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VIEWPOINT

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Blockchains for emergency and crisis management

Wendy D. Chen [1] | **Ilia Murtazashvili** [2]

[1]Department of Political Science, Public Administration, Texas Tech University, Lubbock, Texas, USA

[2]Graduate School of Public and International Affairs, University of Pittsburgh, Pittsburgh, Pennsylvania, USA

Correspondence
Wendy D. Chen, Department of Political Science, Public Administration, Texas Tech University, 113 Holden Hall, Boston & Akron Streets, Lubbock, TX 79409-1015, USA.
Email: wendy.chen@ttu.edu

Abstract

Public managers and administrators confront the increasing scale and prevalence of crises. Despite some deployments, blockchain applications by governments for emergency management and response management have only begun to scratch the surface. To facilitate greater awareness of the promises and challenges of blockchain applications to the public sector, we consider the ways in which distributed ledger technologies can improve emergency and crisis management across the dimensions of transparency, public trust, and social equity. The article ends with a call for a public administration research agenda on blockchains for emergency and crisis management.

Evidence for practice

- Blockchains are increasingly used by the government and not simply as the foundational technology for cryptocurrency.
- The unique blockchain affordances, including openness, transparency, and immutability, are especially desirable for emergency management and crisis response applications.
- Public sector applications of blockchains can improve emergency and crisis management on several margins, including information transparency, trust in government, and social equity.
- Challenges with public sector deployments of blockchain technology include potentially steep learning curves for public administrators and managers.
- Further progress in overcoming the digital divide is critical for blockchains to improve crisis management for historically marginalized communities.

The COVID-19 pandemic brought emergency and crisis management to the forefront of public consciousness (Thornton, Murphy-Greene, & Simon, 2021). Underserved and marginalized communities across the globe and within countries have suffered the most (Deslatte, Hatch, & Stokan, 2020; Wright & Merritt, 2020). Perceptions of inequitable and ineffective government responses generated calls for fuller inclusion of crisis response into the repertoire of public administration scholarship (Di Mascio, Natalini, & Cacciatore, 2020). Beyond the current pandemic, public management and administration scholars as well as practitioners continue to reflect on ways to improve emergency management and crisis response in the wake of government failures in responding to natural disasters such as Hurricane Katrina.

A parallel trend alongside the increasing scale and scope of crises is the rapid development of technologies that promise to improve public service and administrative processes (McDonald, Bruce, Hall, O'Flynn, & van Thiel, 2022). Increasingly, public administration scholars are contemplating the uses and risks of Artificial Intelligence by governments (Busuioc, 2021). Less attention has been placed on blockchains, which in the simplest sense are databases that record information in a decentralized fashion that makes that information available to anyone in a network. Information can be added, but once it is validated through cryptography, that information is available to anyone in the network, and it cannot be manipulated. The result is a digital, shared, and automatically synchronized ledger (Hassan & De Filippi, 2021). For crisis and emergency management, blockchain technology has great potential to address challenges of response, mitigation, and recovery.

The existing deployments of blockchain technology have mostly been with humanitarian organizations responding to crises in the Global South. For example, Oxfam International started accepting crypto donations and provided individuals with cellphones, digital wallets,

training on how to use them to reduce reliance on paper vouchers which are more likely to be lost, stolen, or subjected to fraudulent uses, as well as requiring substantial time to process (Eiven, 2022).

Communities of evacuees in the Global North confront similar challenges with delays in getting funds to evacuees and cumbersome paperwork. Public administrators and managers also confront issues with corruption (misuse of public office for private gain) and fraud (theft by individuals) during crises. Businesses are providing services to address these challenges. Vendors such as Amazon and Dell are also offering disaster recovery as a service (DRaaS). These vendors partner with nonprofits to offer services such as House in a Box, which provides individuals affected by crises with a digital wallet they can use to purchase home goods and to track volunteer and employee hours (Wolfson, 2022). Once the hours are tracked, they can be provided to FEMA, as such recording is necessary to receive funds. This helps FEMA more effectively allocate resources, and community organizations such as churches to scale up operations by improving their ability to communicate activities to the government.

The examples above illustrate how blockchains can be used by governments. In a country like the United States, emergency preparation and management could involve blockchain-based solutions that provide people with digital wallets, with funds dispersed to those wallets for use by vendors who accept cryptocurrency. Governments have incentives to develop them, in part to reduce paperwork but also to improve the speed with which they are able to deliver assistance to individuals confronting displacement from crises. Digital wallets also enable individuals to control their information, which could include health information (such as vaccination status), as well as to provide a secure way for the government to convey information to people about the risks of natural disasters or public health risks.

Our goal here is to raise awareness of the potential for blockchain technology to improve public management with a focus on crisis and emergency management. Below, we explain in more detail what blockchains are and how blockchains can address issues involving transparency of communication, trust in government, and social equity that commonly confront emergency managers. We conclude with a call for greater research on blockchains and public administration.

CHALLENGES CONFRONTING PUBLIC SECTOR RESPONSES TO CRISES

The increasing scale of crises, even before the current pandemic, is reason enough to consider whether novel technologies can assist emergency management and crisis response. In the two decades before the coronavirus outbreak, over 7000 major disaster events occurred, claiming 1.23 million lives and nearly $3 trillion in global economic losses (UN Office for Disaster Risk Reduction, 2020). Criticism of government responses have revolved around issues of transparency, trust, and social equity.

Transparency concerns typically involve government reporting and sharing of information during crises. In some instances, governments fail to actively report to the public about the status of each crisis, and even when they were open and transparent to the public, governments sometimes breach individuals' privacy (Allison, 1971; Benthall, 1993; Cooper & Block, 2006; Moon, 2020). Public administration scholars concerned with the response to Hurricane Katrina have highlighted how lack of transparency, in particular efforts to control information rather than publicize risks from the Hurricane, contributed to delayed preparedness, response, and recovery (Garnett & Kouzmin, 2007). According to the Bipartisan Select Committee on Katrina, top officials from the Homeland Security and the Federal Emergency Management Agency did not effectively convey information about risk or needed preparations, resulting in confusion about an appropriate action plan to prepare for and respond to the hurricane (U.S. House, 2006). Relatedly, intergovernmental communication was found to be lacking (Moynihan, 2009). Transparency is significant in part because it increases community participation in provision of public goods and services (Gil-Garcia, Gasco-Hernandez, & Pardo, 2020). Lack of transparency, alongside failures of communication channels, are especially challenging during crises because the public good of crisis response is coproduced by citizens, community organizations, business, and government entities. Communication failures make this more challenging.

Crises also exacerbate public distrust in government. Historically, when natural disasters took place, public sectors around the world had seen corruption (Yamamura, 2014). For example, after Hurricane Katrina, the then-leaders of New Orleans and the region including the former mayor, Chief Technology Officer, and Executive Assistant to the mayor, were all found to have engaged in various forms of corruption (Voigt & Thornton, 2015). Similarly, after the 2010 Haiti earthquake in which 200,000 were killed and tremendous property damage was suffered, most of the $500 million in funds collected by the Red Cross did not get to the victims (Elliott & Sullivan, 2015). The current pandemic is not an exception either, especially in areas with deficits in public administration prior to the pandemic (Puppim de Oliveira & Berman, 2021). A consequence of declining trust is that it undermines collaborative governance (Bryson, Crosby, & Stone, 2006).

As importantly, major disasters in the United States reveal ongoing challenges for underserved populations. For example, Black communities were less likely to be evacuated and also suffered the most from Hurricane Katrina (Gooden, Jones, Martin, & Boyd, 2009). In addition, Black communities were reported to have received fewer

trailers from FEMA than their neighboring white communities (Craemer, 2010).

THE POTENTIAL FOR BLOCKCHAINS TO IMPROVE EMERGENCY AND CRISIS MANAGEMENT

Unlike other decentralized technologies, such as the Internet or commons-based peer production (e.g., Wikipedia), blockchains combine openness, transparency, and immutability in ways that no other database can (De Filippi & Wright, 2018), which makes it a transformational technology. Below, we explain how blockchains can address governance dilemmas confronting emergency managers outlined above.

Increasing information transparency and privacy

The examples above illustrate a key conclusion in the public administration literature: Information plays a critical role in emergency and crisis management (Boin & Lodge, 2016). Information problems with Hurricane Katrina remain significant for subsequent crises. Blockchain deployments can address interagency communication challenges because they are less reliant on a centralized agency or specialists to govern information. Blockchains enable open participation in the process of sharing information. Once that information is shared and then verified through a consensus, it is an open database that is immutable and open to any agency, and in the case of public blockchains, to the public. Another feature is that information could be automatically shared once entered through smart contract functions of blockchains. A smart contract is self-executing once certain conditions are satisfied. If the government has a protocol that it wants to follow during a crisis, the use of smart contracts can ensure that those contracts are automatically executed, thus reducing errors that result from the fast-moving nature of crises and because sharing of information can be subject to human error.

The COVID-19 pandemic is another example where information was an issue and where blockchains, though such technologies were implemented to an extent, could offer much promise to address these challenges through more extensive use by governments. One of the lessons of the government's pandemic response is that the public needs timely updates from the government which includes sharing information on vaccine data, clinical trials, and so forth. Data on clinical trials and validation of data on trials could be improved with blockchains to record and share information and recording antibody testing. Identities can be placed on blockchains and linked to biophysical markers. By linking data to biophysical markers, blockchain technologies can reduce human error in public health (additionally, fraud is reduced, as the identification of health records and related information are linked to an individual's body). Additionally, the management of the pandemic was hampered by questions about data accuracy. Data dashboards on smart contracts could improve data accuracy as well as address misinformation by providing immutable records of data to respond to conspiracy theories. Also, the speed and accuracy of sharing information among the scientific community and public health officials globally could depend on blockchains.

As crises involve more intrusive demands on health status, privacy may become more of an issue. Privacy concerns about widespread surveillance testing and contact tracing, actions critical to curtailing cases, may be alleviated through blockchains' privacy. Blockchains can be permissioned, and rights of access determined by some governance protocols. Many of the applications of blockchains for public sector governance are permissioned or hybrid, as there are concerns about who has access to data. Based on this feature of blockchains, the technology may be used to deliver and share timely and reliable information within and across national boundaries, improving transparency in public governance.

Improving trust in government and public confidence in solutions

During crises, distrust of authorities can result in underestimating risks with crises. Eisenman, Cordasco, Asch, Golden, and Glik (2007) interviewed evacuees in Houston displaced from Hurricane Katrina. Their study found that distrust of authorities contributed to minimization of the perceived risk of Hurricane Katina. The evacuees' strong social ties were better suited for social support than exchange of new information. Consequently, the authors suggest that social networks such as churches have an especially significant role in communicating new information to individuals during crises. Two of the significant categories of distrust included competency (beliefs in qualifications to perform a specific act) and equity (belief people are treated fairly) (Cordasco, Eisenman, Glik, Golden, & Asch, 2007).

The studies referenced suggest that deployments of blockchain can improve crisis response indirectly. Blockchains can facilitate trust in government by making decisions more transparent, including in public procurements prior to crises (such as spending on levees in the case of Hurricane Katrina). blockchains offer a new architecture of trust which can be deployed in grant disbursement to address challenges including corruption and fraud. Public and private institutions will thus be constrained from opportunism. Another significant aspect of crisis response is procurement, another area where the current pandemic revealed challenges with conventional government responses to public financing of responses to the

pandemic (Atkinson, McCue, Prier, & Atkinson, 2020). Blockchains enable a trustworthy record of transactions in crises, including transfers to individuals and transfers between governments and service providers through public procurement. Since governments contract out much of disaster response, a record of where resources are spent, and points of failure on supply chains, can address an important challenge in crises and increase public confidence in public governance. Blockchains do not themselves contribute to improvements in social equity, though greater transparency afforded by blockchains provide information that can be used to assess the extent to which resources and personnel were equitably deployed during crises. Since blockchain technology can potentially help improve public trust in government, it can thus increase the prospects that government warnings about natural disasters and public health risks resonate with people (thus contributing to prevention and preparedness).

Blockchains can also improve perceptions of competence, as blockchains can improve the coordination of crisis response. Even with the same personnel, a better technology to coordinate responses to a crisis will lead to greater trust in government. In any crisis, the response will be a consequence of coproduction between government and other institutions including nonprofits and private businesses. Blockchains can create a shared ecosystem where knowledge and information are shared among those parties that require such information. As a result, blockchains can better enable trustworthy collaborations among different organizations and allow the government to track information on who has done what with respect to crisis response. A collateral benefit is that people may perceive a more competent response to crises that breeds trust in government.

Blockchains through a social equity lens

Rivera and Knox (2023) define social equity as "The active, culturally competent, and equal provision of services to every social group across all phases of emergency management and the continuing reduction of all groups' social vulnerability that contributes to desperate physical and social damages associated with natural, technological, and na-tech hazards" (10). They consider social equity in six dimensions: procedural fairness, access, quality of service, inclusivity, diversity, and outcomes, each of which is conceptualized as varying on a continuum.

We see blockchains as especially relevant to procedural fairness, access, and quality of service. Procedural fairness conceptualizes as equitable allocation of disaster recovery resources. Blockchains improve public administrators' ability to discern and detect what resources have been allocated and to whom. Access refers to services, personnel, and information. Information is provided through mediums that are proven to be used by all members of a respective public about disasters or emergencies. Quality of service requires that there is no difference in how services are allocated between groups. An issue is that blockchains are not used by all. It is not like, for example, AM radio.

As discussed above, blockchain can improve the process of disbursement of funds to minoritized communities during crises. Individuals from minoritized communities could have greater ability to track their benefits, and less reliance on intermediaries to access benefits. In addition, improvements in the security of transactions and reductions in fraud, in general, will disproportionately benefit minoritized communities because those communities are more likely to be victimized by fraudulent or incompetent healthcare administrators in both the public and private sectors (FTC, 2016). Also, reducing fraud means more resources will be available to the communities that need them most. To the extent minoritized communities may rely more on community organizations for information and services, blockchains can have significant consequences as well, such as by improving the ability of nonprofit organizations—including churches—to validate hours and resources spent, thereby improving the ability of agencies such as FEMA to provide additional funds, quickly, to those nonprofits on the frontlines of crisis response.

DISCUSSION AND CONCLUSION

Blockchain technology offers substantial opportunities to address grand challenges confronting governments responding to crises, including communication failures, distrust in government, and inequities in service provision. Blockchains can improve the ability of government agencies to coordinate their activities and to manage supply chains during crises. Digital wallets can be used by government and nonprofits, and by citizens with the support of government and nonprofits, to improve the ability to receive vouchers after crises, with less paperwork. Blockchains can improve public procurement and reduce fraud. Improvements in those realms could build trust in government. Beyond natural disasters, blockchains have a host of applications in the public health realm that could provide for superior ability to share information about vaccinations, as well as to improve the security of health information. In short, blockchains offer many opportunities.

Admittedly, blockchain technology cannot address all problems that emergency and crisis management face, and its implementation confronts several challenges. For instance, since blockchains are relatively new, there is a learning curve for government officials and the public to get acquainted with the blockchain technology. Also, the successful implementation of blockchains depends on government regulations, as crisis response applications of blockchains typically involve permissioned blockchains

where privacy is desirable, or where supply chain involves goods and services that are highly regulated already. In addition, a blockchain solution must involve an investment in technological literacy for it to work. Therefore, the first focus on a blockchain solution should be to identify who has historically been excluded, and then proceed from there.

Despite many opportunities alongside challenges, governments appear slower to adopt blockchain solutions. To date, blockchains have been deployed mostly by business. In the public sector, nonprofits have taken a lead in deploying blockchain solutions for emergency management and crisis response. The time is ripe to add blockchains to public administration and management scholars' and practitioners' consideration of the links between technology and quality of governance and to consider and study the consequences of implementations of blockchains in crisis response, ongoing barriers to adoption, and variation in the adoption of these technologies.

REFERENCES

Allison, G. T. 1971. *Essence of Decision: Explaining the Cuban Missile Crisis*. Boston: Little, Brown.

Atkinson, Christopher L., Clifford McCue, Eric Prier, and Allison M. Atkinson. 2020. "Supply Chain Manipulation, Misrepresentation, and Magical Thinking during the COVID-19 Pandemic." *The American Review of Public Administration* 50(6–7): 628–34.

Benthall, J. 1993. *Disasters, Relief, and the Media*. London: I. B. Tauris.

Boin, Arjen, and Martin Lodge. 2016. "Designing Resilient Institutions for Transboundary Crisis Management: A Time for Public Administration." *Public Administration* 94(2): 289–98.

Bryson, John M., Barbara C. Crosby, and Melissa Middleton Stone. 2006. "The Design and Implementation of Cross-Sector Collaborations: Propositions from the Literature." *Public Administration Review* 66: 44–55.

Busuioc, Madalina. 2021. "Accountable Artificial Intelligence: Holding Algorithms to Account." *Public Administration Review* 81(5): 825–36.

Cooper, C., and R. Block. 2006. *Disaster: Hurricane Katrina and the Failure of Homeland Security*. New York: Times Books.

Cordasco, Kristina M., David P. Eisenman, Deborah C. Glik, Joya F. Golden, and Steven M. Asch. 2007. "'They Blew the Levee': Distrust of Authorities among Hurricane Katrina Evacuees." *Journal of Health Care for the Poor and Underserved* 18(2): 277–82.

Craemer, Thomas. 2010. "Evaluating Racial Disparities in Hurricane Katrina Relief Using Direct Trailer Counts in New Orleans and FEMA Records." *Public Administration Review* 70(3): 367–77.

De Filippi, Primavera, and Aaron Wright. 2018. *Blockchain and the Law*. Cambridge: Harvard University Press.

Deslatte, Aaron, Megan E. Hatch, and Eric Stokan. 2020. "How Can Local Governments Address Pandemic Inequities?" *Public Administration Review* 80(5): 827–31.

Di Mascio, Fabrizio, Alessandro Natalini, and Federica Cacciatore. 2020. "Public Administration and Creeping Crises: Insights from COVID-19 Pandemic in Italy." *The American Review of Public Administration* 50(6–7): 621–7.

Eisenman, David P., Kristina M. Cordasco, Steve Asch, Joya F. Golden, and Deborah Glik. 2007. "Disaster Planning and Risk Communication with Vulnerable Communities: Lessons from Hurricane Katrina." *American Journal of Public Health* 97(Supplement_1): S109–15.

Eiven, Mitch. 2022. Crypto Is Changing how Humanitarian Agencies Deliver Aid and Services *Cointelegraph Magazine* https://cointelegraph.com/magazine/crypto-blockchain-changing-humanitarian-agencies-deliver-aid/.

Elliott, Justin, and Laura Sullivan. 2015. How the Red Cross Raised half a Billion Dollars for Haiti -and Built Six Homes *ProPublica* https://www.propublica.org/article/how-the-red-cross-raised-half-a-billion-dollars-for-haiti-and-built-6-homes?token=fTyTTpSNdYm2E5qscOh_dgwUNrpWAD1.

FTC. 2016. *Combating Fraud in African American and Latino Communities the FTC's Comprehensive Strategic Plan*. Washington, DC: Federal Trade Commission.

Garnett, J., and Kouzmin, A. 2007. "Communicating throughout Katrina: Competing and Complementary Conceptual Lenses on Crisis Communication." *Public Administration Review* 67(S1): 171–88.

Gil-Garcia, J., M. Gasco-Hernandez, and T. Pardo. 2020. "Beyond Transparency, Participation, and Collaboration? A Reflection on the Dimensions of Open Government." *Public Performance & Management Review* 43(3): 483–502.

Gooden, Susan, Dale Jones, Kasey J. Martin, and Marcus Boyd. 2009. "Social Equity in Local Emergency Management Planning." *State and Local Government Review* 41(1): 1–12.

Hassan, Samer, and Primavera De Filippi. 2021. "Decentralized Autonomous Organization." *Internet Policy Review* 10(2): 1–10.

McDonald, B. D., D. Bruce, Jeremy L. Hall, Janine O'Flynn, and Sandra van Thiel. 2022. "The Future of Public Administration Research: An Editor's Perspective." *Public Administration* 100(1): 59–71.

Moon, M. Jae. 2020. "Fighting COVID-19 with Agility, Transparency, and Participation: Wicked Policy Problems and New Governance Challenges." *Public Administration Review* 80(4): 651–6.

Moynihan, Donald P. 2009. *The Response to Hurricane Katrina* 27–45. Geneva (Italy): International Risk Governance Council.

Puppim de Oliveira, Jose A., and Evan M. Berman. 2021. "Exposing the Unfinished Business of Building Public Administration in Late Democracies: Lessons from the COVID-19 Response in Brazil." *Public Administration Review* 81(6): 1183–91.

Rivera, Jason D., and Claire Connolly Knox. 2023. "Defining Social Equity in Emergency Management: A Critical First Step in the Nexus." *Public Administration Review* 83(5): 1170–85.

Thornton, Tonya E., Celeste Murphy-Greene, and Katherine M. Simon. 2021. "Community Resilience: Measuring Social and Political Vulnerability in the Aftermath of the Deepwater Horizon Oil Spill." *Journal of Emergency Management* 19(1): 79–92.

U.S. House. 2006. *Select Bipartisan Committee to Investigate the Preparation for and Response to Hurricane Katrina. 2006. A Failure of Initiative*. Washington, DC: Government Printing Office.

UN Office for Disaster Risk Reduction. 2020. *The Human Cost of Disasters—An Overview of the Last 20 Years 2000–2019*. Brussels: UNDRR.

Voigt, Lydia, and William E. Thornton. 2015. "Disaster-Related Human Rights Violations and Corruption: A 10-Year Review of Post–Hurricane Katrina new Orleans." *American Behavioral Scientist* 59(10): 1292–313.

Wolfson, Rachel. 2022. "Blockchain-Based Solutions Aim to Address US Disaster Relief." https://cointelegraph.com/news/blockchain-based-solutions-aim-to-address-us-disaster-relief.

Wright, James E., and Cullen C. Merritt. 2020. "Social Equity and COVID-19: The Case of African Americans." *Public Administration Review* 80(5): 820–6.

Yamamura, Eiji. 2014. "Impact of Natural Disaster on Public Sector Corruption." *Public Choice* 161(3): 385–405.

AUTHOR BIOGRAPHIES

Wendy D. Chen is an Assistant Professor in Public Administration in the Department of Political Science at Texas Tech University. Her research interests lie in

public and nonprofit innovation, emergency management, social entrepreneurship, regional economic development, and interorganizational collaboration. Prior to joining Texas Tech, she also had experience working on Capitol Hill and for multiple nonprofit organizations which she seeks to incorporate into all of her research and teaching. Email: wendy.chen@ttu.edu

Ilia Murtazashvili is an Associate Professor in the Graduate School of Public and International Affairs at the University of Pittsburgh. His research and teaching interests include political economy, property rights, self-governance, and natural resource governance. His current research focuses on the political foundations of effective private property rights, the consequences of the shale boom, the link between social institutions and forest governance, and the political and economic significance of blockchain technology. Email: ilia.murtazashvili@pitt.edu

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