# Guest Editorial Preface

# Special Issue on Future Research Directions for Communication and Information Systems Technology for Crisis and Disaster Management

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According to the United Nations Office for Disaster Risk Reduction (UNISDR) the economic cost of disasters from 2005 to 2014 has cost our society 1.4 trillion dollars. In many countries, including the United States, the majority of the costs are not covered by any form of insurance. Moreover, the human impact has been staggering with 1.7 billion people being directly affected and 0.7 million people losing their lives to disasters. The rising impacts are clear and the challenge of designing communication and information systems technology for disaster management has never been greater. Although evidence of risk management practices can be found as early as 3200 BC modern disaster management did not begin to emerge until the mid-twentieth century (Coppola, 2006). With the increase in the number of disasters each year (CRED, n.d.) research into how technology can aid management of these events has grown rapidly over the past 20 years.

The papers included in this Special Issue are the result of two mini-tracks that were run during the Hawaii International Conference on Systems Sciences (HICSS) in January 2017. The first mini-track was on communication and information systems technology for crisis and disaster management. This track looked at how ICT could support crisis managers and other stakeholders in all phases of crisis management. The second mini-track focused on the role of governments (national, regional and municipal) in developing disaster resilience. It highlighted the serious challenges that governments face not only in dealing with disasters but also in developing resilient communities.

Since the HICSS conference reached its 50$^{th}$ anniversary in 2017, it was a good opportunity to reflect on the remarkable and rapid advances that have been made in our domain.

The first ICT for crisis management mini-track in 2013 paved the way for examining the critical issues in our field with looking at data collection to aid better management, lessons learnt from previous disasters, and decision support systems. These topics are still hotbeds of research. However since the inception of the ICT mini-track we have seen the other areas emerge, such as: the increase in use of mobile devices and social media for self-organisation in the face of a crisis and for two-way reporting between citizens to crisis managers; the effect of new technologies, such as advances in wireless networks, communication devices and applications that support crisis management; the increase in frameworks, platforms and approaches for studying and developing information systems for crisis management. Looking ahead, new challenges are on the horizon, we are moving towards a more holistic view of crisis and disaster management that deals with agility and resilience as defining characteristics of good management. Emerging themes are appearing, such as the rising interest in disaster e-Health, UAVs and disaster robotics, as well as ethical legal and social issues associated with disaster management.

The papers in this Special Issue cover a wide spectrum of issues in crisis management. The first paper by Michael R. Bartolacci and Stanko Dimitrov is one of two papers that deal with simulation in order to understand the complexity of crisis management. The paper, titled "Promoting Resiliency in Emergency Communication Networks" develops a network interdiction model to analyse vulnerabilities in public service wireless networks. The model is illustrated with the case study of Miami-Dade County. The work is very useful since the model can be used to identify critical parts of the network that should be particularly protected or that need further investment. By identifying these aspects security budgets can be estimated and the overall the resiliency of the network can be increased.

In the second paper "Building Resilience through Effective Disaster Management: An Information Ecology Perspective" by Mihoko Sakurai and Devinder Thapa looks at analysing resilience as a set of adaptive capacities. This point is illustrated as case studies using the very different responses to the 2011 Great East Japan and 2015 Nepal earthquakes. The work argues that resilience is a set of adaptive capabilities, rather than just a return to equilibrium. The study notes the importance of government initiatives involving local stakeholders and local knowledge to realize effective collaboration.

The third paper is "Comparing Agent Architectures in Social Simulation: BDI Agents versus Finite-State Machines", by Carole Adam, Patrick Taillandier, and Julie Dugdale. Simulation is a powerful tool in crisis management since it allows us to experiment with situations that we cannot do in real life. In order to increase the realism of simulation models we should include representations of human behaviour and decision making including their inherent flaws and biases. An agent based approach in modelling social behaviours has proven very beneficial in the past. However, an important challenge in Agent-Based Social Simulation is to choose the right architecture that reflects the right level of the complexity of human behaviour. Complex patterns of behaviour can emerge from very simple architectures, but it is sometimes necessary to use more realistic architectures to accurately model social human behaviour. Many simulations exist that are based on different underlying architectures, and it appears important to be able to compare them with each other. The paper by Adams, Taillandier and Dugdale is an attempt at comparing two models of human behaviour in bushfires, one using a simple finite-state machine, the other one using a complex Belief, Desire, Intention (BDI) architecture.

The fourth and final paper by Aladdin Shamoug and Radmila Juric is titled "Software Tool for Semantic Resources Allocation in Humanitarian Crises". The paper concerns an automated software tool for resource allocation during crises. This tool enables continuous support in resource allocation from day 1 of humanitarian crises and supports decision making by collecting and interpreting semantics of an environment where humanitarian response is required. The emphasis is on understanding the meaning of available and constantly changing information in humanitarian crisis. The tool also allows the input of various types of information from heterogeneous existing and persistent repositories and gives provision for accepting data from media and social media. One of the most important aspects of the tool is that its computational model, which assists in decision making, is based on SWRL enabled OWL ontologies, which allow the interpretation of collected information and reasoning upon it for semantic resource allocation. This paper demonstrates that it is possible to develop a generic approach that could in principle be applied to very different situations.

What is clear from this selection of papers is the rich diversity of research themes in crisis management, brought together through the goal of using technology in the best way possible to support and advance studies in crisis management. Technology should not be the driving force, but should work synergistically with people to form a strong resilient socio-technical system that is able to address the complexity of crisis response and management.

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## REFERENCES

Centre for Research on the Epidemiology of Disasters. (2009). EM-DAT: The CRED/OFDA International Disaster Database. Retrieved from www.emdat.be

Coppola, D. P. (2006). *Introduction to international disaster management*. Butterworth-Heinemann.