing digital divide between the haves and have-nots; and people living in slums and found it difficult to receive public service and aid

Table 2. A smart governance perspective on smart city transformation

Recommendations	Actor Actions	Technology Transformation	Strategies
Reinforcing the digital capability of local governments to govern COVID-19	<ul style="list-style-type: none"> - Investing in digital technologies for pandemic solutions - Integration of COVID-19 data for dashboards and maps 	<ul style="list-style-type: none"> - Promotion of robots and telemedicine as supplemental measures - Use of various data sources for visualized information 	<ul style="list-style-type: none"> - Improving availability of smart city infrastructure for COVID-19 control - Development of customizable COVID-19 dashboards for better risk understanding
Promoting technology-enabled collaborative actions for post-pandemic recovery	<ul style="list-style-type: none"> - ICT-enabled collaboration between government and citizens - Cross-sectoral collaboration and administrative reforms 	<ul style="list-style-type: none"> - Implementation of blockchain-based unified framework for digital governance - Inter-sectoral coordination and administrative reforms 	<ul style="list-style-type: none"> - Establishing nation-wide public service portals for enhanced connectivity and stakeholder engagement - Leveraging multiple stakeholders’ interests and engagement for citizen and business needs
Building open governance capacities for resilience and future threats	<ul style="list-style-type: none"> - Reduction of social exclusion and promotion of citizen-centric open governance - Handling emergent information in radically deconcentrated systems 	<ul style="list-style-type: none"> - Self-organized platforms for self-governance - ICT-enabled links and contacts for prevention of disorder 	<ul style="list-style-type: none"> - Mitigating digital inequality and ensuring urban resilience - Enhancing digital inclusiveness, data protection regulations, and fostering a multi-stakeholder, e-participation ecosystem for long-term sustainability

amid COVID-19 (Clarence, 2020). Therefore, it was hoped that the Indian government could mitigate those negative impacts caused by digital inequality to achieve urban resilience in the long term (Lakshane, 2020). It is also noted that smart devices and IoT data that prevail in smart cities were often misused, and even pilfered, resulting in infringing on the confidentiality of people's information (Bibri, 2019). In some American cities, experts voiced worries about transparency and overexposure of private information, when the levels of government actively promoted the digital vaccine programs (DeRuy and Moore, 2021). Accordingly, these cities are urged to enhance digital inclusiveness, create data protection regulations, and foster a long-range multi-stakeholder, e-participation ecosystem.

Conclusion

An exogenous shock caused by COVID-19 promoted the potential of digital responses to the pandemic (Cheshmehzangi, 2021; Söderström, 2021). It highlights that short-term transformation in smart cities requires making more investments in connectivity infrastructure and service-oriented technologies as potential solutions to the pandemic. In the medium-term, redefining government leadership and facilitating cross-sectoral and multi-actor collaborations at different jurisdictional levels are needed to facilitate the delivery of high-quality public service and develop better policies. Then, long-term smart city transformation requires cities to recreate their “smart” vision of a city and build open governance capacities for resilience, in particular for future pandemic threats. Note that each phase hardly excludes but builds on the preceding phases and lays the foundation for the following stages of improvement and development.

In brief, the viewpoint offers a framework through which to inspect the chances to accelerate smart city transformation to recover from COVID-19 and enhance urban resilience to cope with future uncertainty. It further highlights that a robust communications policy is needed to transmit this well-timed and critical information to those (e.g., policy makers and practitioners) who are interested in smart city transformation under COVID-19.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

Acknowledgments

The study is supported by the National Natural Science Foundation of China (grant no. 42201207; 72373137; 52000130), Fundamental Research Funds for the Central Universities (grant no. 310421102), Youth Fund of Peking University-Lincoln Institute Center for Urban Development and Land Policy (PLC) (grant no. 2222000255).

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References

- S. Bibri, "On the Sustainability of Smart and Smarter Cities in the Era of Big Data: An Interdisciplinary and Transdisciplinary Literature Review," *Journal of Big Data* 6: 1 (March 15, 2019) 1–30. <<https://doi.org/10.1186/s40537-019-0182-7>>
- Y. Chandra, L. Shang, and J. Mair, "Drivers of Success in Social Innovation: Insights into Competition in Open Social Innovation Contests," *Journal of Business Venturing Insights* 16 (2021) e00257.
- CoronaCheck, n.d., "CoronaCheck app and Printed EU Digital COVID Certificate Privacy Statement." *CoronaCheck*, 2022 <<https://coronacheck.nl/en/privacy>> Accessed July 2021.
- A. Cheshmehzangi, "From Transitions to Transformation: A Brief Review of the Potential Impacts of COVID-19 on Boosting Digitization, Digitalization, and Systems Thinking in the Built Environment," *Journal of Building Construction and Planning Research* 9: 1 (2021) 26.
- A. Clarence, "Aarogya Setu: Why India's Covid-19 Contact Tracing App Is Controversial," *BBC*, May 15, 2020 <<https://www.bbc.com/news/world-asia-india-52659520>> Accessed July 2021.
- J. Criado, A. Ignacio, and J. Villodre, "Using Collaborative Technologies and Social Media to Engage Citizens and Governments during the COVID-19 Crisis. The Case of Spain," *Digital Government: Research and Practice* 1: 4 (2020) 1–7.
- D. Das, and J. J. Zhang, "Pandemic in a Smart City: Singapore's COVID-19 Management through Technology & Society," *Urban Geography* 42: 3 (2021) 408–416.
- E. DeRuy, and S. Moore, "Calif. Plans Vaccine Verification System, Raises Concerns," *Government Technology*, June 17, 2021 <<https://www.govtech.com/health/calif-plans-vaccine-verification-system-raises-concerns>> Accessed July 2021.
- A. Dutta, "Monitoring Worst-Hit Districts: Smart City War Rooms for Affected Areas," *Hindustan Times*, April 8, 2020 <<https://www.hindustantimes.com/india-news/monitoring-worst-hit-districts-smart-city-war-rooms-for-affected-areas/story-opLLPWbDslGV6DCsgtTW7J.html>> Accessed July 2021.
- T. Hornyak, "What America Can Learn from China's Use of Robots and Telemedicine to Combat the Coronavirus," *Executives for Health Innovation*, March 18, 2020 <<https://www.cnbc.com/2020/03/18/how-china-is-using-robots-and-telemedicine-to-combat-the-coronavirus.html>> Accessed July 2021.
- H. Jian, "A SWOT Analysis of Smart Governance Applications amid the COVID-19 Pandemic," *Information Polity Preprint* (2022) 1–17.
- H. Jiang, S. Geertman, and P. Witte, "Smart Urban Governance: An Alternative to Technocratic 'Smartness'." *GeoJournal* 87: 1 (2020) 1–17.
- H. Jiang, P. Witte, and S. Geertman, "Avoiding the Planning Support System Pitfalls? What Smart Governance Can Learn from the Planning Support System Implementation Gap," *Environment and Planning B: Urban Analytics and City Science* 47: 8 (2020) 1343–1360.

- H. Jiang, P. Witte, and S. Geertman, *Smart Governance and COVID-19 Control in Wuhan, China*, in S. Geertman, C. Pettit, R. Goodspeed et al., eds, *Urban Informatics and Future Cities* (Vols. 17–32). Berlin: Springer, 2021.
- Z. Khoury, “In Saudi Arabia, Investments in Digital Infrastructure Are Paying Off,” *World Bank Blog*, June 1, 2020 <<https://blogs.worldbank.org/digital-development/saudi-arabia-investments-digital-infrastructure-are-paying>> Accessed July 2021.
- N. Kumar, R. Agnes, A. Quisumbing, U. Gentilini, and S. Shapleigh, “Toward Inclusive Food Systems: Pandemics, Vulnerable Groups, and the Role of Social Protection,” *IFPRI book chapters* 1 (2021) 54–63.
- R. Lakshane, “Tracking Quarantine, Tracing Cases, Sharing Info: Can These Govt-Issued Apps Help Fight Covid-19?” *Citizen Matters*, April 6, 2020 <<https://citizenmatters.in/tracking-quarantine-tracing-cases-sharing-info-can-these-govt-issued-apps-help-fight-covid-19-17151>> Accessed July 2021.
- T. Lei, J. Deng, Y. Xie, and Y. Tian, “Using Health QR Code to Fight Against COVID-19: Chinese Government’s New Way of Collaborative Governance with Enterprises,” in *2020 International Conference on Management, Economy and Law (ICMEL 2020)*, 194–198. North Holland: Atlantis Press, 2020.
- Y. Lin, “Social Media for Collaborative Planning: A Typology of Support Functions and Challenges,” *Cities* 125 (2022) 1–6.
- A. Mathrani, T. Sarvesh, and S. Mathrani, “Digital Gender Divide in Online Education during COVID-19 Lockdown in India,” in *2020 IEEE Asia-Pacific Conference on Computer Science and Data Engineering (CSDE)*, (2020) 1–6. IEEE.
- A. Meijer, and M. Bolívar, “Governing the Smart City: A Review of the Literature on Smart Urban Governance.” *International Review of Administrative Sciences* 82: 2 (2016) 392–408.
- A. Meijer, M. Lips, and K. Chen, “Open Governance: A New Paradigm for Understanding Urban Governance in an Information Age,” *Frontiers in Sustainable Cities* 1 (2019) 3.
- N. Nurwaesari, “How Jakarta Implements Technologies of Smart City in Covid-19 Mitigation,” *Jakarta Smart City*, February 18, 2021 <<https://corona.jakarta.go.id/en/artikel/teknologi-smart-city-permudah-mitigasi-di-tengah-pandemi>> Accessed July 2021.
- H. Pan, S. Geertman, D. Brian, J. Jiao, and B. Wang, “Planning Support for Smart Cities in the Post-COVID Era,” *Journal of Urban Technology* 29: 2 (2022) 1–5.
- S. Popa, “Reflections on COVID-19 and the Future of Education and Learning,” *Prospects* 49: 1 (2020) 1–6.
- D. Rajan, K. Koch, K. Rohrer, C. Bajnoczki, A. Socha, M. Voss, M. Nicod, V. Ridde, and J. Koonin, “Governance of the Covid-19 Response: A Call for More Inclusive and Transparent Decision-Making,” *BMJ Global Health* 5: 5 (2020) 1–20.
- A. Sharifi, “An Overview and Thematic Analysis of Research on Cities and The COVID-19 Pandemic: Toward Just, Resilient, and Sustainable Urban Planning And Design,” *Iscience* 13 (2022) 1–28.
- A. Sharifi, A. Khavarian-Garmsir, and R. Kummitha, “Contributions of Smart City Solutions and Technologies to Resilience Against the COVID-19 Pandemic: A Literature Review,” *Sustainability* 13: 14 (2021) 8018.
- M. Sharma, “How Drones are Being Used to Combat COVID-19,” *UNICEF*, April 20, 2020 <<https://www.geospatialworld.net/blogs/how-drones-are-being-used-to-combat-covid-19/>> Accessed July 2021.
- O. Söderström, “The Three Modes of Existence of the Pandemic Smart City,” *Urban Geography* 42: 3 (2021) 399–407.
- A. Tsvetkova, I. Kulkov, C. Busquet, P. Kao and M. Kamargianni, “Implications of COVID-19 Pandemic on the Governance of Passenger Mobility Innovations in Europe,” *Transportation Researcher Interdisciplinary Perspectives* 14 (2022) 1–12.
- Z. Tomor, A. Meijer, A. Michels, and S. Geertman, “Smart Governance for Sustainable Cities: Findings from a Systematic Literature Review,” *Journal of Urban Technology* 26: 4 (2019) 3–27.
- Unqork, “New York City Has Deployed a Covid-19 Engagement Portal Built in Partnership with Unqork to Manage Growing Crisis,” *PR Newswire*, April 1, 2020 <<https://www.prnewswire>.

- [com/news-releases/new-york-city-has-deployed-a-covid-19-engagement-portal-built-in-partnership-with-unqork-to-manage-growing-crisis-301033065.html](https://www.nytimes.com/news-releases/new-york-city-has-deployed-a-covid-19-engagement-portal-built-in-partnership-with-unqork-to-manage-growing-crisis-301033065.html) > Accessed July 2021).
- VNA, “USAID Helps Vietnam Strengthen E-Government Capacity,” *Vietnamplus*, October 17, 2020 <<https://en.vietnamplus.vn/usa-id-helps-vietnam-strengthen-egovernment-capacity/188547.vnp> > Accessed July 2021.
- C. Webster, R. William, and C. Leleux, “Smart Governance: Opportunities for Technologically-Mediated Citizen Co-Production,” *Information Polity* 23: 1 (2018) 95–110.
- C. Zdanowicz, “A Software Developer Built a Simpler Vaccine Sign-up Website in Her State While on Maternity Leave.” *CNN*, February 9, 2021 <<https://www.cnn.com/2021/02/08/us/olivia-adams-ma-covid-vaccine-website-trnd/index.html> > Accessed July 2021.
- Y. Zheng, and G. Walsham, “Inequality of What? An Intersectional Approach to Digital Inequality under Covid-19,” *Information and Organization* 31: 1 (2021) 1–6.