Guest Editorial Preface

Special Issue on Building Resilience through Information and Crisis Management and Response

Andrea H. Tapia, School of IS and Technology, Penn State University, University Park, PA, USA
Kathleen A. Moore, Mercyhurst University, Erie, PA, USA

In May of 2016 the international community of scholars and practitioners focusing on Information Systems for Crisis Response and Management (ISCRAM) gathered in Rio de Janeiro, Brazil to hold their annual meeting. The ISCRAM Association's primary mission is to foster a community dedicated to promoting research and development, exchange of knowledge and deployment of information systems for crisis management, including the social, technical and practical aspects of all information and communication systems used or to be used in all phases of management of emergencies, disasters and crises. (iscram.org) This special issue draws from the very best papers presented at this meeting.

The theme of the ISCRAM 2016 annual meeting was "Resiliency by All Means." The ability to withstand, adapt to, and recover from a disruption is generally referred to as resilience, a definition with which many would largely agree (Haimes, 2009, Aven, 2011). Resilience is concept that is increasingly gaining traction in government, industry, and academia (Park et al., 2013, Hosseini et al., 2015). With respect to critical infrastructure, the Infrastructure Security Partnership (2011) noted that a resilient infrastructure sector would "prepare for, prevent, protect against, respond or mitigate any anticipated or unexpected significant threat or event" and "rapidly recover and reconstitute critical assets, operations, and services with minimum damage and disruption." Adger (2000) defined social resilience as "the ability of groups or communities to cope with external stresses and disturbances as a result of social, political, and environmental change."

This Special Issue is focused on Resilience Analytics. Resilience Analytics is defined as a focus on resilience through information systems, management and data analytics has entered the international stage (Barker et al., 2016). In August of 2015 Siddhartha Dalal stated that new methodologies and technologies enable smarter decision-making that improves global resilience. With the increased ability to collect data and analyze this data in real time, the field of crisis response and management is entering an exciting new phase based on real-time probabilistic risk analysis. This emerging paradigm can enable humans to better manage risks associated with complex systems. (August 10, 2015)

Resilience Analytics is based in the belief that data directly contributed by citizens and data scraped from disaster bystanders have positive potential to give crisis managers and professionals accurate and timely information that improves on traditional information gathering methods. Members of the public can now participate more broadly and effectively in times of crisis as they collect, create, share, and seek online information through social media (Hughes et al., 2008, Palen and Liu, 2007, Palen et al., 2009). In turn, this information empowers average citizens to become more aware during disasters and to coordinate to help themselves. According to Meier (2013) improving ways for communities to communicate internally and externally is thus an important part of building more resilient societies. "The part of the system that has been damaged recovers by drawing resources and information from undamaged parts." (Homer-Dixon, 2006). Identifying needs following a disaster and matching them to available resources is an important part of the process. Indeed, accelerating the rate of (1) identification; (2) matching and, (3) allocation, are important ways to speed up overall recovery. This explains why technologies and media are central to growing more resilient societies. They can accelerate impact evaluations and needs assessments at the local level. In other words, "Resilience is the capacity of the affected community to self-organize, learn from and vigorously recover from adverse situations stronger than it was before" (Meier, 2012).

Building on Wood's Four Concepts of Resilience (2015), practitioners and researchers working in the area of Information and Communication Technologies (ICTs) presented works on technical systems seeking to aid or enhance public safety. This in turn would create more elastic systems whereby emergency managers and responders may assist in the faster recovery of communities affected by crisis. ICTs included in this special issue span social media, collaborative technology, and mobile phone applications. This edition includes expanded works on how technical systems aiding in health and crisis communication in the form of alerts, information dissemination, and interactive imagery sharing, support the ideas of flexible and agile systems.

Simone Wurster, Michael Klafft, Frank Friedrich, and Andreas Bohn (TU Berlin, Jade University of Applied Sciences, Bergische Universität Wuppertal, and City of Munster) address the need for alerting and mobilizing trained volunteers already embedded in the community to assist with the common health issues that occur during large-scale events in their paper "Sudden cardiac arrest and the role of crowd tasking apps for risk mitigation." A proposed smartphone application was developed by both researchers and practitioners with feedback from city officials that seeks to alert and communicate with skilled persons within the community to assist with incidents of Sudden Cardiac Arrest. By utilizing competent citizens to aid in one-on-one crises, emergency responders are better able to focus on larger problems during a wide-scale event.

Social media has proven powerful in empowering local citizens in organizing and communicating across channels during emergencies. In their paper "Sharing Radiation Measurements through Social Media: A Methodological User-Oriented Proposal Set of Guidelines", Antonin Segault, Federico Tajariol, Yang Ishikago, and Ioan Roxin (University Bourgogne Franche-Comté, and University of Electro-Communications), the researchers produce guidelines for benchmarking the use of metadata in garnered through social media to enhance hard-sensor radiation measurements, and a software protoype for both citizen and experts aiding in the endeavor.

Continuing with the social media, an ongoing concern in the crisis response community is how to incorporate relevant social media data into decision making. Danial Link, Jie Ling, Jannik Hoffman, and Bernd Hellingrath (University of Muenster and European research Center for Information Systems) Focus on content moderation in their work "A Semi-Automated Content Moderation Workflow for Humanitarian Situation Assessments." By focusing on process through interviews and a serious games approach, the authors designed a semi-automated, interactive system that preserves human sensors through the use of assessment experts.

The last paper in this issue addresses the problems of context and bias with human sensors by changing the tasking of human sensors from providing semantic information to imagery data. In "Communicating with Citizens on the Ground," Suvodeep Mazumdar, Fabio Ciravegna, Neil Ireson, and Peter Crudd (University of Sheffield), present the ANON system where citizens on the ground are directed to use their mobile phone cameras to present information directly to Command and Control centers. With real-time reporting, live imagery, and immediate feedback from emergency managers, the researchers argue this approach will help reduce cases of hyper-reporting and reduce subjectivity in information provided during crisis events. The work concludes with observations, evaluation results, and future recommendations.

ICTs continue to be an ever-evolving player in the crisis response domain, and this special issue addresses diverse areas in its contribution to current understanding and future research efforts.

Andrea H. Tapia
Kathleen A. Moore
Guest Editors
IJISCRAM

REFERENCES

Adger, W. N. (2000). Social and ecological resilience: Are they related? *Progress in Human Geography*, *24*(3), 347–364. doi:10.1191/030913200701540465

Aven, T. (2011). On Some Recent Definitions and Analysis Frameworks for Risk, Vulnerability, and Resilience. *Risk Analysis*, *31*(4), 515–522. doi:10.1111/j.1539-6924.2010.01528.x PMID:21077926

Barker, K., Lambert, J.H. Zobel, C.W. Tapia, A.H. Ramirez-Marquez, J.E. … Caragea. C. (2016). Defining Resilience Analytics for Interdependent Cyber-Physical-Social Networks. *Sustainable and Resilient Infrastructure*.

Haimes, Y. Y. (2009). On the Definition of Resilience in Systems. *Risk Analysis*, *29*(4), 498–501. doi:10.1111/j.1539-6924.2009.01216.x PMID:19335545

Homer-Dixon, T. (2006). *The Upside of Down: Catastrophe, Creativity, and the Renewal of Civilization*. Island Press.

Hosseini, S., Barker, K., & Ramirez-Marquez, J. E. (2016). A Review of Definitions and Measures of System Resilience. *Reliability Engineering & System Safety*, *145*, 47–61. doi:10.1016/j.ress.2015.08.006

Meier, P. (2012) Disaster Response, Self-Organization and Resilience: Shocking Insights from the Haiti Humanitarian Assistance Evaluation. *iRevolutions*. Retrieved from https://irevolutions.org/2012/05/23/haiti-humanitarian-evaluation/

Meier, P. (2013) How to Create Resilience Through Big Data. *iRevolutions*. Retrieved from https://irevolutions.org/2013/01/11/disaster-resilience-2-0/

Palen, L., & Liu, S. B. (2007, April). Citizen communications in crisis: anticipating a future of ICT-supported public participation.*Proceedings of the SIGCHI conference on Human factors in computing systems* (pp. 727-736). ACM. doi:10.1145/1240624.1240736

Palen, L., Vieweg, S., Liu, S. B., & Hughes, A. L. (2009). Crisis in a Networked World: Features of Computer-Mediated Communication in the April 16, 2007, Virginia Tech Event. *Social Science Computer Review*, *27*(4), 467–480. doi:10.1177/0894439309332302

Park, J., Seager, T. P., Rao, P. S. C., Convertino, M., & Linkov, I. (2013). Integrating Risk and Resilience Approaches to Catastrophe Management in Engineering Systems. *Risk Analysis*, *33*(3), 356–367. doi:10.1111/j.1539-6924.2012.01885.x PMID:22967095