



ISSN: 1500-0713

Article Title: Bureaucracy Meets Catastrophe: Global Innovations from Two Decades of Research

Author(s): Margaret Takeda, Ray Jones, and Marilyn Helms

Source: *Japanese Studies Review*, Vol. XXII (2018), pp. 101-122

Stable URL: <https://asian.fiu.edu/projects-and-grants/japan-studies-review/journal-archive/volume-xxii-2018/helms-jones-and-takeda-bureaucracy-meets-catastrophe-two-decades-of-research.pdf>

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BUREAUCRACY MEETS CATASTROPHE:
GLOBAL INNOVATIONS FROM TWO DECADES OF RESEARCH

Margaret Takeda
California State University

Ray Jones
University of Pittsburgh

Marilyn M. Helms
Dalton State College

Introduction

On January 17, 1995, *Hanshin Daishinsai*, a Category 7 earthquake hit Kobe, Japan killing over 5,300 people, injuring 30,000 and leaving 500,000 homeless.¹ The media were present within minutes, but rescue teams and equipment arrived hours later, even though Japan has one of the world's highest per capita GDP expenditures for earthquake detection and prevention, enforces rigid building codes and practices annual drills for police search and rescue, helicopter deployment, seismic testing and emergency train stoppages.² In two decades since Kobe, one fact remains: bureaucracy could not manage the catastrophe. Analysis of response described "the severe holistic management's shortcomings as a paradigm for responding to situations in which the magnitude of the system's task is overwhelmingly complex and the timing process is bounded by the timing urgency."³

¹ M. Aoki, "Towards a Comparative Institutional Analysis: Motivations and Some Tentative Theorizing," *Japanese Economic Review* 47/1 (1996): 1–19; M. Iijima, S. Komatsu, and S. Katoh, "Hybrid Just-In-Time Logistics Systems and Information Networks for Effective Management in Perishable Food Industries," *International Journal of Production Economics* 44/1 (1996): 97–103; N. Kawamiya and H. Aoki, "Japan as Hyper-Construction State: Fiscal, Financial and Environmental Crisis," *Journal of Australian Political Economy* 43 (1999): 63–87.

² H. Fukunaga and K.H. Chinone, "Taking on the System, the Discounting Boom," *Tokyo Business Today*, May 1994, 4–13.

³ M. M. Helms, R. Jones, and M. B. Takeda, "Learning from Kobe: Complexity and Urgency in the Holistic Management Model," *Japan Studies Review* 11 (2007), 27.

Japan leads in teamwork, lean production methods, and quality management. Its holistically managed organizations have found success in complex environments, demanding individuals adapt to benefit the whole in the Kaizen continuous improvement approach.⁴ Moreover, this commitment has serious side effects when outsiders or outside information must be included. Research identified psychological, social, and economic constructs to explain why flawed decision-making and ineffective, slow responses occurred. Escalation of commitment, group-think, peer-pressure, saving face, and holistic management were suggested for the Japanese bureaucratic response.⁵ These same problems occurred in 2005 during *Hurricane Katrina* with the U.S. government, Federal Emergency Management Agency (FEMA), non-governmental organizations (NGOs), private organizations, and citizens.⁶

In contrast, outside-the-system responses are suggested for fluid, dynamic, and effective emergency management.⁷ Disaster management research from scholarly journals in the past decade finds 60,000 entries in Ebscohost® and 120,000 in ABIInform Complete® and related business databases. According to the EM-DAT International Disaster Database, from 2002–2011 there were almost 10,000 natural disasters worldwide, resulting in over 2.4 million deaths. Across the globe, over 190 Red Cross and Red Crescent Societies are joined by disaster focused NGOs, governmental agencies, and private organizations dedicated to prevention, recovery and

⁴ A. Medinilla, *Understanding Kaizen: A Brief Introduction to Continuous Improvement Cultures* (Berlin, Springer-Verlag Berlin Heidelberg Publishing, 2014).

⁵ Helms, Jones, and Takeda, “Learning from Kobe,” 23–50.

⁶ Helms, Jones, and Takeda, “Learning from Hurricane Katrina: Complexity and Urgency in the Holistic Model,” *Japan Studies Review* 12 (2008): 107–124.

⁷ Takeda and Helms, “Bureaucracy, Meet Catastrophe: Analysis of Hurricane Katrina Relief Efforts and Their Implications for Global Emergency Governance,” *International Journal of Public Sector Management*, 19/4 (2006a): 397–411; Takeda and Helms, “Bureaucracy, Meet Catastrophe: Analysis of the Tsunami Disaster Relief Effort and Their Implications for Global Emergency Governance,” *International Journal of Public Sector Management*, 19/2 (2006b): 204–217.

relief. In fact, a whole specialized global industry of universities, think tanks, and engineering firms have evolved.⁸

This study reviews the emerging themes from two decades of global disaster management research. It is important to note the changing definition of a catastrophe. “Disaster” and “catastrophe” often used interchangeably have shifted in the past decade as governmental organizations and the insurance industry specify boundaries for a catastrophe.⁹ According to FEMA in the U.S., a catastrophe is “...any natural or manmade incident, including terrorism, that results in extraordinary levels of mass casualties, damage, or disruption severely affecting the population, infrastructure, environment, economy, national morale, and/or government functions.” For continuity, in this study the word “catastrophe” is used to refer to the broader field of “disaster management.”¹⁰

Methodology and Organization

The methodology for this longitudinal review is based on theoretical and paradigmatic academic research trends. In *Facing the Unexpected*, functionalist theory is implicitly used in the “demand-capability” model and key theoretical research perspectives include:¹¹

⁸ D. Guha-Sapir, R. Below, and P. Hoyois, *EM-DAT: International Disaster Database*, Brussels, Belgium: Université Catholique de Louvain, 2015 (accessed July 20, 2018, <https://www.emdat.be/annual-disaster-statistical-review-2015-0>); and B. D. Phillips, “Disasters by Discipline: Necessary Dialogue for Emergency Management Education,” Presentation, “Creating Educational Opportunities for the Hazards Manager of the 21st Century” Workshop, Denver, Colorado, October 22, 2003.

⁹ T. E. Drabek, D. A. McEntire, “Emergent Phenomena and Multi-organizational Coordination in Disasters: Lessons from the Research Literature,” *International Journal of Mass Emergencies and Disasters* 20 (2002): 197–224.

¹⁰ Federal Emergency Management Agency (FEMA), *National Response Framework*, Washington, D.C.: U.S. Government Printing Office, January 2008 (accessed July 12, 2018, <http://www.fema.gov/pdf/emergency/nrf/nrf-core.pdf>), 42.

¹¹ K. Tierney, M. Lindell, and R. Perry, *Facing the Unexpected: Disaster Preparedness and Response in the U.S.* (Washington, D.C.: Joseph Henry Press. 2001).

- *Social constructionism*: “argues against viewing disasters as objective physical phenomena [but as] “social processes through which groups promote claims about disasters and their consequences.”
- *European critiques of modernity and industrial society*: “sees the potential for disasters as immanent in the social order itself rather than originating outside it, and conceptualizes disasters as an inevitable and direct consequence of the social relations and practices that characterize modern society.”
- *Conflict-based and political-economy theories*: “sees disasters and their impact as resulting from political-economic forces that simultaneously shape both the vulnerability of the built environment to disaster damage and the social vulnerability of exposed populations.”
- *Political-ecological perspectives*: “sees communities not as unitary systems but rather as consisting of loosely-coupled, heterogeneous ecological elements and networks...within these ecological groupings power and resources are not distributed equally” (58).

In *American Hazardscapes*, two common paradigms of disasters were identified:¹²

- *Hazards Paradigm*: “society interacts with the physical environment and this interaction produces both beneficial and harmful effects”.
- *Risk Paradigm*: “has four primary elements: risk identification, dose-response assessment, exposure assessment and risk characterization...the ultimate goal of the risk assessment process was to identify remedial options that posed the least threat to human and ecosystem health” (38).

¹² S. L. Cutter, L. Barnes, M. Berry, C. Burton, E. Evans, E. Tate, and J. Webb, “A Place-Based Model for Understanding Community Resilience to Natural Disasters,” *Global Environmental Change* 18/4 (2008): 598–606.

This review focuses on decision-making systems in catastrophic contexts that reflects an organic (versus intentional) reliance on the political-ecological perspective similar to Richardson, who highlighted how disaster phases represent a relationship between structure and meaning.¹³ To offer new insights in disaster theory, modeling, and management, this research considers the question: What key thematic changes in disaster management research have influenced “innovations” in decision-making within each of the four risk-related phases of disasters (preparedness, response, recovery and mitigation)?

The Four-Phase Model of Disaster Management

The use of phases is common in social science and has endured over 60 years organizing data, describing events, and focusing research analyses.¹⁴ With computer modeling and global sharing of disaster databases, robust phase models emerged.¹⁵ The United States National Governor’s Association (NGA)¹⁶ is credited with early definitions of comprehensive Emergency Management (CEM) defined as (11):

“a state’s responsibility and capability for managing all types of emergencies and disasters by coordinating the actions of numerous agencies. The comprehensive aspect of CEM includes all four phases of disaster or emergency activity and applies to all risks including attack, man-made, and natural, in a federal-state-local partnership.”

¹³ B. K. Richardson, “The Phases of Disaster as a Relationship Between Structure and Meaning: A Narrative Analysis of the 1947 Texas City Explosion,” *International Journal of Mass Emergencies and Disasters*, 23/3 (2005): 27–54.

¹⁴ David M. Neal, “Reconsidering the Phases of Disaster,” *International Journal of Mass Emergencies and Disasters* 15/2 (1997): 239–264.

¹⁵ M. Sullivan, “Integrated Recover Management: A New Way of Looking at a Delicate Process,” *The Australian Journal of Emergency Management* 18/2 (2003), 4.

¹⁶ National Governor’s Association, *Emergency Preparedness Project Final Report*, Washington, D.C., Government Printing Office, 1979.

The NGA report described and identified activities related to the phases:

- “Preparedness activities are necessary to the extent that mitigation measures have not, or cannot, prevent disasters.” (11).
- “Response activities follow an emergency or disaster. Generally, they are designed to provide emergency assistance for casualties ... they also seek to reduce the probability of secondary damage.” (11).
- “Recovery activities continue until all systems return to normal or better ... or improved levels.” (12).
- “Mitigation includes any activities that actually eliminate or reduce the probability of occurrence of a disaster.” (11).

The phases often remain in flux. In a review of disaster phase model developments, a meta-analysis found the four-phase model commonly employed by both researchers and practitioners with support from the Vanderbilt Center for Transportation Research and FEMA.¹⁷ Particularly, Jorgust undefined the stages as preparation, warning, impact, and aftermath and agreed the final aftermath phase should be separated into multiple time periods.¹⁸

Preparedness in Disaster Management

Organizations should make non-routine disaster decisions quickly and effectively. Over the past two decades, organizations of all types and sizes have evolved in their level of preparedness by engaging in the disaster decision-making routines that define the mission and scope, create procedures for various scenarios, and model the processes that will occur as they maintain readiness. Modeling effective disaster preparedness (creating, testing and refining plans) is one of the most cited innovations, but targets

¹⁷ See Phillips, “Disasters by Discipline”; and Malcom E. Baird, “The Phases of Emergency Management,” Background Paper, Vanderbilt Center for Transportation Research, January 2010 (accessed August 1, 2018, http://www.memphis.edu/ifti/pdfs/cait_phases_of_emergency_mngt.pdf).

¹⁸ K. Jorgustin, “The 4 Stages of Disaster. In the Modern Survival Blog – Preparedness for Life,” Modern Survival Blog, 2013 (accessed July 20, 2018, <http://modernsurvivalblog.com/natural-disasters/the-four-stages-of-disaster>).

only one group (i.e., local community, national NGO, government department) and is, until only recently, coordinated across groups or levels.¹⁹ Research suggests this modelling has the highest efficacy when “decisions are shared, and the coordination of shared decisions is harmonized, in order to optimize the entire system.”²⁰ For optimal preparedness, the first step is to understand the characteristics and operational modes of each impacted group and ensure that decisions and routines are harmonized up the hierarchy. In the past decades, there has been significant public and private investment in disaster management innovations, resulting in distinctive decision-making technologies and systems. Preparedness models include the “Hierarchical Holographic Modeling,” a holistic methodology to capture and represent diverse attributes of a system, including multiple features, perspectives and hierarchies. “Phantom System Modeling,” represents a “system of systems,” integrating multiple subsystems, hierarchical organizations, decision-makers, stakeholders, objectives, and sources of risk and uncertainty.²¹

A different evolutionary “managerial” component of disaster decision-making is “strategic preparedness,” a proactive phase of risk management grounded on dynamic and comprehensive scenario structuring.²² To reduce negative consequences, an iterative process using the latest in computational design develops scenarios that require planning for human action and reaction in hypothetical situations.

Another innovation in decision-making models is the Protective Action Decision Model (PADM)²³ based responses to environmental hazards

¹⁹ Y. Y. Haimes, “On the Definition of Resilience in Systems,” *Risk Analysis* 29/4 (2009): 498–501.

²⁰ Ibid; Y. Y. Haimes, “Strategic Preparedness For Recovery From Catastrophic Risks To Communities And Infrastructure Systems Of Systems,” *Risk Analysis* 32/11 (2012): 1834–1845; and Haimes, “On the Definition of Resilience,” 499.

²¹ Haimes, “Strategic Preparedness for Recovery,” 1834–1845.

²² F. H. Norris, S. P. Stevens, B. Pfefferbaum, K. F. Wyche, and R. L. Pfefferbaum, “Community Resilience as a Metaphor, Theory, Set of Capacities, and Strategy for Disaster Readiness,” *American Journal of Community Psychology* 41/1-2 (2008): 127–150.

²³ M. K. Lindell, R. W. Perry, “The Protective Action Decision Model: Theoretical Modifications and Additional Evidence,” *Risk Analysis* 32/4 (2012): 616–632.

and disasters. The multistage PADM model “integrates the processing of information derived from social and environmental cues with messages that social sources transmit through communication channels to those at risk” and identifies reception, attention, and comprehension of warnings preceding further processing.²⁴ The PADM process produces a behavioral response and highlights “realistic” human decision-making processes versus prescriptive or “hoped for” versions from other sources. The lesson from the PADM model is that warning sources carry importance for compliance based on their level of credibility. The higher the degree of ambiguity in disaster messaging, the less likely the target population will respond. PADM counters overlooked natural weaknesses in prescriptive human information processing.

Furthermore, researchers have approached disaster management by assessing why a bureaucratic approach to decision-making in government organizations tends to generate a standardized response in the midst of a catastrophic disaster event.²⁵ Still, the theme of “disaster administration” literature has encouraged bureaucratic actors to focus on sound planning, training and response capabilities, as well as response and recovery from public administration theory.²⁶ Besides decision-making modeling, strategic planning, and prescriptive process developments, breakthrough studies in psychology have studied the human cognition in disaster situations. One primary example considered the effects of preparatory information on enhancing performance under stress where information prior to a stressful event reduced negative responses.²⁷

Results indicated “those who received preparatory information prior to performing under high-stress conditions reported less anxiety, were more confident in their ability to perform the task, and made fewer performance errors than those who received no preparatory information.” These findings

²⁴ Ibid., 618.

²⁵ Jon K. Christensen and Jody K. Young, “Drivers of Complexity in Humanitarian Operations” (Ph.D. diss., Naval Postgraduate School, 2013).

²⁶R. J. Herzog, “A Model of Natural Disaster Administration: Naming and Framing Theory and Reality,” *Administrative Theory & Praxis* 29/4 (2007): 586–604.

²⁷ C. M. Inzana, J. E. Driskell, E. Salas, and J. H. Johnston, “Effects of Preparatory Information on Enhancing Performance Under Stress,” *Journal of Applied Psychology* 81/4 (1996), 429.

became the basis for further research in high stress related situations, including disasters.²⁸

Researchers tested three types of preparatory information. First sensory information considers how the individual is likely to feel under stress. Individuals may perceive intrusive physical and emotional sensations and physiological reactions often include increased heart rate, sweating, shallow breathing, and muscle tension. Emotional reactions include fear, frustration and confusion and are a direct source of interference and distraction to the task performer, and in a highly ambiguous catastrophic event scenario, could prove fatal. Second, procedural information describes events that likely occur in the stress environment, including a description of the setting, the types of stressors, and effects the stressors may have. Previously described scenario planning could mitigate the negative effects of chaotic procedural information by providing performers with pre-conscious conditioning to unknown stressors. Finally instrumental information reduces stress, especially since people have no prior experience with catastrophic events and cannot visualize how to react or what to do.²⁹

It is “common knowledge” that disaster readiness training and education should involve these factors. While not an exhaustive review of decision-making in disaster readiness, this overview of major developments is an advancement from the 1990s.

Response in Disaster Management

Emergency logistics is an emerging field that focuses on the response phase of disaster management, specifically centered on the distribution of rescue resources to facilitate search and rescue operations, provide shelter and food, and enable locals to become self-sufficient again.³⁰

²⁸ Ibid. 426.

²⁹ Ibid.

³⁰ M. S. Chang, Y. L. Tseng, and J. W. Chen, “A Scenario Planning Approach for Flood Emergency Logistics Preparation Problem under Uncertainty,” *Transportation Research* 43/E (2007): 737–54.; L. Özdamar, E. Ekinçi, and B. Küçükyazıcı, “Emergency Logistics Planning in Natural Disasters,” *Annals of Operations Research* 129/1-4 (2004): 217–245.; W. Yi, and L. Özdamar, “A Dynamic Logistics Coordination Model for Evacuation and Support in Disaster Response Activities,” *European Journal of Operational Research* 179/3 (2007): 1177–1193; D. C. Whybark, “Issues in Managing Disaster Relief Inventories,” *International Journal of Production Economics*

During the response phase or emergency response, activities are focused on emergency relief to save lives and meet basic human needs. The length of this period varies from a few days to months or even years according to the circumstances.

According to Chang and his colleagues, emergency response is a two-stage process with the first stage being the life-saving, sustaining response and the second stage the self-sufficiency response.³¹ The life-saving component consists of search and rescue operations while the life-sustaining component involves provisions of human needs.³² These first-stage responses are effective when victims are rescued from life-threatening conditions but is ineffective if needs are not met, resulting in victims experiencing a “second” disaster. Improper burial of the dead, resulting in outbreaks of infectious diseases, is such an example. Responders and decision-makers face dynamic, complex problems with environmental, organizational, and activity-based issues. Way and Yuan developed a framework of context-aware multi-party coordination systems extending dynamic decision-making support systems in response to catastrophic events.³³ Their contribution incorporated context-aware, multi-party relationship management and task-based coordination components into a framework for maximum response based on an analysis of the March 2011 triple disaster of earthquake, tsunami, and nuclear power plant meltdown in Japan, in which 14,508 people were confirmed dead, 11,452 were missing, 76,000 homes were destroyed, 244,000 homes were damaged and over 350,000 citizens were displaced.³⁴ Prior to this event,

108/1 (2007): 228–235; S. H. Shen, C. H. Chiu, and T. S. Hsu, “An Age Replacement Policy Via the Bayesian Method,” *International Journal of Systems Science* 42/3 (2011): 469–477.

³¹ Chang, et al., “A Scenario Planning Approach,” 737–54.

³² United Nations High Commission for Refugees (U.N.HCR), *Handbook for Emergencies*, February 2007 (accessed July 20, 2018, <http://www.refworld.org/docid/46a9e29a2.html>).

³³ S. Way and Y. Yuan, “Transitioning from Dynamic Decision Support to Context-Aware Multi-Party Coordination: A Case for Emergency Response,” *Group Decision and Negotiation* 23/4 (2014): 649–672.

³⁴ N. Mimura, K. Yasuhara, S. Kawagoe, H. Yokoki, and S. Kazama, “Damage From the Great East Japan Earthquake and Tsunami—A Quick Report,” *Mitigation and Adaptation Strategies for Global Change* 16/7 (2011): 803–818.

many proposed and tested frameworks were proposed for government decision-makers.

In 2004, research provided design recommendations for a dynamic emergency response management information system (DERMIS) with specific system and design requirements based system training and simulation, information focus, crisis memory, exceptions as norms, scope and nature of crisis, role transferability, information validity and timeliness, free exchange of information, and coordination.³⁵

A 2005 study identified the major task requirements and associated key issues for intelligent *mobile* crisis response systems.³⁶ Additionally in 2010, another study proposed a system-oriented framework based on the work of Mitroff and Linstone in *The Unbounded Mind* (1993)³⁷ for analyzing and evaluating emergency response that became the foundation for an information system support protocol.³⁸ With the invention and continuous innovations in mobile communications, dynamic disaster decision-making support represents an opportunity for new applications of these technologies.³⁹

In the study of psychological foundations of disaster response decision-making "swift trust" emerges as a powerful explanatory variable in situations where professionals come together on short notice to respond to high stakes disaster events. This theory posits that trust occurs swiftly and implicitly, by the immediacy of the situation, requiring respectful, collaborative efforts to make sense of the situation. Additionally, situational

³⁵ M. Turoff, M. Chumer, B. V. de Walle, and X. Yao, "The Design of a Dynamic Emergency Response Management Information System (DERMIS)," *Journal of Information Technology Theory and Application* 5/4 (2004), 3.

³⁶ Y. Yuan and B. Detlor, "Intelligent Mobile Crisis Response Systems," *Communications of the ACM* 48/2 (2005): 95–98.

³⁷ I. I. Mitroff and H. A. Linstone, *The Unbounded Mind: Breaking the Chains of Traditional Business Thinking* (New York: Oxford University Press, 1993).

³⁸ M. Abrahamsson, H. Hassel, and H. Tehler, "Towards a System-Oriented Framework For Analyzing and Evaluating Emergency Response," *Journal of Contingencies and Crisis Management* 18/1 (2010): 14–25.

³⁹ Abrahamson, Hassel, and Tehler, "Towards a System-Oriented Framework," 14–25.

cues or influences, not organizational affiliation, shape decision-making preferences among responders.⁴⁰ Similarly, a major implication of the swift trust phenomenon is that organizational forms may be vulnerable to flawed decision-making in early stages of crisis response where temporary groups operate in a political structure, relying on affiliation influences to the exclusion of situational cues. Since accurate early problem formulation is critical for disaster response, this tendency could hinder effectiveness of readiness planning and execution.

Recovery in Disaster Management

Disaster Recovery represents a significant departure from other phases in the Disaster Management model. Because this phase has a longer time horizon, it is often industry specific in its analysis and approach (construction, health care, insurance), highly dependent on the success of prior phases (how well planners and responders prepared the groundwork for minimizing disaster impacts), and highlights the critical nature of stakeholder coordination and collaboration. Sullivan suggested an integrative approach to recovery management based on the *Australian Emergency Manual Disaster Recovery* with eight guiding principles: Define recovery; plan and manage; recognize changing needs and complexity; take a community development approach; involve human service organizations; begin at impact; train and exercise recovery arrangements; and comprehensive, integrated, timely, fair and flexible arrangement.⁴¹ This integrated approach places the community at the center of recovery management and includes planning, training and rehearsing, while emphasizing flexibility, the component most often found lacking when recovery failures are scrutinized.⁴²

⁴⁰ P. Drnevich, R. Ramanujam, S. Mehta, and A. Chaturvedi, "Affiliation or Situation: What Drives Strategic Decision-Making in Crisis Response?" *Journal of Managerial Issues* (2009): 216–231; L. Poppo, K. Z. Zhou, and S. Ryu, "Alternative Origins to Interorganizational Trust: An Interdependence Perspective on the Shadow of the Past and the Shadow of the Future," *Organization Science* 19/1 (2008): 39–55; Norris, et al., "Community Resilience as a Metaphor," 127–150.

⁴¹ Sullivan, "Integrated Recover Management."; and Peter Koob, ed., *Australian Emergency Manual–Disaster Recovery* (Canberra, Australia: Emergency Management Australia, 1996).

⁴² Sullivan, "Integrated Recover Management."

In 2013, a study analyzed post-disaster satisfaction levels of local stakeholders in housing reconstruction projects in Tunisia, where tactical decisions were concentrated by members of the Council of the Governorate at the regional level.⁴³ Interviews confirmed lack of active participation by end-users in decision-making and a top-down approach. Those responsible for the relocation said: “We have built housing for disaster victims. We have not had enough time to consult end-users as the presidential project imposed limited time.”⁴⁴

A Project Management Institute (PMI) study explored the structure of the team established to conduct housing reconstruction projects and the satisfaction of end-users, confirming the need to decentralize decisions at a level that optimizes the efficiency of local stakeholders, facilitates the participation of end-users, and allows an appropriate distribution of responsibilities and risks among stakeholders. Constraints to local involvement included:⁴⁵

- (1) Limited access to pertinent information for decision-making during project planning and development;
- (2) Temporariness of the project process which led to an important emphasis on tactical planning and caused difficulties for implementing strategic planning;
- (3) Temporary nature of the recovery team itself, which increases organizational fragmentation and causes difficulties for cooperation (PMI, 2008).

The PMI study and others like it, finds significant logistical barriers to understanding the interplay among variables affecting the efficacy of disaster planning and management. Each disaster is unique, within a diverse context of geographic, historical, cultural, social, psychological, and legal factors impossible to test or foresee. The recovery phase, like triage, does not ask

⁴³ Bouraoui, D., & Lizarralde, G. (2013). Centralized decision making, users' participation and satisfaction in post-disaster reconstruction: The case of Tunisia. *International Journal of Disaster Resilience in the Built Environment*, 4(2), 145–167.

⁴⁴ Ibid. 151.

⁴⁵ Project Management Institute (PMI). (2008). *PMBOK Guide*. Newtown Square, PA: Project Management Institute.

deep questions but seeks to minimize the short-term damage and destruction. It is not until the relief phase that the disaster community can begin to ponder, “What next?”

Mitigation in Disaster Management

The final phase in disaster management cycles, and the first phase in the iterative process of resolution, is mitigation, which encompasses the long-term preparatory planning and modeling that are the foundation for disaster-proof infrastructures, architecture, and people-centered products and services. It addresses the long term humanitarian assistance that communities rely upon for years. There are many locale-dependent factors that limit comparison of relief efforts, however, certain “key success factors (KSF)” for effective relief that have been discovered to hold true around the globe.

Oloruntoba⁴⁶ explored KSFs for improving the efficiency and effectiveness of disaster mitigation in *Cyclone Larry*, which devastated the Australian coastline. KSFs grouped into preparedness and readiness and the unity of direction and cohesive control of responding government agencies, NGOs, private businesses, and individuals. Preparedness examples included prior cyclone awareness campaigns, education and community training. Stakeholders at all levels were involved in determining necessary relief measures, including updated equipment, infrastructure, and communication systems. Another readiness KSF was an early warning of the event, through modeling, before the cyclone made landfall. Communication strategies featured disaster modeling experts on TV, radio and Internet. The disaster administration human infrastructure was in a constant state of alert, communication, planning and preparation and represents a model to replicate in other regions.

Relief is supported by disaster decision support systems (DSS), i.e., software, programming, technology and engineering know-how, that over the past two decades has produced sophisticated modeling, equipment, and devices for disaster reduction (i.e., satellites, drones). DSS components include a data bank, data analysis capability, normative models, technology for display, and interactive data use.⁴⁷ Disaster DSS “provide support to

⁴⁶ R. Oloruntoba, “An Analysis of the Cyclone Larry Emergency Relief Chain: Some Key Success Factors,” *International Journal of Production Economics* 126/1 (2010): 85–101.

⁴⁷ W. A. Wallace and F. de Balogh, “Decision Support Systems for Disaster Management,” *Public Administration Review* (1985): 134–146.

decision-makers and their stakeholders; evolve as the users become more familiar with the technology; be interactive and controllable; recognize their non-routine, but consequential use; and adapt to the idiosyncrasies that are inherent in human decision making.”

In their DSS innovation, Thaler and Sunstein address the critical issue of retrofitting along with their nudge theory, defined as “any aspect of the choice architecture that alters people’s behavior in a predictable way without forbidding any options or significantly changing their economic incentives.”⁴⁸ They developed the theory after observing ways homeowners failed to make rational decisions in natural disasters to benefit from loss reduction measures. An example is automatic enrollment in a benefit that is free or low to no risk, such as automatic enrollment in warranty programs upon purchase. Automatic enrollment provides the nudge necessary for individuals to accept a new status quo.⁴⁹ The implication is clear and provides automatic enrollment in retrofitting for disaster prevention.

Global Examples of Disaster Response

In the responses to the most publicized disasters, there is a comparison of global versus local responses and in most cases local groups outperform national planning. Recent Ebola and Zika virus outbreaks, lost airplanes and weather events share the same response challenges. Unfortunately disaster response has not improved and has possibly worsened. When the March 2015 snowstorm, *Thor’s Hammer*, blanketed several U.S. cities near the Kentucky and Illinois state border, over 400 stranded motorists waited 19 hours before a coordinated response occurred. A woman in one of the 15 miles of stranded cars stated there were no emergency vehicles and no information shared via social media about any forthcoming aid or helicopter assessments. Expectations were that governmental agencies, departments of transportation and other state and national governmental agencies would have winter storm preparedness responses in place particularly given

⁴⁸ R. H. Thaler and C. R. Sunstein, *Nudge: Improving Decisions about Health, Wealth, and Happiness* (New Haven, CT: Yale University Press, 2008), 85.

⁴⁹ T. Fujimi and H. Tatano, “Promoting Seismic Retrofit Implementation Through ‘Nudge’: Using Warranty as a Driver,” *Risk Analysis* 33/10 (2013): 1858–1883.

accurate early weather forecasts. The slow responses were seen as too little and too late.⁵⁰

A similar snowstorm in Atlanta, Georgia found U.S. citizens living near the interstate offering food to stranded motorists at a grassroots level when organized governmental help was slow to arrive.⁵¹ Both examples were predicted but the responses were delayed and fragmented turning a disaster into a catastrophe, highlighting the escalating problems as well as response inefficiencies and lack of planning and coordination.

The developed U.S. economy with institutions supporting rapid response, and Nepal, a poor country with few resources, illustrate the same problems. Government managed disaster responses follow a traditional command and control structure. Recently there are signs of global and local improvements. Globally, the United Nations (U.N.) “Build Back Better” initiative has gained widespread traction, especially through its implementation in Japan (Fukushima disaster) and Nepal (earthquake May 2015).⁵² A key U.N. provision is rapid recovery and long term, integrated, coordinated “community based” resilience building:

During the World Conference, States also reiterated their commitment to address disaster risk reduction and the building of resilience to disasters with a renewed sense of urgency within the context of sustainable development and poverty eradication, and to integrate, as appropriate, both disaster risk reduction and the building of resilience into

⁵⁰ S. Masunaga and K. Lee, “Hundreds Of Motorists Trapped On Kentucky Roads In Massive Snowstorm,” *Los Angeles Times*, March 5, 2015 (accessed August 2, 2018, <http://www.latimes.com/nation/nationnow/la-na-ice-snow-southeast-northeast-winter-storm-20150305-story.html>); Heartland News, “I-24 Shut Down, National Guard To Assist,” *KFVS12*, March 2, 2015 (accessed August 1, 2018, <http://www.kfvs12.com/story/28243218/ky-national-guard-deployed-to-assist-300-stranded-vehicles-on-124/>).

⁵¹ C. Morgan, “Five Disaster Recovery Lessons from Atlanta’s Snow Storm,” *Recovery Zone*, January 31, 2014 (accessed July 20, 2018, <http://www.storagecraft.com/blog/recovery-lessons-atlanta/>).

⁵² William J. Clinton, *Lessons Learned from Tsunami Recovery: Key Propositions for Building Back Better*, December 2006, Office of the U.N. Secretary-General’s Special Envoy for Tsunami Recovery (accessed July 20, 2018, http://www.conflict-recovery.org/bin/Clinton-Building_Back_Better.pdf).

policies, plans, programmes and budgets at all levels and to consider both within relevant frameworks (resilience is defined as: “The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions).⁵³

After the U.N. Conference on Disaster Relief hosted in Sendai, Japan ended in March 2015, the resolution was tested. Nepal experienced its most devastating earthquake in 100 years, losing over 9,000 lives. Within hours, U.N. member states voted to request the Secretary-General and the wider U.N. system assist Nepal in coordination of the national and international relief/reconstruction efforts. The 193-member body emphasized linking relief with rehabilitation and development, of building resilience, and building back better.⁵⁴ Community-based local responses embodied within the U.N. approach requires improvisation by people who have detailed knowledge of the community’s needs.

As seen in responses from religious-based organizations and NGOs in Hurricane Katrina, community-based responses are outside governmental disaster plans. Their response is quicker and more effective and often the only action some effected individuals see or receive aid from.⁵⁵ The bureaucratic failure to adapt during Hurricane Katrina exhibits numerous instances of reactive and paralytic crisis and the collective dysfunctional responses

⁵³ U.N. General Assembly, Resolution 69/283, Sustainable Development: International Strategy for Disaster Reduction, A/69/L.67, May 15, 2015 (accessed August 1, 2018, https://www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/69/283).

⁵⁴ U.N. General Assembly, Resolution 69/PV.90, Strengthening of the Coordination of Humanitarian and Disaster Relief Assistance of the United Nations, Including Special Economic Assistance: Special Economic Assistance to Individual Countries or Regions, A/69/L.66, May 13, 2015 (accessed August 2, 2018, http://www.un.org/en/ga/search/view_doc.asp?symbol=A/69/PV.90).

⁵⁵ A. Alvinus, “Bridging Boundaries in the Borderland of Bureaucracies: Individual Impact on Organizational Adaption to Demanding Situations in Civil and Military Contexts” (Ph.D. diss., Karlstad University, Sweden, 2013).

culminated in extreme conflict, repeated communication snafus, and an ultimate systematic failure.⁵⁶ The administrative failure in Hurricane Katrina, like Kobe, spurred agents to be more agile in their responses and design a system to promote resilience with attention to double-loop learning.⁵⁷

The emerging literature on disaster response is varied. One particular study found operations diverge from plans in emergency responses and call for a systems relationship between personnel and organizations⁵⁸ Researchers studying response capabilities needed by local governments found needs assessment, exchange of information, and logistical expertise should precede recovery, where expertise in damage assessment, debris removal, disaster assistance, and key capabilities are required.⁵⁹ Others suggest an integrated expert system can better model disaster assessment.⁶⁰ Herzog noted theory and reality differ, especially from management perspectives, as his disaster administrative model combines mitigation and planning, disaster management, response, and recovery, and learning from past failures.⁶¹

Interestingly an overwhelming number of studies only highlight problems. Most are hypothesized coordination models and leadership

⁵⁶ A. M. Olejarski, and J. L. Garnett, "Coping with Katrina: Assessing Crisis Management Behaviors in the Big One," *Journal of Contingencies and Crisis Management* 18/1 (2010): 26–38.

⁵⁷ N. Mehrotra, V. Ahuja, and N. Sridharan, "Disaster Resilience and Self-Organization: Urban Development and Management Perspective," *International Journal of Business Continuity and Risk Management* 5/2 (2014): 85–107; D. D. Thompson, "Leveraging Learning to Improve Disaster Management Outcomes," *International Journal of Disaster Risk Science* 3/4 (2012): 195–206.

⁵⁸ C. Uhr, H. Johansson, and L. Fredholm, "Analyzing Emergency Response Systems," *Journal of Contingencies and Crisis Management* 16/2 (2008): 80–90.

⁵⁹ B. Kusumasari, Q. Alam, and K. Siddiqui, "Resource Capability for Local Government in Managing Disaster," *Disaster Prevention and Management: An International Journal* 19/4 (2010): 438–451.

⁶⁰ G. Kou, D. Ergu, and Y. Shi, "An Integrated Expert System for Fast Disaster Assessment," *Computers & Operations Research* 42 (2014): 95–107.

⁶¹ Herzog, "A Model of Natural Disaster Administration," 586–604.

models. As an example, Uhr and Johansson⁶² continued research on a web-based method for mapping agent relationships and identifying key. Their study of responses to a release of 16,000 tons of sulphuric acid in Helsingborg, Sweden found some agents not part of the response plan played key roles. These groups were overlooked in the holistic planning yet the agencies were better informed and equipped to offer immediate aid. In research on *Hurricane Katrina*,⁶³ conceptual response patterns and the imbalance between counterproductive and constructive archetypes was the focus. Reactive behaviors were over-represented in their findings, leading to increased conflict, and communication and systemic government failures.

Flora profiled the Society for National Integration through Rural Development's success in involving local communities in India, finding participation in resource identification, capabilities, coping mechanisms, and vulnerability assessments, improved responses.⁶⁴ Flora's work extended a prior observation on the role of community participation and public awareness.⁶⁵ Similarly, Chou and Chen⁶⁶ suggest governments establish permanent recovery institutions and coordinators, but note rescue activities depend heavily on civilians and organizations, evident in the earthquakes, tsunamis, and nuclear radiation damage occurring in Japan in 2011. Other researchers found decision-making in disaster risk management has evolved and re-focused from a top down to a more people-centered approach with participation from local agencies, focused on private citizens.⁶⁷ However

⁶² C. Uhr and H. Johansson, "Mapping an Emergency Management Network," *International Journal of Emergency Management* 4/1 (2007): 104–118.

⁶³ Olejarski and Garnett, "Coping with Katrina," 26–38.

⁶⁴ U. P. S. Flora, "Disaster Management and Possible Strategies for Its Management in India," *National Academy Science Letters* 37/6 (2014): 555–560.

⁶⁵ J. K. Newport and G. G. P. Jawahar, "Community Participation and Public Awareness in Disaster Mitigation," *Disaster Prevention and Management* 12/1 (2003): 33–36.

⁶⁶ S. Y. Chou and D. Chen, "Emergent Disaster Rescue Methods and Prevention Management," *Disaster Prevention and Management* 22/3 (2013): 265–277.

⁶⁷ A. Scolobig, T. Prior, D. Schroter, J. Jorin, and A. Patt, "Towards People-Centered Approaches for Effective Disaster Risk Management: Balancing

insufficient local level resources and an unwillingness to share responsibility for disaster management with authorities often results and local participation created conflict between public and private interests. The solution is to understand both civil and state responsibility.

While participatory processes necessary for recovery are increasing, community-based disaster management is lagging. The growing role of NGOs in disaster relief and assistance in East Asia found civil society organizations emerged to meet urgent needs and area nongovernmental initiatives were critical in relief responses. The role of NGOs has become more significant. In the 2004 tsunami, half the \$14 billion pledged for the catastrophe was implemented by NGOs. Osa noted the magnitude and frequency of disasters exceeds the capabilities of governments and NGOs can mobilize monies and volunteers and make connections and offer services to rebuild communities, including food, water, medical services and shelter.⁶⁸

NGOs provide information and are often the first to arrive at disaster sites before U.N. agencies, FEMA, or governments. NGO's role can be noted in the *Building Back Better* key propositions, in Addendum 1, from a report by former U.S. President Clinton, heading the U.N. Secretary-General's special envoy for Tsunami recovery:

Addendum 1 – The United Nations “Build Back Better” Propositions⁶⁹

PROPOSITION 1: Governments, donors, and aid agencies must recognize that families and communities drive their own recovery.

PROPOSITION 2: Recovery must promote fairness and equity.

PROPOSITION 3: Governments must enhance preparedness for future disasters.

Rhetoric with Reality,” *International Journal of Disaster Risk Reduction* 12 (2015): 202–212.

⁶⁸ Y. Osa, “The Growing Role of Ngos in Disaster Relief and Humanitarian Assistance in East Asia,” in R. Sukma and J. Gannon, eds., *A Growing Force: Civil Society's Role in Asian Regional Security* (Washington, D.C.: Brookings Press, 2013), 66–89.

⁶⁹ William J. Clinton, *Lessons Learned from Tsunami Recovery: Key Propositions for Building Back Better*, December 2006, Office of the U.N. Secretary-General's Special Envoy for Tsunami Recovery (accessed July 20, 2018, http://www.conflictrecovery.org/bin/Clinton-Building_Back_Better.pdf).

PROPOSITION 4: Local governments must be empowered to manage recovery efforts, and donors must devote greater resources to strengthening government recovery institutions, especially at the local level.

PROPOSITION 5: Good recovery planning and effective coordination depend on good information.

PROPOSITION 6: The U.N., World Bank, and other multilateral agencies must clarify their roles and relationships, especially in addressing the early stage of a recovery process.

PROPOSITION 7: The expanding role of NGOs and the Red Cross/Red Crescent Movement carries greater responsibilities for quality in recovery efforts.

PROPOSITION 8: From the start of recovery operations, governments and aid agencies must create the conditions for entrepreneurs to flourish.

PROPOSITION 9: Beneficiaries deserve the kind of agency partnerships that move beyond rivalry and unhealthy competition.

PROPOSITION 10: Good recovery must leave communities safer by reducing risks and building resilience.

NGOs are trusted because they use local staff to offer aid. In the aftermath of the 1995 Great Hanshin-Awaji earthquake in Japan, NGO assistance led to passage of an act to ease the incorporation of nonprofits. The Japan Platform of 2000 is a multi-sectoral system of NGOs, the government, and the community working together as equals. Their role was evident in the 2011 earthquake in Japan. NGOs remain effective even though they are often not acknowledged or accepted, but signs of change include faster regional cooperation and sharing best practices learned the Asian disasters.

Researchers investigated preparedness, impacts, and humanitarian responses in Eastern Uganda landslides following the 2010 flooding and found the community and governments were unprepared.⁷⁰ Similarly, a study

⁷⁰ S. Doocy, E. Russell, Y. Gorokhovich, and T. Kirsch, "Disaster Preparedness and Humanitarian Response in Flood and Landslide-Affected Communities in Eastern Uganda," *Disaster Prevention and Management*, 22/4 (2013): 326–339.

of earthquakes response and recovery in Canterbury, England, found that it mirrored those of U.S. Hurricane Katrina and the Australian bushfires.⁷¹ Other studies evidenced more entrepreneurial (than bureaucratic) community networks adapted to both formal and informal leadership that emerged. Hence, the research proposed a virtual database to allow information sharing among public and private community organizations to better mobilize resources.⁷² The significance of the process raises community awareness, using local knowledge and resources to provide faster assessment and aid. This model for community-based databases advances response management through networking resources.

Conclusion and Future Research

This 20-year review calls for collaboration on naming conventions and across research and practitioner disaster communities, improvements in scaling for promising research and practices regardless of the source (i.e., prestige of research institution, sophistication of the developer or technological innovation of the contribution). This study found using the same academic database in universities from different countries that the results varied, even when using translation software in the searches to minimize this outcome. Depending on an individual's location in the world, even in a prestigious university, understanding of the latest developments may be constrained simply because of an institution's database subscriptions.

A promising development is the rise of professional accreditation and certification in Disaster and Emergency Management. Resources for certificates, programs, webinars, social media links, and smartphone applications can be found internationally.⁷³ However, the unfortunate reality remains as bureaucracies remain unable to handle catastrophes. More collaboration among stakeholders in disaster management is needed at all levels to resolve this longstanding conundrum.

⁷¹ C. Mutch and J. Marlowe, "Lessons from Disaster: The Power and Place of Story," *Disaster Prevention and Management* 22/5 (2013): 385–394.

⁷² J. Li, Q. Li, C. Liu, S. U. Khan, and N. Ghani, "Community-Based Collaborative Information System For Emergency Management," *Computers & Operations Research* 42 (2014): 116–124.

⁷³ A U.S. search found FEMA's website featured many university degree programs, see "The College List," Emergency Management Institute, 2018 (accessed July 20, 2018, <http://www.training.fema.gov/hiedu/collegelist/embadegree/>).