

COMMON ORGANIZATIONAL FEATURES THAT IMPEDE THE
RESPONSE TO NATURAL DISASTERS

A thesis presented to the Faculty of the U.S. Army
Command and General Staff College in partial
fulfillment of the requirements for the
degree

MASTER OF MILITARY ART AND SCIENCE
General Studies

by

EMIR HELIC, CAPTAIN, ARMED FORCES OF BOSNIA AND HERZEGOVINA
B.S., Turkish Military Academy, Ankara, Republic of Turkey, 2005

Fort Leavenworth, Kansas
2019

Approved for public release; distribution is unlimited. United States Fair Use determination or copyright permission has been obtained for the use of pictures, maps, graphics, and any other works incorporated into the manuscript. This author may be protected by more restrictions in their home countries, in which case further publication or sale of copyrighted images is not permissible.

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.					
1. REPORT DATE (DD-MM-YYYY) 14-06-2019		2. REPORT TYPE Master's Thesis		3. DATES COVERED (From - To) AUG 2018– JUN 2019	
4. TITLE AND SUBTITLE Common Organizational Features that Impede the Response to Natural Disasters				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Emir Helic				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Command and General Staff College ATTN: ATZL-SWD-GD Fort Leavenworth, KS 66027-2301				8. PERFORMING ORG REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION / AVAILABILITY STATEMENT Approved for Public Release; Distribution is Unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT Major natural disasters inflict severe damages to property and present everlasting danger to human lives despite technological advances and increased capabilities to provide early warning and response. Developed countries incorporate lessons learned with traditional observable disaster trends in their area to create disaster management systems that provide the best model for mitigating the catastrophic effects of natural disasters. Historically, disaster management systems include more than one governmental organization across a span of hierarchical levels. Recognizing what impedes the response by those cross-organizational systems would offer a chance to address and mitigate observed deficiencies. This study is essential to both military organizations that contribute to the disaster management and to civilian authorities that establish, organize, equip, train, and mobilize disaster management system. The study reveals those impeding elements that are observable despite geographical, cultural, or ethical differences among selected disaster management systems.					
15. SUBJECT TERMS Disaster Management. Defense Support of Civil Authorities.					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT (U)	b. ABSTRACT (U)	c. THIS PAGE (U)			19b. PHONE NUMBER (include area code)
			(U)	147	

MASTER OF MILITARY ART AND SCIENCE

THESIS APPROVAL PAGE

Name of Candidate: Emir Helic

Thesis Title: Common Organizational Features that Impede the Response to Natural Disasters

Approved by:

_____, Thesis Committee Chair
O. Shawn Cupp, Ph.D.

_____, Member
Gregory K. Butts, M.S., M.A., MMAS

_____, Member
Eric J. McGraw, MBA

Accepted this 14th day of June 2019 by:

_____, Director, Graduate Degree Programs
Robert F. Baumann, Ph.D.

The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

COMMON ORGANIZATIONAL FEATURES THAT IMPEDE THE RESPONSE TO NATURAL DISASTERS, by Emir Helic, 147 pages.

Major natural disasters inflict severe damages to property and present everlasting danger to human lives despite technological advances and increased capabilities to provide early warning and response. Developed countries incorporate lessons learned with traditional observable disaster trends in their area to create disaster management systems that provide the best model for mitigating the catastrophic effects of natural disasters. Historically, disaster management systems include more than one governmental organization across a span of hierarchical levels. Recognizing what impedes the response by those cross-organizational systems would offer a chance to address and mitigate observed deficiencies. This study is essential to both military organizations that contribute to the disaster management and to civilian authorities that establish, organize, equip, train, and mobilize disaster management system. The study reveals those impeding elements that are observable despite geographical, cultural, or ethical differences among selected disaster management systems.

ACKNOWLEDGMENTS

First and foremost, I would like to thank my wife, Amela, and our daughters, Lamija, and Esma. I am grateful for your continuous support and patience that allowed me to complete the thesis. To my lovely wife, thank you for encouraging me to take on this project, knowing too well it would take additional sacrifice measured in our time together. To my committee members, thank you for your patience, expertise, and constructive feedback throughout my thesis project. It was your experience in some of the studied cases and the knowledge in disaster management that steered the project and brought it to the finish.

TABLE OF CONTENTS

	Page
MASTER OF MILITARY ART AND SCIENCE THESIS APPROVAL PAGE	iii
ABSTRACT.....	iv
ACKNOWLEDGMENTS	v
TABLE OF CONTENTS.....	vi
ACRONYMS.....	ix
ILLUSTRATIONS	xi
TABLES	xii
CHAPTER 1 INTRODUCTION	1
Background.....	1
The Research Purpose.....	1
The Research Question	3
Assumptions.....	4
Definitions	4
Limitations	8
Scope and Delimitations	9
The Significance of the Study.....	10
Summary.....	10
CHAPTER 2 LITERATURE REVIEW	11
Introduction.....	11
The 2008 Wenchuan Earthquake in China	13
Introduction.....	13
Response	13
Mitigation Measures	16
Structural Failures.....	17
Health Protection	17
International Support	18
The 2011 Great East Japan Earthquake	19
Introduction.....	19
Response	20
Mitigation Measures	21
Fukushima Daiichi Nuclear Power Site.....	23
The 2012 “Superstorm Sandy” in the USA	25

Introduction.....	25
Mitigation Measures	25
Response	27
Summary.....	29
CHAPTER 3 RESEARCH METHODOLOGY	30
Introduction.....	30
Research Questions.....	31
Methodological Design and Analysis	31
Case Description	32
Within Case Analysis.....	33
Cross-Case Theme Analysis	33
Assertions.....	34
Methodology Process and Data Collection.....	35
Organization.....	38
Training.....	39
Material	40
Leadership and Education.....	40
Summary.....	41
CHAPTER 4 ANALYSIS	42
Introduction.....	42
Description of Cases and the Context.....	46
The 2008 Wenchuan Earthquake in China	46
The 2011 Great East Japan Earthquake	50
The 2012 Superstorm “Sandy” in the USA	55
Within Case Analysis.....	60
The 2008 Wenchuan Earthquake in China	60
Organization.....	60
Data Analysis	60
Emerging themes	65
Training.....	68
Data Analysis	68
Emerging Themes	70
Material	71
Data Analysis.....	71
Emerging Themes	72
Leadership and Education.....	74
Data Analysis.....	74
Emerging Themes	75
The 2011 Great East Japan Earthquake	76
Organization.....	76
Data Analysis	76
Emerging Themes	85

Training.....	88
Data Analysis.....	88
Emerging Themes.....	90
Material.....	91
Data Analysis.....	91
Emerging Themes.....	94
Leadership and Education.....	95
Data Analysis.....	95
Emerging Themes.....	98
The 2012 Superstorm “Sandy” in the USA.....	99
Organization.....	99
Data Analysis.....	99
Emerging Themes.....	106
Training.....	110
Data Analysis.....	110
Emerging Themes.....	111
Material.....	112
Data Analysis.....	112
Leadership and Education.....	112
Data Analysis.....	112
Emerging Themes.....	113
Cross-Case Analysis.....	115
Organization.....	117
Training.....	119
Material.....	119
Leadership and Education.....	119
Assertions.....	120
CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS.....	121
Introduction.....	121
Conclusion.....	121
Significance of Study Findings.....	124
Recommendations for Future Research.....	125
Summary.....	126
REFERENCE LIST.....	127

ACRONYMS

CBA	Capability Based Assessment
CDMC	Central Disaster Management Council
CDRH	Central Disaster Response Headquarters
DHS	Department of Homeland Security
DLRO	Department of Logistics and Resource Operations
DOD	Department of Defense
DOE	Department of Energy
DOI	Department of Interior
DOTMLPF-P	Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, Facilities, and Policy
DM	Disaster Management
DRM	Disaster Risk Management
DSCA	Defense Support of Civil Authorities
EMO	Emergency Management Office
FEMA	Federal Emergency Management Agency
GEJE	Great East Japan Earthquake
HQDA	Headquarters Department of the Army
ICS	Incident Command System
JMA	Japan Meteorological Agency
MCA	Ministry of Civil Affairs
NCDR	National Committee for Disaster Reduction
NGO	Non-Governmental Organization
NIMS	National Incident Management System

NISA	Nuclear and Industrial Safety Agency
NRCC	National Response Coordination Center
NRF	National Response Framework
NSC	Nuclear Safety Commission
PAP	People's Armed Police
PLA	People's Liberation Army
POTUS	President of the United States
SDF	Self-Defense Forces
TEPCO	Tokyo Electric Power Company

ILLUSTRATIONS

	Page
Figure 1. Multiple Case Study Chart.....	34
Figure 2. DOTMLPF-P Incorporated into Cross-case Analysis	44
Figure 3. The Widespread Collapse of Buildings in Beichuan Town Killed 75 Percent of the Population	49
Figure 4. Chinese Disaster Management System.....	63
Figure 5. Japan's Disaster Management System.....	78
Figure 6. The Integration of Planning and Disaster Management	101

TABLES

	Page
Table 1. Template Table for the Cross-case Analysis	45
Table 2. The Cross-Case Analysis	116

CHAPTER 1

INTRODUCTION

Background

Major disasters and hazards ravage the surface of the earth almost daily. Agencies of the US Federal government were involved in response to the total number of 377 major disasters that had occurred in the US in the period January 2000 to March 2007 (Williams 2010). Disasters span from natural and man-made hazards that require little response, to hazards that threaten to turn or have already turned into major disasters and require a significant and appropriate response from responsible authorities. The response in this manner refers to actions directed to save lives, protect the property and the environment, stabilize the incident, and provide for basic human needs (DHS 2013b, 1).

Disaster management organizations are usually not stand-alone organizations; their branches include various government bodies spanning levels of governance, aiming to increase the effectiveness by diversifying capabilities. The response to an incident requires all those pre-determined parts and players to come together, and direct efforts of the response to better meet the situation in the affected area. Centralized incident management enables the establishment of a common operational picture (COP) about the incident. On the other hand, the complexity of disaster management organizations can have an undesirable impact on the effectiveness of the response.

The Research Purpose

Disaster management, like many other unique services, reflects its language, procedures, technologies, and culture through the interaction of disaster management

personnel with the outsiders. Individuals and groups originating from organizations directly unrelated to the disaster management can find the terminology uncommon, procedures ineffective, and overall effort slow (DHS 2011, 2). While nation-states tailor respective disaster management systems based on the local legislation, the perceived presence of threats and hazards, and available resources, several features span across most disaster management organizations. These include some hierarchical and standing structure, cross-service and cross-branch coordination mechanisms, and usually a minimum three disaster management stages (preparation, response, and recovery). However, the bureaucracy and the complexity of the disaster management organizations can present the organizational features that impede the work of disaster management organizations.

Major disasters can be devastating, while hazards can quickly turn into disasters; slow, inadequate, or insufficient response increases the risk of loss of life and damage to property. Respective national authorities generally lead contemporary responses to major disasters. Usually, the significant international support accompanies these responses helping the response phase and speeding up the recovery phase. The problem emerging from nation state led responses to major disasters that do not affect neighboring countries is that lessons learned and lessons identified usually remain confined to the national authorities. International organizations and communities that are included in these efforts very often reflect exclusively on their lessons to learn. The significance of the problem is the lack of collaborated source that points out common organizational features that impede the response to major disasters, leaving individual countries to learn from their performance during a disaster.

The purpose of the research is to shed light on processes or characteristics of disaster management on a national level that reduce the efficiency of the initial response to natural hazards and disasters. The research extrapolates the themes and patterns that present the issue among the selected responses to identify shared organizational features that impeded the studied responses. The purpose of the research is not to compare the selected national disaster management systems or to compare the quality of responses against each other. The research aims to increase the overall awareness on the presence of such organizational features and to point out the negative effects that these elements have on disaster responses. There is no expectation that the research will detect and bring forward organizational flaws unseen or unheard of in the disaster management lessons learned the system; the expectation is that the research will distinguish those flaws common to the researched disasters responses and gather those under the single title.

The Research Question

The thesis question is concerned with those common features that are relevant for preparation and the initial response phases. The question is: What are the common organizational features that impede the initial response of the national level disaster management authorities in response to major disasters?

Supporting questions are directed to bring clarity to the overall disaster management system on the nation state level. What triggers the response to a major disaster on the nation state level? How do developed countries who have dealt with major disasters set up and manage disaster response system? Supporting questions enable the understanding of the DM system during the response to the selected disasters.

Assumptions

The overall organization of the national disaster management authorities will remain closely tied to existing resources and capacities that span across governmental agencies and services. The existing differences between researched national disaster management systems will not affect the data collection and the analysis. Despite the limited focus of the qualitative research on only a few major disasters, the qualitative review will produce sufficient meaningful data for academically acceptable conclusion to facilitate further research and discussion.

Definitions

The definitions section covers the terminology related to disaster management. Terminology is in line with the U.S.A. definitions to preserve clarity and prevent misunderstanding as the research progresses through disaster responses across the globe. The sources for the definitions section come from the U.S.A. legislative and the disaster management doctrinal literature. The sources reflect the current terminology to help the understanding of the disaster management system as it is during the research and to set conditions for the research by binding the different national disaster management systems through common terminology. The research will clearly define and explain specific terminology related to foreign disaster management systems as necessary.

Authority Having Jurisdiction (AHJ). An entity that has the authority and responsibility for developing, implementing, maintaining, and overseeing the qualification process within its organization or jurisdiction. This may be a state or Federal agency, training commission, NGO, private sector company, or a tribal or local agency

such as a police, fire, or public works department. In some cases, the AHJ may provide support to multiple disciplines that collaborate as a part of a team (DHS 2017, 61).

Coordinate. To exchange information systematically among principals who have or may have a need to know certain information to carry out specific incident management responsibilities. (DHS 2017, 62).

Critical Infrastructure. Assets, systems, and networks, whether physical or virtual, so vital to the United States that the incapacitation or destruction of such assets, systems, or networks would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters (DHS 2017, 62).

Defense Support of Civil Authorities (DSCA). Support provided by U.S. Federal military forces, DOD civilians, DOD contract personnel, DOD Component assets, and National Guard forces (when the Secretary of Defense, in coordination with the Governors of the affected States, elects and requests to use those forces in title 32, United States Code) in response to requests for assistance from civil authorities for domestic emergencies, law enforcement support, and other domestic activities, or from qualifying entities for special events. Also known as civil support (HQDA 2012, 3).

Emergency. Any occasion or instance for which, in the determination of the President, Federal assistance is needed to supplement State and local efforts and capabilities to save lives and to protect property and public health and safety, or to lessen or avert the threat of a catastrophe in any part of the United States (Stafford Act 1988, Sec. 102).

Emergency Operations Center (EOC). The physical location where the coordination of information and resources to support incident management (on-scene

operations) activities normally takes place. An EOC may be a temporary facility or located in a more central or permanently established facility, perhaps at a higher level of organization within a jurisdiction (DHS 2017, 63).

Evacuation. The organized, phased, and supervised withdrawal, dispersal, or removal of people from dangerous or potentially dangerous areas, and their reception and care in safe areas (DHS 2017, 64).

Incident. An occurrence, caused by either human action or natural phenomena, that requires action to prevent or minimize loss of life or damage to property and/or natural resources (HQDA 2012, 10-11).

Incident Command System (ICS). A standardized approach to the command, control, and coordination of on-scene incident management, providing a common hierarchy within which personnel from multiple organizations can be effective. ICS is the combination of procedures, personnel, facilities, equipment, and communications operating within a common organizational structure, designed to aid in the management of on-scene resources during incidents. It is used for all kinds of incidents and is applicable to small, as well as large and complex, incidents, including planned events (DHS 2017, 64).

Incident Management Team. A rostered group of ICS-qualified personnel consisting of an Incident Commander, Command and General Staff, and personnel assigned to other key ICS positions (DHS 2017, 65).

Local Government. Public entities responsible for the security and welfare of a designated area as established by law. A county, municipality, city, town, township, local public authority, school district, special district, intrastate district, council of governments

(regardless of whether the council of governments is incorporated as a nonprofit corporation under state law), regional or interstate government entity, or agency or instrumentality of a local government; a tribe or authorized tribal entity, or in Alaska, a Native Village or Alaska Regional Native Corporation; a rural community, unincorporated town or village, or other public entity (DHS 2017, 66).

Major disaster. Any natural catastrophe (including any hurricane, tornado, storm, high water, winddriven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, or drought), or, regardless of cause, any fire, flood, or explosion, in any part of the United States, which in the determination of the President causes damage of sufficient severity and magnitude to warrant major disaster assistance under this Act (Robert T. Stafford Disaster Relief and Emergency Assistance Act) to supplement the efforts and available resources of States, local governments, and disaster relief organizations in alleviating the damage, loss, hardship, or suffering caused thereby (Stafford Act 1988, Sec. 102).

Mitigation. The capabilities necessary to reduce the loss of life and property from natural and/or manmade disasters by lessening the impacts of disasters. (DHS 2017, 67).

National. Of a nationwide character, including the local, state, tribal, territorial, and Federal aspects of governance and policy (DHS 2017, 67).

National preparedness. The actions taken to plan, organize, equip, train, and exercise to build and sustain the capabilities necessary to prevent, protect against, mitigate the effects of, respond to, and recover from those threats that pose the greatest risk to the security of the Nation (DHS 2017, 67).

Protocol. A set of established guidelines for actions (designated by individuals, teams, functions, or capabilities) under various specified conditions (DHS 2017, 69).

Response. The capabilities necessary to save lives, protect property and the environment, and meet basic human needs after an incident has occurred (DHS 2017, 70).

Unified Command. An ICS application used when more than one agency has incident jurisdiction or when incidents cross political jurisdictions (DHS 2017, 71).

Whole Community. A focus on enabling the participation in incident management activities of a wide range of players from the private and nonprofit sectors, including NGOs and the general public, in conjunction with the participation of all levels of government, to foster better coordination and working relationships (DHS 2017, 71).

Limitations

The time available for the research is a significant constraint. Taking into account noteworthy and the seemingly increasing number of major disasters worldwide one can barely hope to touch information available. Scientific researches and government inquiries that indeed provide the most accurate and least biased data take a long time to produce and are not always publically available (Creswell 2014, 242-243). This fact limits the research on major disasters that have had a significant impact on societies and governments. The author limits his research to major disasters that occurred long enough to be researched by relevant scientific, academic, and governmental authorities. The research remains focused only on major natural disasters that required a significant response by the respective national disaster management organizations. The study does not encompass incidental or deliberate man-made hazards and disasters regardless of their size and severity.

Scope and Delimitations

This study focuses only on major disasters that provoked a significant response by respective governments and associated disaster management systems. The occurrence of such disasters has increased in the last two decades (Ritchie and Max 2018). Among disasters which provoked a nation-wide disaster response are 2004 Indian Ocean quake and tsunami, 2005 Hurricane Katrina, 2008 Sichuan earthquake, 2010 Haiti earthquake, 2011 Fukushima earthquake and tsunami, and the 2017 Hurricane Maria in Puerto Rico to name some. However, trying to elaborate on all major disasters within the two decades time frame would prove to be beyond capacities of time and resource available. The study encompasses three major disasters and subsequent national responses; the 2008 Wenchuan Earthquake in Sichuan Province in China, the 2011 Great East Japan Earthquake offshores Fukushima Daiichi in Japan and the 2012 Superstorm “Sandy” in the United States of America. Therefore, the research deals with a relatively short period: 1 May 2008 to 30 November 2012. The intent of the study is not to compare the national disaster management systems against each other and claim the best or less efficient system, nor to value the results of the studied responses.

The selected three disasters have had a significant impact on societies, organizations, and infrastructure. The all three selected disasters also provide the abundance of literature for the research. The research is restricted on publicly available official reports by agencies and governments, case studies, scientific and academic journal articles, and news reports on selected major disasters and following disaster responses. The research does not utilize or release any officially restricted information. All times in this research are local, expressed in the 24-hour format.

The Significance of the Study

Natural major disasters inflict severe damages to property and present everlasting danger to human lives despite technological advances and increased capabilities to provide early warning and response. Developed countries incorporate lessons learned with traditional observable disaster trends in their area to create disaster management systems that provide the best model for mitigating the catastrophic effects of natural disasters. Disaster management systems include more than one organization across a span of hierarchical levels. Recognizing what impedes the response by those cross-organizational systems would offer a chance to address and mitigate observed deficiencies. This study is essential to both military organizations that contribute to the disaster management and to civilian authorities that establish, organize, equip, train, and mobilize disaster management system. The study reveals those impeding elements that are observable despite geographical, cultural, or ethical differences among selected disaster management systems.

Summary

This study explores those inherent elements that reduce the effectiveness of disaster management during natural occurrences, followed by substantial consequences to societies and property. The chapter reviews the significance of the disaster management and its complexity at a nation state level, where the disaster management usually falls under the responsibility of a single agency whose efforts get augmented by cross-agency and cross-service capabilities. The first chapter provides insight into the problem and the research question setting the path to chapters two and three, that further elaborate available literature and qualitative study process.

CHAPTER 2

LITERATURE REVIEW

Introduction

The focus of the research is on major disasters and organizational features that impede initial response efforts on nation state levels. The purpose of the literature review is to summarize available literature and sources of information relevant to the research questions. The literature review used two distinct but mutually supporting forms to achieve this purpose, integrating what others have written and said, and building bridges between topics, organizing the literature to match like topics (Creswell 2014, 61). The research uses the data collected from reliable sources to provide the necessary level of depth and retain credibility. Many resources include governmental agencies, credible scholars, and subject matter experts. The sources used in this research mostly consist of qualitative documents, and to a lesser extent, qualitative audio and visual materials (Creswell 2014, 240). The scope of the research, and the time available to conduct this qualitative research, limit the data collection to readily available sources of information.

The research question that the case study is set to answer is: What are the common organizational features that impede the initial response of the national disaster management authorities in response to major disasters? Supporting questions aim to set conditions for a successful answer to the primary research question. What triggers the response to a major disaster on the nation-state level? How do developed countries who have dealt with major disasters set up and manage disaster response system?

Generally, by researching the larger the number of cases, in other words by introducing the maximum variation sampling to the research, researchers manage to

decrease the ambiguity and a generalization (Creswell 2007, 126-128). The maximum variation sampling increases the relevance of the research as it helps the reveal of shared patterns that span across cases (Palinkas, Horwitz, Green, Wisdom, Duan, and Hoagwood 2015, 534). This research aims to achieve maximum sampling from the well documented natural disasters which occurred in the last two decades. Therefore, the research remains focused on the three disasters: the 2008 Wenchuan Earthquake, the 2011 Great East Japan Earthquake, and the 2012 “Superstorm Sandy.”

The time and space present a significant difference between the cases. Therefore, the literature review follows the chronological order. The thesis separates available sources into three distinctive categories to enable academically acceptable research and the least biased analysis: primary sources, secondary sources, and tertiary sources (Turabian 2018, 25). The nation-state level documents present the primary sources; after action reviews, independent reports, academic papers are secondary sources; all other documents, including audio and video sources, are tertiary sources.

Accepting that national disaster management systems might be set in a way to cover the vast array of incidents, the focus of the literature review is on organizational features which respond only to natural disasters. The critical feature of the nation-state level documents review is that it covers only documents that were in effect when the disasters occurred. In the absence of such documents, the focus of the research shifts to after-action reports and lessons learned that best depict those policies and practices that were in use at the time of the disasters. The review of the literature further extracts the data from after-action reports and reviews issued by disaster management agencies, and humanitarian, international or other involved organizations. By reviewing the after-action

reports and reviews, the inquiry establishes what the first response measures to the selected disasters were and how the results of those actions differ from what responders expected. Additional qualitative documents include independent reviews, scientific researches, news articles, and case studies relevant to selected disasters (Creswell 2007, 129-132). The organization of the literature review follows a thematical structure trying to set conditions for the analysis.

The 2008 Wenchuan Earthquake in China

Introduction

The earthquake of the magnitude of 7.8 struck Wenchuan county in the Sichuan province of People's Republic of China (PRC) at 14:28 local time on 12 May 2008. The tremors spread as far as the capital Beijing almost 1,500 kilometers away in the northeast of PRC, and the distant cities like Bangkok in Thailand that is almost 2,000 kilometers in the south (Lo 2014, 29). Officials reported casualties almost instantaneously as the earthquake caused many buildings to collapse trapping people. By the 13 May 2008, there were reports of 9,219 dead and more than 60,000 missing. The PRC government named the earthquake by the province where it occurred.

Response

The Chinese Premier Wen Jiabao took the command of Chief Command Headquarters (CCH) of the Earthquake Relief and Rescue Operation from the very first moment, thus enabling the unified response efforts across the levels of governance. The central government of the PRC in Beijing reacted immediately by issuing an essential directive to the local governments' officials urging them to request the immediate rescue

operations. In the evening of the same day, the central government's minister in charge of the Ministry of National Land and Resources organized a working group to assess the situation and the level of risk from additional damage from mudslides, landslides, the collapse of mountains. At the same time, the Transport Ministry organized a working group to conduct emergency planning to decide which roads and railroads need urgent repair to boost the rescue operations. Initial efforts mirrored Wen's guidance just hours after the earthquake: (1) mobilize more troops to save the most citizens in the shortest time possible; (2) open the paths and roads to the affected areas at all costs; (3) efficiently deploy medical agencies and units to the disaster area, (4) fully resettle rescuees and survivors and protect them from the adverse weather and after-shocks (Lo 2014, 35).

The government's centralized approach to the disaster and control helped the responding forces to overcome these initial challenges quickly. Premier Wen's overall directive was to direct all efforts into saving lives and easing the suffering of survivors by bringing more rescuers to dig through the rubble while simultaneously improving the road and shelter conditions. On 14 May 2008, the Standing Committee of Chinese Communist Party Politburo concluded the meeting confirming that the rescue operations are progressing systematically due to the whole-government approach and extensive citizen support. (Lo 2014, 40). Indeed, the provinces not affected by the earthquake quickly collected donations and delivered billions of yuan in money and supplies, with the public and private companies donating the money and supplies. Independently from the government's efforts, citizens in the nearby towns, counties, and provinces self-organized to donate blood, money, or to help in whatever way possible (Lo 2014, chap. 1).

The military headquarters in Chengdu, the province capital, initiated the emergency response plan and dispatched the personnel to the Wenchuan county in less than two hours. The national and provincial headquarters for disaster management, including the medical command services, were set up within the same timeframe (Shen, Kang, Shi, Li, Li, Su, Wu, Zheng, Jiang, Hu, Yang, Tang, Wen, Li, Shen, and Zhong 2012, 76). Almost simultaneously, the nearby Chongqing province mobilized military, police, and medical resources to take part in the response at once. The People's Liberation Army (PLA) Command Headquarters mobilized their airborne troops and parachuted over 4,000 while dispatching in over the 60,000 troops to the affected areas in less than one day after the earthquake (Lo 2014, 36). The Ministry of Health organized and dispatched 51 medical teams with more than 2,000 personnel in 24 hours after the earthquake (Yang, Chen, Liu, and Zheng 2014, 1133). The trouble was that there was only a limited number of specially trained rescuers in the larger cities under the leadership of different organizations (Lingling, Jiexiu, and Lianyou 2008, 129-30). The overall number of PLA deployed was 113,000 active duty and reservists.

The destroyed road infrastructure affected the speed of the initial response despite the overwhelming number of PLA, People's Armed Police (PAP), and other personnel which deployed to the area. Rescue troops had to walk over the steep terrain for hours crossing distances as long as 90 kilometers, to arrive at the affected areas by afternoon on 13 May 2008; and only the small groups of up to 200 rescuers arrived. By 14 May 2008, the PLA airlifted 11,420 soldiers to Chengdu with provinces neighboring Sichuan mobilized reserves to open devastated roads and deliver rescuers. On the same day, the significantly greater groups of rescuers reached some larger communities either on foot,

or by helicopters, or by parachuting in delivering necessary supplies the same way (Lo 2014, 44). The situation was tense in some areas where the additional tremors and subsequent landslides trapped the rescue teams while the rain and debris prevented helicopters from landing there (Lo 2014, 40)..

The rescue efforts were already visible at the Chengdu airport on the 13 May 2008 where PLA, PAP, firefighters, and medical personnel massed the considerable amounts of tents, blankets, medical supplies, and food (Lo 2014, chap. 2). Even with these extraordinary efforts, survivors were facing the shortage of basic life needs such as food, potable water, and shelter forcing many to initiate long marches over the rugged terrain to Chengdu some 100 kilometers away. The lack of a more extensive vertical lift capability significantly reduced the capacity of PLA to respond quickly to the remote areas.

Mitigation Measures

Sichuan province is the earthquake-prone region where the steep mountains with over 4,000 meters' altitude in the west meet eastern plateaus and valleys (Chan and Lee 2016, 14). The PRC worked for decades extensively on the disaster mitigation and preparation measures. In theory, the mitigation and preparation included all levels of governance in a way that would complement the national disaster preparedness. However, the lowest levels of governance generally ignored the need for education on disaster preparedness. Hence the education was sporadic and limited; general public was unaware of risks and ways to mitigate those risks (Lixin, Lingling, Dong, Junxue, and Zhanwu 2012, 305; Zhang, Yi, and Zhao 2013, 2225). The China Earthquake Administration was responsible for the earthquake prediction and prevention throughout

the utilization of the extensive network of seismic reference and telemetric stations. The Earthquake administration primarily worked on the forecast of earthquakes based on historical data and the scientific methods of the forecast (Lixin et al. 2012, 297-300). The seismic networks in China were not the early warning system like one in Japan. The China Meteorological Administration was responsible for the mitigation and prevention of meteorological disasters (Lixin et al. 2012, 297-300).

Structural Failures

While Premier Wen was personally directing the rescue operations confirming that the central government and the Communist party were doing everything in their power, many parents felt a different way. Many schools collapsed trapping thousands of students and teachers under the debris. More than 6,000 students died in their schools before any help could reach them (Earthquake Committee 2014, 1). The prospect of saving children trapped under the debris diminished each passing hour as the rescuers only had their hands and light hand tools. The community blamed the local government's bureaucratic corruption for the so-called "tofu" schools, referring to the substandard concrete used in the construction of those schools (Lo 2014, 38). Indeed, some research lists substandard construction that did not incorporate the seismic design requirements as a substantial cause for the widespread destruction (Earthquake Committee 2014, 37).

Health Protection

The widespread destruction, loss of life, and failure of essential services leaving large areas without electricity, water, and health protection concerned the authorities. Such conditions might cause possible outbreaks of communicable diseases. The reason

for the concern comes from the fact that in the mountainous region of Sichuan emergency health services were located on county-level making them extremely understaffed and underequipped to deal with the disaster of this magnitude (Chan and Lee 2016, 16). The government ordered the implementation of special preventive measures to prevent the outbreaks, saturating the affected region by 15 May 2008 with more than 10,000 health workers from various agencies and organizations. The special measures were: the safety of food and potable water, environmental disinfection, the vaccination of the survivors, the proper arrangement of the corpses of deceased, the close and continuous monitoring of possible outbreaks, and the proper hygiene and health safety of medical workers (Lo 2014, 16). Probably the best care was provided by the military medical units, which were more mobile and self-sustainable. The military also opened the field hospitals that served as the initial care and triage points (Zhang et al. 2012, 856).

International Support

The Wenchuan earthquake was the first time in the history of the PRC to seek rescue assistance from the other countries (Lingling, Jiexiu, and Lianyou 2008, 22). The first to respond to the earthquake actively were Japan and Taiwan who offered to send their rescue teams to the area. Countries like Russia, Singapore, and South Korea followed the example immediately with their rescue teams, while organizations such as European Union and the United Nations Central Emergency Response Fund donated a significant amount of money (Lo 2014, 45). Some neighboring countries used their civilian airplanes to deliver thousands of tons of humanitarian relief and supplies. The US used the C-17 planes to deliver much-needed tents, blankets, and other necessities to the PRC. Additionally, the US announced that the US satellites did not find leakage in the

Chinese nuclear testing facilities. The other significant form of help from the US came in the form of exchange of information on how the US has dealt with the disease control after hurricane Katrina in 2005. Despite the considerable interest in the earthquake and its outcomes, the United Nations' presence in the field had a relatively small footprint (Chan and Lee 2016, 21).

Many national and international Non-Governmental Organizations (NGO) offered their assistance and support to PRC and the people of China after the earthquake. Some NGOs reacted as soon as the news of earthquake spread throughout China, while the majority waited for the next 24 hours to initiate their actions. Numerous Chinese and international NGOs took some part in response to the earthquake and later in the recovery phase. This time the Central Government allowed both national and international NGOs to take broader part in the rescue and recovery operations (Yang 2017, 36-39). However, unlike some other disasters where the NGOs remained devoted through the response and recovery phases, in the Sichuan earthquake, the number of NGOs involved significantly diminished within a year.

The 2011 Great East Japan Earthquake

Introduction

Japan is the nation accustomed to living in the earthquake-prone region. The earthquake that struck Japan in 2011 was the strongest ever measured in Japan (Mimura, Yasuhara, Kawagoe, Yokoki, and Kazama 2011, 805). The official name used for this earthquake is the Great East Japan Earthquake (GEJE), as named by the Japanese Government (The Japan Society of Mechanical Engineers 2014, 9). The centuries of earthquakes and tsunamis shaped the people and their lives, making the Japanese

protection measures against disasters one of the most developed in the world. The protection measures involved evacuation drills and ever-evolving policies on the soft side, with the inclusive earthquake and tsunami early warning systems, tsunami walls, floodgates, and earthquake and tsunami proof shelters on the hard side (Rauhala 2011).

Japan founded its tsunami protection measures on historical data. The most widely used data was from the tsunami which hit the shores of Japan in 1960, limiting the tsunami height threshold to three to six meters at the most. Thus, it was reasonable to conclude that people felt relatively safe behind tsunami walls that in some places rose as much as 10 meters above the sea surface along Sanriku coast (Koshimura and Shuto 2015, 6). However, these measures meant little when the earthquake of magnitude 9.0 struck 76 kilometers off shores Honshu island in the Pacific Ocean at 14:46 local time on 11 March 2011 creating the tsunami that penetrated existing tsunami walls.

Response

Japan has a long history of adaptive disaster management. The Disaster Management Council was in charge of all disaster-related matters at the national level as the lead governmental permanent body at the time of GEJE (Ranghieri and Ishiwatari 2014,72-73). When the earthquake struck, Prime Minister Naoto Kan acted immediately by establishing the Headquarters for the Disaster Response (Umeda 2013, 5). The Headquarters mobilized the extensive rescue operation with Japan Self Defense Forces, the Inter-Prefectural Emergency Police Forces, the Emergency Fire Response Teams, the Disaster Medical Assistance Teams. The disaster management system included not only the governmental agencies but also the private companies and NGOs. The Japanese Red Cross Society (JRCS) generally acted as the public relief organization under the Disaster

Rescue Law and as auxiliary to the official organizations included in the response.

(Umeda 2013, 4; Ranghieri and Ishiwatari 2014, 71-74, 128-28).

With the declaration of the state of emergency, the Cabinet Office initiates the implementation of the Basic Disaster Management Plan (BDMP). The BDMP serves as the framework for the lower levels of governance and designated public agencies to establish respective Disaster Management Operations Plans and Local Disaster Management Plans. Therefore, the prefectures have the primary responsibility for disaster management and the response. However, the established disaster response Headquarters serves only as of the coordinating body at the national level responsible for overseeing the implementation of emergency activities. In the case of GEJE, the Government had to step in and provide additional resources as some municipalities got destroyed entirely and local governments could not deal with the cost of response activities (Umeda 2013, 6-7). The Government of Japan requested the construction of temporary houses to accommodate the hundreds of thousands of evacuees that either lost their homes or were unable to return to their homes due to the radiation spill. The plan was to build 30,000 temporary houses in the first two months under the Disaster Response Law (Umeda 2013, 23-24). Unfortunately, the lack of workforce, materials, and other factors played into the quality of these temporary houses (Ranghieri and Ishiwatari 2014,195).

Mitigation Measures

The damage from the earthquake was not as extensive as in 1995 when the Kobe earthquake resulted in the significant infrastructure damage and loss of life for 6,000 citizens of Kobe. The Japanese authorities learned a great deal from the Kobe earthquake and implemented those lessons into all spheres of life to protect against future

earthquakes. These measures included stricter building codes, seismic detection, earthquake early warning system connected to the multichannel dissemination systems, hazard mapping, immediate halt, and evacuation for railways, and finally evacuation drills and education for society (Ranghieri and Ishiwatari 2014, 10; Talbot 2008).

The Government of Japan undertook significant activities in protecting the buildings from earthquakes after 1995 introducing the Act for Promoting Seismic Retrofitting of Existing Buildings. Under this Act, the Government and local governments tried to promote the seismic retrofitting by providing various subsidies to strengthen the resilience of buildings and homes. In addition to the activities under the Act, the major upgrades of existing and new infrastructure took place in years following the Kobe earthquake, reinforcing highways, railroads, bridges. As a result, the infrastructure did not suffer catastrophic damage from the earthquake, and most damages to the infrastructure came from the tsunami (Ranghieri and Ishiwatari 2014, 33-38).

In 1997 the Government of Japan issued guidelines for tsunami countermeasures consisting of 3 basic concepts: (1) building physical barriers to protect lives and properties; (2) efficient urban planning to create tsunami-resilient communities throughout the land management and arrangement of facilities to provide vertical shelters; (3) evacuation planning, public education, and the dissemination of information about the threat. These guidelines resulted in hazard maps, which local governments disseminated to the communities and local businesses; hazard maps included areas flooded by the previous tsunamis, areas likely to be flooded in any future tsunamis, evacuation guidelines, and shelter information. Many coastal communities then conducted evacuation drills regularly to maintain the level of preparedness.

Fukushima Daiichi Nuclear Power Site

Fukushima Daiichi's seismic sensors picked up the ground movement at 14:46 initiating the automatic shutdown procedures that would keep the three nuclear cores stable in case of an emergency. Within a minute, all three reactors were shut down, and the Fukushima Daiichi personnel was following established safety procedures. The challenge with the nuclear reactors is that the fuel continues to emit the heat long after the fission has stopped (Lochbaum, Lyman, Stranahan, and the Union of Concerned Scientists 2014, 7). Keeping the heating fuel rods under control requires the water used in electricity production to continue to submerge the core of the reactor. With the lost external power, Fukushima Daiichi's automated back-up generators immediately switched on continuing to provide electricity that runs safety systems (The Japan Society of Mechanical Engineers 2014, 91). The historical data reduced the risk of tsunamis more massive than 6.1 meters at the Fukushima Daiichi site; hence the authorities built the main facilities on 10 meters high platform in addition to the tsunami wall that extended to the sea (The Japan Society of Mechanical Engineers 2014, 12).

The first tsunami wave hit the Daiichi Nuclear site's tsunami wall at 15:27; the sea walls easily deflected this four meters high wave. However, at 15:35 the new wave at the height of almost 16 meters penetrated tsunami defenses at the Daiichi flooding the main facilities with the back-up power generators and distribution systems (Lochbaum et al. 2014, 10). The tsunami caused significant damage to the Daiichi power plant, destroying the heat exchangers and seawater pumps, preventing the procedural cooling of the cores. At 19:45, Premier Kan declared the nuclear emergency, ordering the

evacuation of the population in the areas surrounding the Fukushima Daiichi. The Government later extended the evacuation zone several times.

Soon the crews operating the nuclear power plant found themselves facing their worst nightmares: all measuring devices and indicators failed; they had to perform untried emergency procedures; emergency manuals lacked clarity. Also, the crew could access the manual controls to the core and steam venting systems only through the dark, flooded, and possibly contaminated nuclear reactor buildings. In the end, chemical reactions caused by the overheating cores accumulated the hydrogen gas in the reactor building causing the explosions releasing the radiation into the atmosphere (Lochbaum et al. 2014, chap. 1, chap. 3; The National Diet of Japan 2012, 12-19).

The response measures included the deployment of Japan Self Defense Forces and US military assets to measure the radiation from the ground or air and provide specialized personnel and equipment trying to prevent the spread of radiation. In the final stages, the responders used various robotic equipment to mitigate the adverse effects of high radiation (The Japan Society of Mechanical Engineers 2014, chap. 5; Dion-Schwarz, Evans, Geist, Harold, Koym, Savitz, and Thrall 2016, chap. 6). Ultimately, the safety systems could not operate without the electrical power, and the limited access by debris and the series of unforeseen events hindered all alternative ways to prevent the meltdown (Carle 2015, 4). The sum of natural disaster consequences and human-made errors led to the overheating of cores and the nuclear meltdown (The National Diet of Japan 2012, 15). The tsunami was the primary cause of the subsequent nuclear meltdown at Fukushima Daiichi and the release of radiation in the environment (The Japan Society of Mechanical Engineers 2014, 9).

The 2012 “Superstorm Sandy” in the USA

Introduction

The post-tropical storm, later known as the hurricane or Superstorm Sandy, formed on 22 October 2012 in the central Caribbean. As the storm moved northwards across the Atlantic, it intensified into the hurricane. The storm Sandy hit the shores of New Jersey in the vicinity of Brigantine on the evening of 29 October 2012 with heavy rainfall and hurricane winds over 90 miles per hour (NOAA 2019). The storm engulfed 24 US states at different levels of landfall. The storm left almost 8,6 million people without electrical power, destroyed 570,000 homes and buildings, killed 162, and caused \$70.2 billion of damage making it the second-costliest hurricane after 2005 Katrina (DHS 2013a, iii; FEMA 2018).

The Federal Emergency Management Agency (FEMA) coordinated the large scale response operation, which included all levels of government, communities, NGO, and non-profit organizations. Numerous other federal and state agencies, as well as the military, took part in the response providing the healthcare, food distribution, fuel distribution, debris removal, and draining flooded areas. FEMA mobilized the prepositioned stocks, operation centers, and worked hard on providing the necessary resources to increase the efficiency of the response and begin the recovery. However, FEMA also recognized challenges in preparing and deploying its personnel, as well as in working with Federal partners, local governments, and communities (DHS 2013a, iii).

Mitigation Measures

The East Coast was not new to tropical cyclones – an overall term that includes hurricanes, tropical storms, and tropical depressions. The area suffered from 98 tropical

cyclones since 1842, which passed within 200 nautical miles from NYC (Torres et al. 2015, 4). Out of those tropical cyclones, 33 were hurricanes category two and higher (Torres et al. 2015, 4). The experiences with storms led to the establishment of protection and mitigation measures along the coast in an attempt to mitigate floods and subsequent damages. While the measures varied not only from state to state but also among regions within each state, we summarize them as natural and man-made barriers. Variety natural barriers such as beaches, dunes, barrier islands, wetlands, and bluffs fringed the USA coasts (DOI 2013, 13-14). The residents of coastal areas later enhanced many of these natural barriers to improve their efficiency; for instance, thousands of metric tons of sand brought from elsewhere contributed to the creation of dunes behind beaches. The manmade barriers along the USA coast included seawalls, groins, bulkheads, revetments, and piers (SSIR 2013, chap. 3).

The responsibility for the regulation of waterfronts and waterways entwines among several agencies and departments from across the city, state, and federal-national levels (SSIR 2013, chap 3). The partnership among those agencies contributed to the execution of several studies and projects aimed at reducing the risk from floods and storms (SSIR 2013, chap 3). However, the time consuming nature, required funding, lack of census on solutions, and occurring emergencies, slowed or completely stopped some of those projects. Regardless, the coastal defenses that were in place before the Superstorm Sandy provided some level of protection despite Sandy's extraordinary energy and the amount of water it brought. Hurricane Sandy caused flooding by one of three ways or by a combination of: (1) bringing water from the Atlantic Ocean causing the beach erosion and over-wash of coastal defenses; (2) bringing water throughout the

unprotected backdoor waterways; and (3) finally by overtopping the drainage and sewage system (SSIR 2013, chap 3).

Response

Unlike earthquakes in China and Japan, the meteorological authorities were able to predict hurricane Sandy before it hit northeastern US states, giving a window of opportunity for preparation. Numerous US governmental agencies and non-governmental bodies tracked hurricane Sandy closely with radars, airplanes, and satellites from its inception on 22 October 2012 to the final dissipation of the hurricane on 31 October 2012 (Blake, Kimberlain, Berg, Cangialosi, Beven 2013, 4). The close monitoring allowed the states on the eastern coast of the US to prepare by issuing appropriate warnings, initiating the evacuation, and mobilizing the National Guard. It also provided the opportunity to the President of the United States (POTUS) to declare the state of emergency for several states in Sandy's path on 28 October 2012. The declaration of emergency expedited the preparations for the oncoming hurricane; FEMA deployed about 900 personnel and established staging and support centers in multiple states in the northeast (DHS 2013a, 4-5).

The early declaration of the emergency also allowed FEMA to transfer the resources directly to the lower levels of governance (Ladislav 2013). Subsequently the POTUS signed the emergency declaration for some other states in the northeast, and finally, he signed the major disaster declaration for 12 states enabling the Federal assistance to the affected communities (DHS 2013a, 4-5). States nationwide mobilized 60,000 National Guard and Air Force members in an expectation to deploy them in the rescue operations. In the end, 11,000 National Guard members deployed to the affected

areas next to the 17,000 Federal personnel (DHS 2013a, 5). The states also anticipated the response, thus activating their whole community approach to the hurricane, which proved to be a key element for the immediate response (Ladislaw 2013). The focus in the first 72 hours was on saving lives and assisting the first responders in restoring power and stabilizing the communities.

When the hurricane hit the shores of New Jersey and New York, it crippled the transport and the power distribution affecting the vast area and millions of people. High waves penetrated coastal barriers where there were some and flooded the nearby communities. In New York, the ocean water made its way to the subways and tunnels cutting off the electrical power, covering streets (FEMA 2018). The ocean water washed away many homes in New York, affecting some 305,000 homes. In New Jersey, the ocean rendered unusable 22,000 homes, displacing more than 61,000 families (Hatzikyriakou and Lin 2018, 2-3). In New York, water made its way to the flood resistant hospital basements flooding the back-up generators and forcing the evacuation of at least two hospitals amid a hurricane (Powell, Hanfling, and Gostin 2012, 2569).

In the aftermath of the hurricane, the FEMA continued to coordinate the multi-agency response to provide the restore the power and stabilize the affected area. The unity of effort was crucial. To achieve unity, the FEMA utilized the online crisis management system, WebEOC, which enabled timely information sharing among the Federal responders (DHS 2013a, 9) FEMA established the Energy Restoration Task Force which coordinated DOD, other states, and utility company efforts to transport areas the necessary equipment and over 70,000 workers to restore electrical power in the affected (DHS 2013a, 6). The US Army Corps of Engineers assisted with pumping out

the water from flooded subways and tunnels in New York, restoring the 80 percent of transport capacities by 5 November 2012 (DHS 2013a, 6). Fuel distribution was an acute problem. The Energy Restoration Task Force coordinated the fuel supply points for first responders while working on the restoration of electric energy as the precursor for normalization in fuel supply (DHS 2013a, 6). Finally, all levels of governance participated in the assistance to the hurricane survivors who lost their homes. The Federal Government worked through FEMA to provide initial repairs to lightly damaged homes, assist survivors with paying rents in the temporary housing, and through working on long term housing solutions.

Summary

The literature review aims to organize available literature into orderly sections that will enable meaningful analysis in the following chapters. The literature review consists of three sections that cover the selected disasters. The literature review within these sections contains subsections divided by prevailing themes. All themes then extrapolate the information from all three levels of sources. Understanding that the language barrier might affect the availability of official documents and reports, the research included case studies, independent reviews, news articles, and scientific studies to extract necessary information.

CHAPTER 3

RESEARCH METHODOLOGY

Introduction

The third chapter deals with the research methodology and the analytical processes utilized in the research. The methodological approach for the thesis is qualitative research while the research design within the qualitative methodology is a case study which encompasses multiple cases (Creswell 2007; Creswell 2014). Although the case study covers three specific and distant cases, the inquiry does not focus on the cases trying to evaluate the national response to the selected disasters, but it focuses on an issue as described by the research question (Creswell 2007, 74). The research seeks to isolate previously detected issues inside the selected cases by conducting the within-case analysis (Creswell 2007, 73-76).

The within-case analysis helps to organize all three cases in line with the DOTMPLF-P construct, classifying events, activities, and processes in the common organizational areas by identifying emerging patterns and themes presenting the issue (Creswell 2007, 163-164). This analysis is then followed by the cross-case examination of the identified themes and patterns to bring forward shared features relevant to the research question (Creswell 2007, 73-76). The cross-case analysis' quality depends mostly on the quality of within-case analysis and the ability of a researcher to identify and classify the sub-elements of the researched cases to match DOTMPLF-P construct. The cross-case analysis allows for the detailed background examination of areas of concern (Creswell 2007, 76-81).

Research Questions

The primary research question is: What are the common organizational features that impede the initial response of the nation-state disaster management authorities in response to major disasters? Supporting questions that assist in answering the primary research question are: What triggers the response to a major disaster on the nation-state level? How do developed countries who have dealt with major disasters set up and manage disaster response system?

Methodological Design and Analysis

The qualitative research conducted through the multiple case study design requires an in-depth examination of the case or cases pertinent to the research question (Creswell 2007, 73). The case study approach is useful when the research includes cases with easily identifiable boundaries and aims to provide an extensive understanding of the cases or to compare the cases against each other (Creswell 2007, 74). The multiple case study analysis flows across several distinct steps starting with the description of the case or cases, followed by the within case analysis which enables the cross-case analysis and ends with generalizations (Creswell 2007, 172). Selecting the case study design made sure that the data collection is extensive, yet focused on relevant cases and themes (Creswell 2007, 73). The cross-case analysis methodology within the multiple case study design extends a researcher's knowledge past the single case. The cross-case analysis allows a researcher to reveal different factors that affected the outcomes of studied cases, to reveal why some cases are similar or different (Khan and VanWynsberghe 2008). From the analysis quality stance, including the variety of sources for the analysis promotes its accuracy and ensures good academic standards.

The case study design provides insight into themes and patterns, tying the analysis to the four selected elements of the DOTMLPF-P construct. The research examines the selected cases across elements of organization, training, material, and leadership and education. Selecting the three directly unconnected but world-wide researched cases for the case study, namely the the 2008 Wenchuan Earthquake in Sichuan Province in China, the 2011 Great East Japan Earthquake offshores Fukushima Daiichi in Japan, and the 2012 Superstorm “Sandy” in the United States of America offers necessary in-depth detail to identify the common themes and conduct the cross-case analysis (Creswell 2007, 163). Organizing the within-case analysis under the DOTMLPF-P elements funnels the data to common headings; thus, the DOTMLPF-P construct provides the framework for the selection of themes for the cross-case analysis. The number of selected DOTMLPF-P elements does not affect the sequence and the number of steps for the multiple case study methodology. The number of steps or phases in this methodology varies from one researcher to another, as some researchers elevate sub-steps to the level of steps of analysis; the logical sequence and overall structure remain (Creswell 2007, 163-164, 172). The research analyzes the selected disaster responses in four distinct steps following all cross-case analysis sequences (Creswell 2007, 163).

Case Description

Providing a detailed description and a context of the cases sets conditions for a meaningful analysis of presented cases (Creswell 2007, 163-164). The focus of this step or phase of the research remains on those conditions which are relevant for the primary and supporting research questions (Creswell 2007, 75). The description of the cases includes the portrayal of each of selected cases, the severity and consequences, and the

initial response by the respective national disaster management authorities. The study exploits numerous open sources documents, ranging from the officially issued plans and assessments to independent studies to analyze thoroughly as possible.

Within Case Analysis

The second step in this analysis is to inspect selected cases to establish patterns and themes (Creswell 2007, 246). The focus of the analysis is on the preparation or mitigation phase, and the response phase to the studied disasters. The importance of this step originates from the classification of themes within the thematic framework provided by the DOTMPLF-P construct. The within-case analysis leads the classification of the patterns and themes to correspond to the four selected elements of the DOTMPLF-P construct: organization, training, material, leadership and education. Creswell (2007, 163) recognizes this as “pulling the data apart and putting them back together in more meaningful ways.” Achieving the necessary depth of details requires the analysis to include the lessons learned relevant for the selected disasters. Thus this step encompasses the lessons learned from each of the selected disasters. Identifying and grouping patterns under the DOTMPLF-P introduce conditions for the cross-case analysis. The within case-analysis provides answers to the supporting research questions.

Cross-Case Theme Analysis

As a research method, the cross-case analysis compares commonalities and variances among events, activities, and processes which a researcher uses as the units of analysis in the case study (Khan and VanWynsberghe 2008). In the third step of the analysis, the research compares the thematic DOTMPLF-P results from the within-case

analysis, bringing to light the similarities and the differences among the cases (Creswell 2007, 163). The cross-case analysis provides an answer to the primary research question and generates meaningful data to conduct the final step of the analysis. Figure 1 depicts the cross-case analysis process utilized in this research.

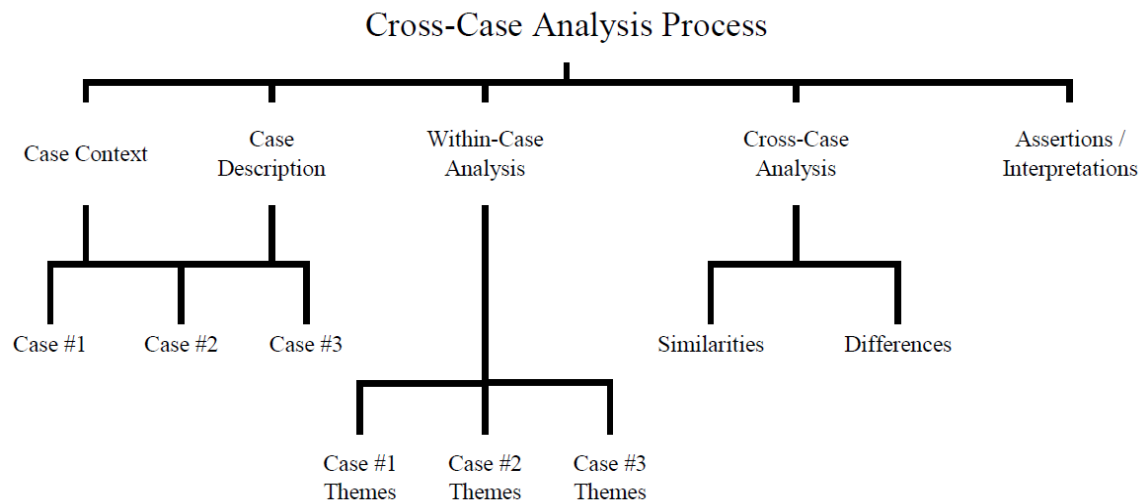


Figure 1. Multiple Case Study Chart

Source: Creswell 2007, 172.

Assertions

Creswell places assertions, or interpretation of the meaning of the case as the final step in the cross-case analysis methodology; he sees the final step as the “lessons learned” from the case (Creswell 2007, 196). The interpretation of the results of the cross-case analysis requires an academic rigor that keeps the researcher’s interpretation of case unaffected by personal biases. The continuous validation of findings throughout the research maintains the rigor. The purpose of the validity check is to ensure the

accuracy and credibility of the research results. To control the accuracy of findings, a researcher employs specific procedures; in other words, a researcher applies a qualitative validity (Creswell 2014, 273). The procedures that a researcher employs to check the accuracy are known as validation strategies. To check the accuracy of this research, the researcher applied several validation strategies, reflectivity, negative or discrepant information, and peer debriefing (Creswell 2014, 251-52). Along with the qualitative validation, a researcher utilizes the qualitative reliability to check the credibility of findings. Qualitative reliability refers to a researcher's consistent approach across different researches (Creswell 2014, 251).

Methodology Process and Data Collection

The focus of the inquiry remained on the national response to the three specific natural disasters. The reason for the selection of the three natural disasters lies in their undeniable impact on economies, regions, and nations where they had occurred. The purpose behind the study of the 2008 Sichuan earthquake, 2011 Daichii earthquake and tsunami, and the 2012 Superstorm "Sandy" is to provide a better purposeful sampling for the case. While the selection of these specific cases provides the necessary sampling, it also bounds the case study within a specific timeframe and the acceptable number of cases (Creswell 2007, 76). The sampling strategy in this collective case study is the maximum variation sampling (Creswell 2007, 129). The maximum variation refers both to the selection of cases and the data collection.

Selecting different cases in this purposeful sampling strategy aims to represent the multiple perspectives of the issue the research question is trying to answer (Creswell 2007, 125-129; World Health Organization Essential Medicines and Health Products

Information Portal 2004). The scope, distances between the subject sites, and time constraint reduce the possibility of collecting information from interviews, direct observations, participant observations, and the collection of physical artifacts (Creswell 2007, 73). Thus, the data collection in the research is limited to the review of qualitative documents as the only way to conduct this multi-site inquiry (Creswell 2007; Creswell 2014). Collecting data from multiple credible sources provides the depth necessary to set the context and understand each of the selected cases (Creswell 2007, 73-75). The research utilizes only the readily existing information eliminating the need for the on-site research and the construction of additional data.

There are several disadvantages of the cross-case analysis that are inherent in the multiple case study research methodology. The first disadvantage relates to the fact that the research covers several directly unrelated cases requiring the in-depth analysis of each selected case (Creswell 2007, 76). The research mitigates this by focusing on specific issues of the selected cases that directly contribute to answering the research and supporting questions. The number of included cases presents the second disadvantage. More cases could potentially produce better results, but on the other hand, more cases could hypothetically result in an increased ambiguity and inconclusiveness (Creswell 2007, 76). The third disadvantage of the selected research methodology is that it is difficult to establish clear boundaries for the research. Specific activities of interest within the selected cases might not have clear boundaries in time or space, so constraining the research within time and space may be challenging (Creswell 2007, 76). Additionally, the inquiry in part addresses events that took place outside of the U.S., creating what is known as “field issues,” issues of data collection which may contribute

to the unavailability of the necessary information (Creswell 2007, 138-142). The extensive collection of data from multiple resources spanning from the official documents and reports to independent studies and news articles offers the mitigation for field issues (Creswell 2007, 138-142).

The inquiry analyzes the selected cases through the scope of the US Department of Defense's (DOD) doctrine, organization, training, material, leadership and education, personnel, facilities, and policy (DOTMLPF-P) construct. The DOD utilizes the DOTMLPF-P analysis in the Capabilities Based Assessment (CBA) to identify required capabilities, analyze current capabilities and identify capability gaps, and recommend possible materiel or non-materiel solutions (HQDA 2013, 15-19; DLRO 2016, 2). The DOTMLPF-P offers thorough analysis across eight domains while preserving the analytical rigor (DLRO 2016, 2, 12). DOTMLPF-P can be used independently of the CBA when the organization is not envisioning the new material solution to the capabilities gap (DLRO 2016, 12). In addition to being a construct for analysis, the DOTMLPF-P also serves as the framework to classify and prepare elements for the CBA or other analytical methods (CJCS 2016, C-2).

The usefulness of the DOTMLPF-P comes from its simple, yet comprehensive content and construction that offers a comfortable arrangement and the analysis of collected data. The DOTMLPF-P represents a coding system which permits a meaningful classification of the data in both the collection and later in the analysis phases (Creswell 2014, 246-250; CJCS 2016, C-2). As the time available for the research presents a significant constraint, of the eight domains of the DOTMLPF-P, the research encompasses four as the most appropriate and relevant ones for the research (McLeod,

Nacouzi, Dreyer, Eisman, Hura, Langeland, Manheim, and Torrington 2016, 1-2; Shoomaker 2013). Picking out organization, training, material, and leadership and education enables the analysis of themes for each case, and then across different cases (Creswell 2014, 249). Selecting the four DOTMLPF-P elements narrows the analysis from the broad front to the focused areas helping to identify overarching themes or issues among the cases (Creswell 2007; Creswell 2014). When used as a coding system, the DOTMLPF-P enables the recognition of issues and themes related to the research question proving especially suitable for the classification of collected data. The proper classification based on DOTMLPF-P enables effectual within-case analysis laying a necessary foundation for the cross-case analysis (Creswell 2014, 249). The earlier identified issue of the limited availability of official documents in the English language originating from Japan and China restricts the full potential of DOTMLPF-P analysis. Regardless of this fact, the research encompasses numerous official documents and reports, after action reviews, lessons learned reports, independent studies, and articles that provide valuable information.

Organization

The definition of an organization relates to an association or group of persons with corresponding objectives (DHS 2017, 68). The organization element within the DOTMLPF-P corresponds to how military organizes to accomplish missions, execute functions, and deliver support (CJCS 2016, A-3). Therefore, the organization enables individuals to cooperate systematically to achieve common objectives (DLRO 2016, 15). The analysis in the research deals with the multiple organizational aspects of the national disaster response systems. The analysis aims to recognize the scheme and the critical

nodes of the selected disaster management systems with the primary purpose to identify the governmental bodies and agencies and establish the flow of information and tasking. Additionally, the analysis deals with the roles, responsibilities, and the response contribution of those agencies identified as relevant to the case study.

Training

The training aims at instilling the desired skills and abilities to the individuals, units, and staffs to enable the successful execution of the mission (DLRO 2016, 15). Therefore, the training is crucial for organizations which by definition are striving to achieve the common objective. The relevance of training in this case study emerges from the fact that the disaster response more than often requires timely and effective action. The speed and quality of the response by designated agencies and organizations partially depend on the level of appropriate training (Alexander 2015, 7-8). The training in this essence does not only refer to the ability of personnel included in response to operate the specialized equipment or to perform specialized tasks (DHS 2017, 7, 53). The training also refers to the synchronization of individuals or teams involved in the response with the overall response plan and procedures (DHS 2017, 122). Therefore, the training in this study also refers to the displayed ability of disaster responders to act in line with the response baseline plan, procedures, and expectations (DHS 2013b, 6; Alexander 2015, 11). The research includes only the training for the entities responding to the disaster in the portion relevant to the disaster studied, thus keeping the analysis of training within the bound of the case study.

Material

Material refers to everything necessary to equip the organization to perform its mission and achieve its objectives, not including real property, installations, and utilities (DLRO 2016, 15). The material, together with the trained and expert personnel, and the infrastructure establishes the threshold of the capability to respond to natural and other disasters (Alexander 2015, 7). As the national material base for disaster management depends on multiple factors, the research does not deal with the overall national materiel capabilities devoted to the disaster management systems. Instead, the focus of the research remains on the nation's access to the necessary resources in the times of the crisis, particularly at the time of the selected disasters.

Leadership and Education

There are too many definitions of a leader and leadership. However, from the disaster management stance, a leader is defined as a person who is responsible for the supervision of a unit, strike team, or a task force (DHS 2017, 66). From the military point of view, the leadership and education refer to the professional development of the leader as a product of continuous learning through education, training, experiences, and self-improvement (DLRO 2016, 15). Common training and education set conditions for the disaster management leadership to perform assigned tasks in a consistent and unified manner regardless of the incident type and location (DHS 2017, 47). Also, education in disaster management includes not only disaster management professionals but also the general population (Alexander 2015, 27).

As the research deals with the nation-level disaster management systems, the study observes those leaders and leadership who by their position, roles, and duties took

part in response to the selected disasters. The elected and appointed officials play crucial roles in disaster management, for they generally provide policy level strategies and guidance on response and recovery (DHS 2017, 40). When addressing the overall leadership encompassed by the study, it becomes clear that the leadership is responsible for the successful organization, policy-setting, management, supervision, and the resourcing of disaster management systems and responses (DHS 2017, 36). The analysis of the leadership provides answers to both the research question and the supporting questions.

Summary

The research design for this inquiry is the multiple case study. The analysis covers only the organizational aspects of all three selected cases in the form of the within-case analysis by separately examining each case with the focus on a specific aspect of the case (Creswell 2007, 163). DOD's DOTMLPF-P construct provides a framework to classify data and conduct the within-case analysis. Consequently, the research follows the cross-case analysis utilizing the results of within-case analysis based on DOTMPLF-P construct to identify shared features among three selected cases. The cross-case analysis is an attempt to discover the common organizational features that impede the initial response in natural disasters. The review of qualitative documents enables the use of only readily available sources without a need to produce new data.

CHAPTER 4

ANALYSIS

Introduction

Chapter Four utilizes the information and methodology presented in previous chapters to execute the analysis and provide the answers to the research question and supporting questions. The research aims to answer the primary research question, What are the common organizational features that impede the initial response of the nation-state disaster management authorities in response to major disasters? Supporting questions are, What triggers the response to a major disaster on the nation-state level? How do developed countries who have dealt with major disasters set up and manage disaster response system? Chapter Four follows the multiple case study design, which analyzes the three distinct and unrelated cases of national responses to natural disasters to identify underlying organizational issues by conducting the cross-case analysis. The purpose of the cross-case analysis is not to compare the three cases against each other to determine the best disaster management system or to find out the best response among selected disasters.

On the contrary, the cross-case analysis extrapolates common themes and patterns among the cases to point out similarities and differences. In this research, the focus is on the organizational similarities which impede the response of the national disaster management systems. Therefore, the cross-case analysis requires several steps or phases to precede it to organize the data into usable segments for the cross-case analysis (Creswell 2007, 75). The cross-case analysis ends with generalizations or assertions (Creswell 2007, 73-76, 172). The thesis analyzes three major natural disasters and

corresponding national responses to the 2008 Wenchuan earthquake in China, the 2011 Great East Japan Earthquake in Japan, and the 2012 Superstorm “Sandy” in the USA.

The cross-case analysis depends on the context of the cases and the within-case analysis for each selected case (Creswell 2007, 172). The context of the cases establishes the basis for the understanding of the cases; it is the first step or phase of the analysis (Creswell 2007, 74-76, 172). The analysis in this chapter presents each of the selected cases in the first step providing the necessary background information about the 2008 Wenchuan Earthquake in China, the 2011 Great East Japan Earthquake in Japan, and 2012 Superstorm “Sandy” in the USA. Once the description of cases provides facts about the cases, then the analysis steps up to the following phase, namely the within-case analysis (Creswell 2007, 163-164, 172).

The within-case analysis identifies themes and patterns relevant to the research within each studied case (Creswell 2007, 163). The research breaks down all three cases under the US Department of Defense’s (DOD) doctrine, organization, training, material, leadership and organization, personnel, facilities, and policy (DOTMLPF-P) construct to provide the easy and efficient classification of themes. Such breakdown of the data, or pulling of the data apart enables the within-case analysis and the recognition of common themes and patterns among the cases (Creswell 2007, 163-164). The within-case analysis identifies themes under the four selected DOTMLPF-P headings providing the common ground for the cross-case analysis. The preferred DOTMLPF-P headings for this within-case analysis are organization, training, material, and leadership and education as the most important ones (McLeod et al. 2016, 1-2; Shoomaker 2013). Picking out only these four DOTMLPF-P elements enables the analysis of themes for each case, and then across

different cases (Creswell 2014, 249). Once the within-case analysis establishes common themes and patterns, the analysis transfers the findings to the cross-case analysis in the next step. Figure 3 shows how the elements of DOTMLPF-P fit into the cross-case analysis.

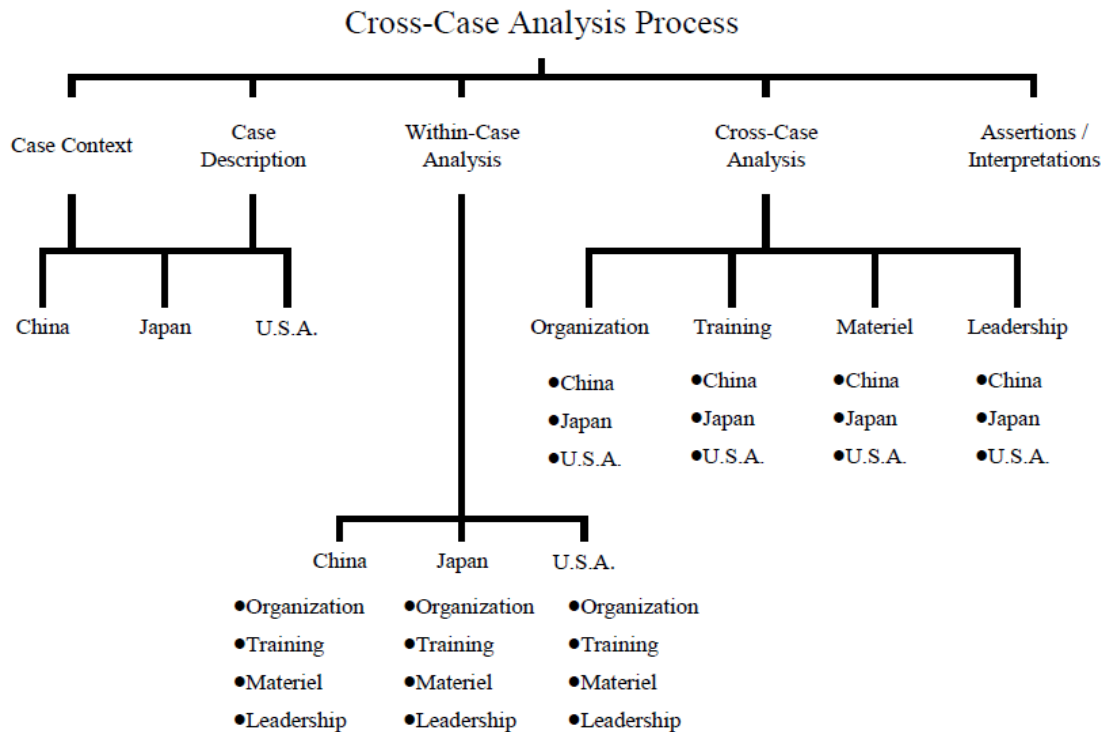


Figure 2. DOTMLPF-P Incorporated into Cross-case Analysis

Source: Created by author.

The cross-case analysis generally seeks to identify similarities and differences between cases by importing themes and patterns from the within-case analysis (Creswell 2007, 163, 196-197). This research deals exclusively with the specific set of similarities that correspond to each other, that is those which impede the response to natural disasters.

The examination of the emerging patterns takes the form of the appropriate word table that lists identified patterns under the relevant DOTMLPF-P headings while organizing each case under the vertical columns to enable visual recognition of shared patterns (Creswell 2007, 163, 196). The table collects the within-case analysis data under a single observable framework enabling the identification of shared patterns and themes (Creswell 2007, 196-197).

Table 1. Template Table for the Cross-case Analysis

	Themes	2008 Wenchuan Earthquake	2011 GEJE	2012 Superstorm Sandy	Shared themes
Organization	Theme #O1	X		X	
	Theme #O2	X	X		
	Theme #O3	X	X	X	X
Training	Theme #T1		X	X	
	Theme #T2	X	X	X	X
	Theme #T3	X			
Material	Theme #M1	X	X	X	X
	Theme #M2	X		X	
	Theme #M3	X		X	
Leadership and education	Theme #L1		X		
	Theme #L2		X	X	
	Theme #L3	X	X	X	X

Source: Creswell 2007, 163.

Following the cross-case analysis, the research then presents the assertions as to the researcher's interpretation of the meaning of the case (Creswell 2007, 163, 196).

Assertions are the summary of what the researcher understands about the cases researched and how that understanding affected the initial generalizations (Creswell 2007, 196). Assertions in this research shape Chapter Five by proving or disproving the

existence of shared organizational features, which impede the national response to natural disasters.

Description of Cases and the Context

The 2008 Wenchuan Earthquake in China

According to the national earthquake relief headquarters, 137 days after the earthquake, 69,227 people were confirmed to have been killed, 374,643 people were injured, 17,923 people were missing, 46,240,000 people were affected, 15,100,000 people urgently had to leave their homes to seek safer shelter, and communications were not restored until 42-150 h after the earthquake. (Zhang, XuLiu, Li, Yuan Liu, Zhipeng Liu, Lin, Shen, Tang, Zhang, and Liang 2012, 853)

Sichuan province is considered a zone with high seismic activity (Chan and Lee 2016, 14). PRC is a country ravaged by various disasters every year, predominantly by floods, typhoons, droughts, earthquakes, landslides, but also others (Lixin et al. 2012, 295-296). More than half of the PRC's population live in the disaster-prone regions, with the location of more than 60 percent of provincial capital cities and municipal cities within zones with seismic intensity higher than VII (Lixin et al. 2012, 295-296). PRC suffered severely from floods and earthquakes as some of the worst disasters in the history of disaster recording took place on the Chinese soil (Bai 2013, chap. 25). Apart from meteorological and geological disasters, PRC witnessed many technological disasters such as fire and mine incidents, and the pandemics of Severe Acute Respiratory Syndrome (SARS) and flu (Bai 2013, chap. 25).

The most affected area in the 2008 earthquake was Wenchuan county in Sichuan province, hence the name of the earthquake "2008 Wenchuan Earthquake" (Lingling, Jiexiu, and Lianyou 2008, 1). The tectonic movements of the Indian continental plate against the Eurasian continental plate stress the central China area (Earthquake

Committee 2014, 9, 207). The areas affected by the earthquake are mountainous with the average above sea altitude more than 3,000 meters contributing significantly to the risk of secondary disasters such as landslides (Lingling, Jiexiu, and Lianyou 2008, 19). The province has 6,678 dams and reservoirs of different sizes and purposes, ranging from flood protection and water supply to the production of electric power (Earthquake Committee 2014, 9, 207). The geographical features limit the access to the area usually to a single road with numerous choke points such as bridges, mountain passes, or tunnels (Lingling, Jiexiu, and Lianyou 2008, 20). The population of the province lives in both economically less developed and high-tech industrial zones (Lingling, Jiexiu, and Lianyou 2008, 19-20). According to the national census conducted in 2010, Sichuan was the fourth most populated Chinese province with 81 million inhabitants (Chan and Lee 2016, 14).

The 7.8 magnitude earthquake occurred precisely at 14:28 hours' local time on 12 May 2008 in Wenchuan county of Sichuan province in PRC. As soon as the earthquake occurred, the regional military headquarters in the capital of the province, Chengdu, immediately activated emergency response plan and dispatched reconnaissance teams to the affected area in less than two hours after the earthquake (Lo 2014, 5, Table 1.2). The State Council established the Earthquake Disaster Relief Headquarters as soon as the reports of the earthquake reached the State Council. The headquarters included nine working teams which dealt with the different aspects of the disaster response incorporating representative from several government departments and bodies (Lingling, Jiexiu, and Lianyou 2008, 21-22). The local authorities in Sichuan activated their emergency response plans and mobilized available resources to provide the rescue to

people affected by the earthquake. The PRC Premier, Wen Jiabao assumed the command for the overall response to the earthquake issuing directives from the affected area to all participating government agencies to speed up the rescue and improve the health conditions of survivors (Lo 2014, 35).

The first responders started reaching affected areas on the same day when the earthquake struck, but the out of area help reached the most affected and the distant regions only in the afternoon the next day, 13 May 2008 (Lo 2014, 5-8). Initially, the PLA refused to send in troops with helicopters, which at the time was a decision based on the confusing authority and the role of the PLA in disaster response (NIDS 2012, 20-24). Most of the first responders coming from the outside of the affected area were PLA and PAP forces who either walked in, flew in with helicopters, or parachuted into the affected areas (Lo 2014, 5-8). Besides the national responder, the international community reacted, particularly neighboring Japan and Taiwan, by sending specialized rescue teams and donations; the response to the Wenchuan earthquake became one of the rare situations when China asked for foreign assistance (Lingling, Jiexiu, and Lianyou 2008, 22). However, the PLA carried the most significant portion of the response and rescue efforts with more than 140,000 soldiers being deployed in the response (Yang et al. 2014, 1132).

Due to the widespread destruction of facilities, the medical care for survivors had to be provided mainly by the out of the area medical teams. Thousands of medical workers organized into medical teams with various purposes flooded the area working around the clock to provide the best possible care (You, Chen, and Yao 2009, 383-387). PLA, with its field hospital and other capacities, played a unique role in the response

subsidizing for the lack of standing medical facilities and other medical teams (You, Chen, and Yao 2009, 387-389). In the end, the total number of 66,590 medical workers, including volunteers with medical backgrounds, took part in the response (Yang et al. 2014, 1132).



Figure 3. The Widespread Collapse of Buildings in Beichuan Town
Killed 75 Percent of the Population

Source: NBC Universal 2009.

The earthquake affected the lives of 46,250,000 people in several provinces, with Sichuan being the most hit province. The death toll reached staggering 69,227 by 25 September 2008 (Lingling, Jiexiu, and Lianyou, 2008, 19). The number of injured people eventually rose to 374,643 with 17,923 missing and 15,106,207 evacuated from the

endangered areas. The earthquake led to the destruction of 7,967,436 buildings of all kinds and damage to the millions of others (Lingling, Jiexiu, and Lianyou, 2008, 19). The critical life supporting infrastructure in Wenchuan was devastated amounting to the majority of damage sustained in China in the earthquake. The 91 percent of the overall cost to the infrastructure occurred in Sichuan province, making the economic loss of RMB 852.309 billion or USD 124.062 billion (Lingling, Jiexiu, and Lianyou, 2008, 80-83).

The 2011 Great East Japan Earthquake

On March 11, 2011, an earthquake large enough to shift the Earth's axis by several inches sent a massive tsunami speeding toward the Japanese coast and the aging and vulnerable Fukushima Daiichi nuclear power reactors. The world watched in horror as the reactors' safety systems failed and explosions turned concrete and steel buildings into rubble. In just a few hours, a terrible natural disaster triggered a technological catastrophe – a triple meltdown that became the worst nuclear crisis since Chernobyl (Lochbaum et al. 2014).

The Great East Japan Earthquake shook the ocean floor east of the Honshu island's Tohoku region at 14:46 on 11 March 2011 with the magnitude of 9.0 in the epicenter. The earthquake caused the loss of power and communications, prompting the initiation of emergency procedures. The earthquake-induced the tsunami that hit the more than 650 kilometers of the east coast of Japan, mainly the Tohoku region. The tsunami's terrifying force overtopped or breached seawalls and tsunami breakers destroying cities and villages, and flooding more than 500 square kilometers of the coast (Ranghieri and Ishiwatari 2014,1). Tohoku region comprises of several prefectures from north to south: Aomori Prefecture, Iwate Prefecture, Miyagi Prefecture, and Fukushima Prefecture. The southern part of the Tohoku region is known as Sendai Plain, while the northern part is known as the Sanriku region (Mori and Takahashi 2012, 1).

Japan lies in the tectonically active area with the long history of earthquakes and tsunamis. Having suffered significant destruction and the loss of life throughout the centuries, Japan has established an elaborate system of protective measures. The protection measures involved evacuation drills and ever-evolving policies on the soft side, with the inclusive earthquake and tsunami early warning systems, tsunami walls, floodgates, and earthquake and tsunami proof shelters on the hard side (Rauhala 2011). Japan constructed its tsunami protection measures on historical data. The most widely used data was from the tsunami which hit the shores of Japan in 1960 after a powerful earthquake hit Chile, limiting the tsunami height threshold to three to six meters at the most. Thus, it was reasonable to conclude that people felt relatively safe behind tsunami walls that in some places rose as much as 10 meters above the sea surface along Sanriku coast (Koshimura and Shuto 2015, 6). Unfortunately, the tsunami was much larger than expected with the highest wave at sea up to 20 meters, and with the run-up height of 40 meters onshore in Miyagi prefecture (Koshimura and Shuto 2015, 7). Despite the height of the tsunami, the early warning provided enough time for many to evacuate the immediate danger zones and head for safety.

The Japan Meteorological Agency (JMA) is the national agency responsible for the hazard early warning. At the time of GEJE, the JMA relied on the historical data, technologically collected the real-time hazard data, and the scientific methods of calculation to predict disasters and issue an early warning (Koshimura and Shuto 2015, 3-5). The elaborate network of seismic detectors provided the real-time detection of so-called P waves which preceded the destructive S waves. Detecting the P waves provided enough time for the JMA to issue earthquake warning stopping fast bullet trains and

factory processes. The warning also provided precious time measured in seconds to the general population enabling the evacuation or the implementation of protective measures (Ranghieri and Ishiwatari 2014, 93-95). The earthquake's early warning system proved its effectiveness in GEJE when it contributed almost a minute to the citizens of Tokyo, and up to 40 seconds to other cities to evacuate buildings and trains minimizing the deaths from the earthquake. Indeed, no more than 200 people died in the earthquake-related building, collapses, and landslides (Ranghieri and Ishiwatari 2014, 35-37; Mimura et al. 2011, 808).

Following the earthquake and the collection of data, the JMA issues the initial tsunami early warning. The initial tsunami early warning could underestimate the size of the tsunami as the calculations and comparison of the data used to take several minutes (Ranghieri and Ishiwatari 2014, 91-93). The JMA issued an initial early warning for tsunami only three minutes after the earthquake, at 14:49 (Mori and Takahashi 2012, 2). This warning calculated the magnitude of the earthquake at magnitude 7.9 leading to the significant miscalculation of the tsunami size at up to six meters, while in reality, it was as much as three times higher (Ranghieri and Ishiwatari 2014, 91-95). The delivery of the early warning depended on the existing power and communication lines. However, delivering and updating the disaster warning was not possible after the earthquake damaged the power and communication lines. Hence, some people reacted only to the initial alert that predicted much smaller tsunami and stayed in place, trusting the high tsunami walls. The JMA issued the updated warnings for the tsunami higher than 10 meters some 40 minutes after the earthquake, but by that time it was already too late (The Japan Society of Mechanical Engineers 2014, 11-12).

Within the 30 minutes after the earthquake, the Cabinet Office established the Emergency Disaster Response Headquarters with the Prime Minister as the chair. The mission was to coordinate and oversee the response to the earthquake (Ranghieri and Ishiwatari 2014, chap. 14). Within minutes after the earthquake, the Self-Defense Forces (SDF), Japan's armed forces, dispatched the helicopters and airplanes from multiple services to gain the situational awareness. Concurrently the local authorities along the Tohoku coast established their emergency response headquarters. Initially, the local headquarters had available only the professional Emergency Fire Response Teams (EFRT) and police forces, while the rest of community-based responders was undergoing the mobilization (Howitt 2012). The overall situation changed quickly as the first tsunami waves hit the Tohoku shores at 15:30 (Ranghieri and Ishiwatari 2014, 94). The tsunami hit six prefectures in northeastern Japan, but Iwate, Miyagi, and Fukushima prefectures sustained the worst damage. Prefectures reached the nearby SDF trying to increase own efficiency under the existing emergency response plans to organize the search and rescue in the towns and areas hit by the tsunami. As the situation got somewhat clearer that afternoon, the Prime Minister ordered the SDF to mobilize and deploy in response to the tsunami.

As soon as the JMA issued the first tsunami warning, citizens initiated the evacuation in many coastal communities. The well-known danger of tsunamis instilled the culture of safety to the society enabling the timely evacuation for most people in the flooded areas. The historical tsunamis increased the tsunami awareness at the people of northern Sanriku area, while this was not the case in the southern Sendai plains that historically suffered less from tsunamis. To that end, many people lost their lives because

they returned from the evacuation areas, or they did not evacuate for various reasons, or they got stuck in the traffic and were swept away by the tsunami (Ranghieri and Ishiwatari 2014, 10; Suppasri, Shuto, Imamura, Koshimura, Mas, and Yalciner 2013, 1113).

The tsunami created mayhem along eastern Tohoku coast. As the numerous governmental organizations and NGOs deployed to the affected areas to execute the response measures, the staff at the Fukushima Daiichi Nuclear Power Plant fought a different battle. The earthquake severed the source of the external power and the communication lines forcing the emergency safety systems to cease fission reactions in the nuclear cores safely. The back-up generators continued to provide the power for the cooling pumps that circulate the water around the hot nuclear cores that continue to emit the heat long after the fission had come to a stop (Lochbaum et al. 2014, 7). The high tsunami waves penetrated the power plant's tsunami defenses flooding the back-up generators and damaging safety systems. Unable to cool down the cores, the power plant's staff tried several emergency and improvised solutions that failed, ultimately leading to the severe damage to the cores and the meltdown of several reactor units. The meltdown resulted in the uncontrolled release of radioactive steam and gas to the atmosphere exposing as much as 1,800 square kilometers and forcing more than 78,000 people out of the immediately restricted zone for years (Ranghieri and Ishiwatari 2014, chap. 11).

The GEJE was the worst accident in the post-World War II Japan featuring the unprecedented triple disaster comprising of the earthquake, the tsunami, and the nuclear meltdown (Umeda 2013, 1). In the aftermath of the GEJE 21,839 people died or went

missing, 6,219 sustained injuries, and 127,830 houses faced destruction (Cabinet Office 2015a, A-10). The response included more than 107,000 Japan Self-Defense force members, 540 aircraft, almost 60 vessels, 30,000 firefighters, thousands of police officers, and 1,800 disaster medical assistance members from 380 teams (Ranghieri and Ishiwatari 2014,126-128).

The 2012 Superstorm “Sandy” in the USA

The storm’s effects were extensive, leaving more than 8.5 million customers without power, causing widespread flooding throughout the region, and contributing to acute fuel shortages in parts of New York and New Jersey. The storm damaged or destroyed hundreds of thousands of homes, caused tens of billions of dollars in damages, and killed at least 162 people in the United States (DHS 2013a, iii).

The Superstorm Sandy started its path on 24 October 2012 in the Caribbean Sea as the late-season hurricane. The hurricane increased in strength from the category one to category three on 25 October 2012 over eastern Cuba. Then Sandy weakened back to a category one after passing through the Bahamas on 27 October 2012 but started growing in size due to the various meteorological processes and phenomena (Blake et al. 2013, 2-3). By the time the hurricane reached the northern United States of America, on 29 October 2012, it had grown in size to almost 1,000 miles in diameter (Blake et al. 2013, 6). The hurricane made a landfall at 23:30 on 29 October 2012 near Brigantine, in New Jersey bringing extraordinary amounts of seawater and to some extent rain (Blake et al. 2013, 4). Soon after the landfall, Sandy gained the notorious reputation as the second-largest Atlantic storm, hence the name Superstorm Sandy (Torres et al. 2015, 7).

The storm affected the entire East Coast of the USA, but the majority of damage occurred in the Northeastern states, New York and New Jersey (Dipace 2014, 77). The

significance of the storm's impact comes from facts that the two most affected states contributed to the nine percent of total USA population, and ten percent of the national gross domestic product (Dipace 2014, 77). Contrary to the regions from the previous two cases within this research, the region affected by the Superstorm was, as it remains today, extremely racially and ethnically diverse (Dipace 2014, 77). The critical feature of the region, particularly of New York City (NYC), is that the majority of citizens depend on the extensive public transportation (Thompson 2014). The region of the two states and many other areas along the East Coast were hit by hurricane Irene just a year earlier in 2011. Hurricane Irene also caused significant damage and hardships prompting improvements in local disaster management (Gibbs and Holloway 2013, 6-8).

The ability of the US National Weather Service to track and predict a hurricane's behavior significantly contributed to the ability of agencies to prepare and respond once the storm made landfall. Federal Emergency Management Agency (FEMA) took a proactive approach by acting to some extent independently, and partially upon receiving requests for assistance from states expecting the Superstorm (DHS 2013a, 4). FEMA mobilized and deployed 900 personnel before the landfall, established the Incident Support Bases in Massachusetts and New Jersey, as well as several Federal Staging Areas in New York state stockpiling significant quantities of supplies (DHS 2013a, 4-5). Additional measures taken by the FEMA include deploying specialized search and rescue teams, liaison officers, mobile command centers, and ambulances (DHS 2013a, 5). FEMA activated the National Response Coordination Center (NRCC) – the coordination center with a purpose to enable multi-agency support to the response for all emergencies and major disasters (DHS 2013a, 5). To complement the NRCC and provide the Whole

Community capabilities FEMA also activated all Emergency Support Functions (ESF) and Regional Response Coordination Centers (RRCC) for FEMA Regions I through IV (DHS 2013a, 5).

FEMA served as the overall coordinator of the federal government's support efforts, to include the preparation (FEMA 2012). Department of Defense (DOD) deployed and collocated their Regional Defense Coordinating Officers (DCO) and the Defense Coordination Elements (DCE) with FEMA. The Department of Energy (DOE) also deployed and collocated their response and coordinating personnel with FEMA working closely with the state and local authorities, and energy industry to prepare for the power restoration if necessary (FEMA 2012). The Federal Aviation Administration continued to monitor the storm advising all aviation participants and airports on mitigation measures with the ultimate goal to reopen the airspace and airports as soon as possible (FEMA 2012). The Red Cross mobilized hundreds of workers preparing shelters and supplies to support the response (FEMA 2012).

On the local level, states, towns, and cities activated the available resources and services to protect property and save lives. For instance, the Governor of New Jersey declared the emergency well in advance, on 27 October 2012, urging citizens to evacuate from the areas closest to the Ocean, while the utility companies predicted the loss of power (Washburn and Hayes 2012). The NYC activated the Coastal Storm Plan Evacuation Zone A on 28 October 2012, ordering a mandatory evacuation for more than 375,000 citizens in endangered areas (Gibbs and Holloway 2013, 8). A total of 11 states declared the state of emergency. This was followed by the POTUS declaration of emergency on 28 October 2012, granting the federal assistance by FEMA and other

federal agencies in response to the incoming Superstorm (DHS 2013a, 5). Nation-wide, the total of 60,000 National Guard members remained on alert expecting their involvement in the response. Local agencies and services tried to reduce the potential damage by shutting down transportation or electrical power nodes to protect them from damage by flood and invasion of salty ocean water (Gelinas 2013; TEEX 2012). Having learned the lesson on the evacuation difficulties of bedridden patients during the hurricane Irene, the NYC authorities ordered hospitals in the Zone A not to evacuate but to shelter in place (Gibbs and Holloway 2013, 8).

The Superstorm Sandy made landfall late on the 29 October 2012. The record high water surges, exceeding four meters in some places, crippled the transportation, fuel distribution facilities, and power gridlines as early as 29 October 2012 (Gibbs and Holloway 2013, 14). The damage to the electrical power lines peaked on 30 October 2012, leaving more than 8.5 million citizens across several states without access to electric power for days, even weeks (DOE 2013, 2-3). The exceedingly high number of people choose not to evacuate, especially in NYC, leading to loss of life, mainly by drowning. While there were different reasons for people not to evacuate, the majority based their decision on a belief that the storm would not affect them significantly because they either underestimated the storm or were out of the mandatory evacuation zones (Rice 2014, chap. 3).

The storm surge breached many existing flood reduction measures; flooding large portions of what coastal communities, including those assessed as the low to moderate risk flood zones (Hatzikyriakou and Lin 2017, 955-956). The large portion of flooding occurred in one of three ways or a combination of those: (1) high and persistent waves

penetrated the eroded sand dunes or caused the immediate erosion, (2) the seawater found its way through the unprotected lowlands and canals, (3) the surge overtopped the sewage and drainage system causing the backflow (SSIR 2013, chap 3). Although the Superstorm Sandy caused floods evaluated as one in 400-year event, the fact remained that FEMA based its 2006 flood mapping zones on the coastal analysis conducted in 1983 (Hatzikyriakou and Lin 2017, 955). The storm's surge destroyed some 22,000 housing units in New Jersey and damaged or destroyed as much as 305,000 houses in New York state (Hatzikyriakou and Lin 2018, 2-3). Waters reached and flooded entire Lower Manhattan with tunnels and subway closing it for over a week (Dipace 2014, 78). The wastewater plants in NYC suffered from the storm's surge as the seawater penetrated 10 of 14 wastewater treatment facilities affecting their operations. As a result, some 2.081.685 tons of water of untreated sewage water mixed with seawater escaped into local waterways (SSIR 2013, chap. 12).

The FEMA deployed more than 7,500 employees in various roles both during the response and later during the early recovery phases (DHS 2013a, 5). States deployed a total of 11,000 members of National Guard units assisting in response and recovery across several affected states (DOD 2012). The DOD deployed 4,000 personnel from all services providing critical support to the FEMA and local authorities. DOD's involvement included the ground and air transport of the crucial equipment and vehicles; pumping out water from tunnels, subways, and buildings; repairing the power lifelines and delivering power generators; transporting more than 292,870 tons of fuel to FEMA supply points (DOD 2012). The US Coast Guard provided the command and control facilities onboard of one of the ships saving the precious available space on the ground

for the accommodation of evacuees (Dipace 2014, 78). On 30 October 2012, the POTUS signed the declaration of a major disaster in affected states approving a significant FEMA assistance in housing relief. The declaration funded multiple recovery programs as trying to help states and survivors overcome the loss of functional capabilities and housing capacities for thousands of survivors damages to property rose over \$ 50 billion (DHS 2013a, 6-7).

Within Case Analysis

The 2008 Wenchuan Earthquake in China

Organization

Data Analysis

At the time of the 2008 earthquake, the overall disaster management system in China was set up to function under the leadership of the central government, with the specific functional departments being responsible for a single type of disasters (Lixin et al. 2012, 296). Also, the response to disasters was divided among the levels of governance so that lower levels of government would deal with minor accidents, while the central government would step in to respond to the major disasters (Lixin et al. 2012, 296). The levels of emergency were graded as (1) especially serious, (2) serious, (3) relatively serious, and (4) common (Wang, Chan, Liu, and Yeung 2016, 2). In 2006, the central government established the Emergency Management Office of State Council (EMO) as the primary national body for all disasters under the direct management of the Ministry of Civil Affairs (Lixin et al. 2012, 300). The Emergency Management Office was not a body responsible for the risk assessment, mitigation, and preparedness; it was an agency serving as the framework for the comprehensive disaster management related

planning, preparation, response, and recovery (Kunreuther and Useem 2010, 198). The EMO served as the primary source for the staffing of temporary emergency headquarters and the coordination of the response efforts by various governmental bodies and agencies (Wang et al. 2016, 8-9; Lingling, Jiexiu, and Lianyou 2008, 44). Multiple ministries and lower levels of government adopted the EMO structure in an attempt to assign a specific office for the disaster management within those ministries and governments (Kunreuther and Useem 2010, 198).

Even before the establishment of the Emergency Management Office, the State Council had a standing body, National Committee for Disaster Reduction (NCDR) which included all national ministries and relevant national agencies. The NCDR was responsible for all disasters, but that changed after the SARS pandemic when China recognized emergencies in four categories: (1) natural disasters, (2) public health incidents, (3) accidental disasters, and (4) social safety incidents (Kunreuther and Useem 2010, 198). Therefore, China gradually established additional three committees within the State Council: to manage public health incidents the National Committee for Food Safety, to deal with industry incidents the National Committee for Work Safety, and to manage general security the National Committee for Integrated Management (Kunreuther and Useem 2010, 198). Such division left the NCDR responsible only for natural disasters. The lower levels of government established the corresponding disaster management bodies to reflect the gradual response and the local responsibility approach to disaster management.

At the national level, the four committees had no real authority over the ministries and relied heavily on different national ministries to do their part in disaster management

(Lingling, Jiexiu, and Lianyou 2008, 36-44). The Ministry of Civil Affairs (MCA) served as the secretariat for the NCDR carrying out all daily tasks related to disaster management. When an emergency occurs, the local governments would respond to the emergency. If the local government is unable to cope with the situation, it will request assistance from the central government. The EMO, under the MCA, would assess the scope and severity of the emergency and inform the State Council – NCDR. The NCDR would then if necessary declare the state of emergency and task different “single job” ministries or organize them under the temporary headquarters to take part in the response (Lingling, Jiexiu, and Lianyou 2008, 36-44). The overall emergency system at the State Council level included the Master State Plan for Rapid Response to Public Emergencies, 25 specific emergency response plans, and 80 sector-specific emergency response plans in 2007 (Kunreuther and Useem 2010, 200). The local governments followed by creating more than a million of corresponding emergency response plans nationwide as a baseline for the graded and coordinated response (Wang et al. 2016, 3-4; Kunreuther and Useem 2010, 200).

Over the years China passed many laws related to the disaster management trying to increase the efficiency of departments responsible for a single disaster instead of having a fundamental disaster management law (Lixin et al. 2012, 304). In reality, the decentralization significantly complicated the overall system as it dispersed the preparation, prevention, and mitigation among different departments. Such a decentralized approach and the utilization of temporary response headquarters presented problems during the Wenchuan earthquake response in the command structure, coordination, and information dissemination (Lingling, Jiexiu, and Lianyou 2008, 61).

One of the reasons for observed problems is the strict vertical structure of Chinese governance, which hinders horizontal coordination at all levels of management (Kunreuther and Useem 2010, 207). Additionally, single-style disaster meant that there were grey areas no agency was responsible for, or overlapping responsibilities, which resulted in the authority and effort conflicts (Lingling, Jiexiu, and Lianyou 2008, 61).

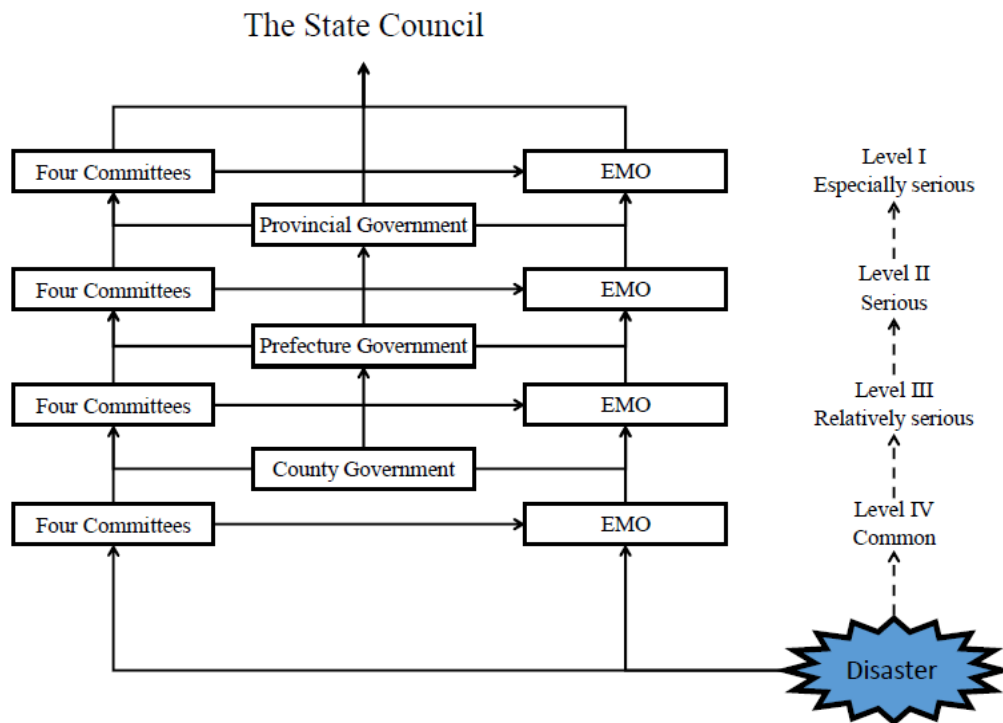


Figure 4. Chinese Disaster Management System

Source: Kunreuther and Useem 2010, 200.

Despite being earthquake-prone country, apart from the seismic monitoring stations designated to fill in the scientific data after earthquakes, PRC did not have an earthquake early warning system, but only the earthquake forecast system (Lixin et al.

2012, 297). The existing seismic stations provided data to Chinese scientists who would use the data in the forecast of earthquakes, which is quite different from the prediction (Weng et al. 2006, 757-759). The Chinese earthquake forecast depended on multi-disciplinary data inputs and observations, and an extensive human involvement; therefore, it was significantly less accurate than the contemporary prediction based on technology (Weng et al. 2006, 757-759). Nevertheless, at the time of the earthquake, PRC was a country with the experienced Earthquake Administration incorporated into the Central Government's administration and to all levels of governance (Lixin et al. 2012, 27-298). The responsibility of the Earthquake Administration includes the earthquake forecast, earthquake assessment, earthquake-related damage assessment, and seismic zoning (Lingling, Jiexiu, and Lianyou 2008, 43-47).

China issued the last updated seismic intensity zoning map in 2001 in scale 1:4,000,000 (Lixin et al. 2012, 287-89). One of the significantly worrying features of the Wenchuan earthquake was widespread destruction of school buildings. By some accounts, more than 9,000 school children and teachers died in over 7,000 collapsed schools (Saban 2014, 138-139). The central government conducted the investigation on the allegations that the substandard construction caused the widespread collapse of schools and other collective buildings; the investigation's results proved that there is evidence of a significant neglect and substandard construction in so-called "tofu" schools (Saban 2014, 138-139; Lingling, Jiexiu, and Lianyou 2008, 128). While the engineered buildings showed greater resilience than the un-engineered houses made by their owners, the lack of appropriate seismic zoning and poor seismic design allowed the construction of buildings with a lower seismic resistance that should have been. Such a faulty design

led to the widespread failure of highways, bridges, tunnels, and electric substations (Earthquake Committee 2014, chap. 3). The more proper seismic zoning and the enforcement of the zoning regulation could have reduced the damage from the landslides (Earthquake Committee 2014, 280). It appears that despite the multi-sectoral approach to disaster management, there was no collaboration between the Earthquake Administration, NCDR, and provincial governments to ensure the implementation of seismic zoning into disaster management. The seismic zoning is significantly more related to the prevention and mitigation of natural disasters; however, the Wenchuan earthquake pictured that the damage to the critical infrastructure, especially medical facilities, power lifeline facilities, and the transportation network hurts the effectiveness of the response.

Emerging themes

The organizational and bureaucratic complexity of disaster management is the overarching theme. PRC's disaster management system at the time of the Wenchuan earthquake depended on multiple governmental coordinating bodies and executive ministries with their subordinate agencies. Coordinating bodies played almost no role daily in disaster management. The executing agencies could not react on their own but required the approval from the State Council (Lingling, Jiexiu, and Lianyou 2008, 127-132). Despite the quick initial reaction by the State Council which established the temporary earthquake relief headquarters, there were too many agencies included in the overall mechanism that it disintegrated the unity of the response. The legislative setup led to the single agencies directing their efforts to their niche capabilities, which resulted in inadequate information sharing horizontally and delays of other agencies' efforts. Also, the legislation confused the agencies about their responsibilities in the collaborative

disaster management response creating grey areas that slowed the response (Lingling, Jiexiu, and Lianyou 2008, 127-132).

The lack of collaborated risk assessment by a single dedicated agency presents itself as the theme. The absence of collaborated risk assessment prevents valid risk identification and assessment, and risk mitigation and management as necessary steps to the disaster mitigation and prevention (Kunreuther and Useem 2010, 208-209). The PRC has traditionally been reactive in its disaster management by building its capacities to execute the response and relief, and acting predominantly after the disaster strikes (Lingling, Jiexiu, and Lianyou 2008, 62, 127-132). The comprehensive all-around risk assessment and risk reduction would lead to the integration of preventive measures in all spheres of society and governance, creating resilient and prepared disaster management model. The lack of collaborated risk assessment as a theme describes a missing organizational feature; therefore, this theme is suitable for the cross-case analysis.

Another emerging theme is the lack of collaboration due to the decentralization, legislation, niche capabilities, or a combination of these factors. This is different from a lack of coordination; coordination implies that the DM system's composition requires all players to supplement each other's efforts. In the case of PRC, the entire DM system is composed of individual ministries and departments all responsible for the exclusively single disaster; hence, the DM system requires no coordination in the single-type disaster response. The overall idea of the PRC's disaster management was to have unified command over the single-style responding agencies at all levels once the disaster occurs. The entire disaster management legislation supported such a setup.

However, natural disasters rarely confine within precise boundaries, but rather spill over the multiple domains requiring a multi-sectoral response. The multi-sectoral response does require all involved agencies to collaborate in advance and establish standard operating procedures resolving any conflicting areas and gapping the observed deficiencies (Kunreuther and Useem 2010, 208-209). One of the best examples comes from the fact that the Earthquake Administration rated the area as the low seismic hazard zone despite the historical evidence of earthquakes larger than Magnitude 7 striking the area. Even if their assessment was correct, there was still no enforcement of the seismic design by appropriate urban planning authorities as the seismic design requirement for the area was set at zero (Earthquake Committee 2014, 16-17). Another example comes from the separate reaction from the PLA which dispatched their forces in the reaction to the earthquake, while the Ministry of Health independently deployed hastily organized medical teams to the affected area.

Additional theme related to the organization is complicated or superficial response plans that set the requirements beyond the capability of the respective responding agency. All the levels of governance developed their emergency response plans that in theory, would fit into the higher levels plans. In practice, some plans created confusion and collided with those of the higher levels of governance or with the roles of other ministries and agencies (Lingling, Jiexiu, and Lianyou 2008, 127-132). Many of those plans were useful only for common emergencies but provided limited usefulness in emergencies of the higher level (Kunreuther and Useem 2010, 206). These plans did not envision the creation and the composition of the medical response teams appropriate for the type of the disaster. The fact that the plans failed to provide usefulness for various

reasons qualifies this theme for a cross-case analysis as an organizational element of the DM.

The evacuation planning and execution is the final theme. There is no clear evidence that evacuation on a large scale was a part of any plans. The extensive evacuation of survivors took place everywhere, but it seems that the evacuation in the hardest hit areas was spontaneous simply because the survivors did not have where to stay and have begun to move on their own (Lo 2014, 44). In some places, the earthquake-induced landslides blocked local rivers creating unstable artificial lakes which threatened downstream communities. The prospect of the collapse of those lakes prompted the evacuation of threatened places (Lo 2014, 60). Even though the evacuation took place, not having a working framework or a plan for such an endeavor qualifies this theme for a cross-case analysis as an organizational element of the DM system.

Training

Data Analysis

The overall emergency system in PRC seemed robust and well-developed, enabling a gradual response to increase the efficiency and focus the resources. However, in reality, the provincial officials and those at lower levels of governance had little awareness of the emergency response plans and their contents. Some officials later admitted that they did not even know these plans existed (Lingling, Jiexiu, and Lianyou 2008, 61-62). Besides, these plans often conflicted with each other presenting dilemmas both horizontally and vertically during rare exercises and drills (Lingling, Jiexiu, and Lianyou 2008, 61-62).

The critical response force on the national level comes from PAP, with the PLA providing support when necessary or acting as the primary response forces when responding upon requests by state ministries or local governments (Lingling, Jiexiu, and Lianyou 2008, 41-43). At the time of the earthquake, specialized rescue teams were available only in larger cities and in small numbers operating under different agencies and departments. These facts limited the availability and the efficiency of rescue teams even when the nation's almost all rescue teams deployed to the Wenchuan area as the sheer scale of the disaster overwhelmed the limited numbers of rescuers (Lingling, Jiexiu, and Lianyou 2008, 129-130).

The earthquake resulted in thousands of casualties overwhelming whatever the damaged medical care and health system in Wenchuan. The Ministry of Health dispatched numerous medical teams accompanied by the PLA medical personnel and volunteers to help survivors and prevent the escalation of infectious diseases. The medical workers sprayed corpses with the anti-decay solution preventing the outbreaks of infectious diseases despite the presence of many unattended bodies on the streets and roads (Chan and Lee 2016, 22; Lo 2014, 50). On the other hand, the local medical personnel was not adequately trained to deal with the disaster-induced injuries which resulted in the increased number of limb amputations (You, Chen, and Yao 2009, 390; Yang et al. 2014, 1130). Some medical teams suffered from inappropriate staffing resulting in less than desired medical response and support. The issue was that some highly specialized doctors arrived into areas where they did not have necessary supporting personnel or specialized equipment to provide adequate assistance (You,

Chen, and Yao 2009, 390). In such instances, the highly specialized and educated surgeons had to act as the general medical doctors.

Emerging Themes

Weak enforcement of a disaster response proficiency as an emerging theme. Having emergency response plans was not enough. All agencies and personnel with a role in those plans should know their role and tasks to give value to those plans. Unfortunately, many of those required to act in line with the corresponding emergency response plan were not aware of the plans' requirements when the earthquake hit. The fact that many in the DM system got caught by surprise shows that no one enforced the disaster management proficiency. Continuous drills and rehearsals could have established a proficiency in the execution of plans and possibly even led to the improvement of conflicting emergency response plans (Alexander 2015, 11-12). The DM system did not clearly state the requirement for the enforcement and checkup of DM proficiency at lower levels. This fact features the theme as an organizational element of the DM system.

The lack of role-related training within the DM organization emerges as a theme. This requirement relates to the reduced performance of local medical personnel to deal with earthquake-induced injuries. The general medical training proved to be inadequate when addressing specific trauma injuries. It also encompasses a lack of specialized emergency and rescue teams at the lower levels and in sufficient numbers throughout the country to deal with a disaster of such proportions. The PLA carried the bulk of response and rescue efforts without necessarily being trained on how to perform delicate operations in such an environment. The PRC's DM system did not envision specialized local emergency response teams, nor did it require local medical personnel to be

proficient in the provision of medical assistance in the area-specific disasters. Therefore, this theme presents itself as an organizational element of the DM system.

Material

Data Analysis

Walking rescue parties could not bring heavy tools and machinery necessary to excavate thousands who perished under rumpled debris; the thousands of students remained buried along with their teachers in their schools. Rescuers tried desperately to clear the debris by hands and light tools, hoping to reach those who still might have a chance to survive. For the initial three days after the earthquake, the PLA did not have access to the heavy cranes, stone cutting equipment, and drilling equipment. At the same time, there was an overall lack of small scale equipment and hand tools that could speed up the rescue efforts (Lo 2014, 78). From the search equipment point, the PLA had only a small number of search dogs which could have played a crucial role in the search and rescue efforts.

At the time of the earthquake, the PLA had only one MN-26T heavy transport helicopter that could transport 120 soldiers, or 60 litter patients, or 20 tons of equipment. It was this single MN-26T that airlifted 15 cranes into the affected areas to help with the removal of debris. For everything else, rescuers had to rely on a much smaller military and civilian aircraft (Lo 2014, 77). The Russian made Mil-171 transport helicopter was utilized heavily in the rescue operation, but its limited capacity and mechanical problems that presented themselves during the rescue evidenced the need for a larger helicopter. Emergency services evacuated the 97.7 percent of all evacuated people by either military or civilian air assets; however, none of those were specialized airplanes that would enable

casualty evacuation with the appropriate level of care onboard (Zhang et al. 2012, 857). Overall, the PLA utilized over the 100 helicopters of various types and sizes along the tens of airplanes. The PLA was the quickest to respond by mobilizing available forces in and out of the affected areas. The first responders found out that their standard radio communications were insufficient to communicate with the higher headquarters and coordinate the response (Lo 2014, 77). Once supplied with the civilian satellite telephones, they gained the communications capability on 13 May 2008, a day after the earthquake.

As the numbers of injured quickly rose over 220,100 by 18 May 2008, the lack of medical supplies became acute to the point where even the medicine with the expired dates had to be used (Lo 2014, 61). Unfortunately, the response plans did not envision the earthquake in the studied area. Therefore, there were no required stocks of necessary medicine, blankets, tents, and other supplies that would support the initial response to the disaster (You, Chen, and Yao 2009, 390).

Emerging Themes

The lack of prepositioned stocks, or insufficient availability, or an inadequate composition of prepositioned stocks. The description includes medical supplies and equipment, communications equipment, search and rescue equipment, evacuation, and relief supplies. China had established a system of prepositioned stocks for the disaster response, but it was mostly insufficient both from the quantity and the variety of goods stored (Lingling, Jiexiu, and Lianyou 2008, 61-62). Unfortunately, the prepositioning of the emergency related stocks depends on the risk assessment and the disaster prevention and mitigation strategy. The way that the DM system treated the existence of

prepositioned stocks places this theme in the category of organizational features of the DM system.

The lack of rescue tools and equipment for the main response force is an important emerging theme under the material. For the first few days, the PLA carried the bulk of the response by bare hands at the least accessible areas. Had the PLA units which deployed to the Wenchuan had the rescue tools and equipment either prepositioned or on hands it would have significantly contributed to their ability to execute the rescue. This theme links with the training of rescue teams at the local level as the PAP and PLA are usually the main responding forces. The PRC DM system depended on the PLA's personnel, construction and engineering capability, and a transportation capability to execute tasks in the disaster response. However, a lack of necessary tools and equipment within the PLA describes the organizational deficiency suitable for the cross-case analysis.

The lack of specialized medical evacuation planes emerges as a theme. This theme lends itself for the analysis only in cases of geographically large countries, and other countries with sufficient economic means to procure such capability. In this instance, PRC is a vast country which cannot rely on transport helicopters to safely and quickly evacuate large numbers of casualties from the affected areas into areas with sufficient medical capabilities. Possessing such a capability would reduce the improvisation, hence increase the efficiency and speed of disaster response. The PRC's DM system did not contemplate specialized medical evacuation airplanes as a military or DM capability. Therefore, this theme describes an organizational element of the DM system.

A lack of long-range robust communication assets is another theme. While the military forces usually deploy robust long-range radios, such assets are usually vehicle-borne, making the communication with those limited to the trafficable areas. The Wenchuan earthquake covered a large area spanning over several extremely high and inaccessible mountains. Radio equipment, which due to its size and power consumption, depend on military vehicles becomes unusable in such an environment. Therefore, other means of communications suitable for movement and operation by a single person fits the requirements better. From the military aspect, this theme is purely the technical element of military units. However, in the DM system, it becomes an organizational element because the PLA, as the emergency response force, did not understand the long-range communication requirement for emergency responders in the degraded environment.

Leadership and Education

Data Analysis

The PRC premier Wen Jiabao assumed the leadership position in response to the earthquake as soon as the news reached Beijing. Being the administrative and executive part of the Chinese government, he did not have direct authority over the PLA, which at the time was the largest and the most capable responding force (Lo 2014, 46). The disaster management apparatus also included several ministries and agencies with their leadership and the overall disaster management were quick to react and establish planned response headquarters (Lingling, Jiexiu, and Lianyou 2008, 25-26). The provincial governmental and military authorities initiated the response immediately after the earthquake. However, the study conducted on behalf of the Ministry of Civil Affairs revealed that the government officials, at multiple levels, lacked the knowledge and

awareness on hazards, risks, disasters, and their role in the emergency response plans (Lingling, Jiexiu, and Lianyou 2008, 61-63).

The education of the local population, including the officials, plays a part in the disaster management system, especially in disaster prevention and the mitigation (Lixin et al. 2011, 305). The Chinese population lacked awareness in disaster prevention, mitigation, and self-protection in the face of living in the earthquake-prone area (Ye, Zhai, and Hu 2011, 608-609). The lack of hazard awareness contributed significantly to a large number of casualties (You, Chen, and Yao 2009, 390; Lingling, Jiexiu, and Lianyou 2008, 64-65). On the other hand, there are examples of how successful local education and training reduced the loss of life by teaching school children how to react in earthquakes and evacuate orderly. All school personnel and students successfully left the Sangzao Middle School in An County in 1 minute and 36 seconds without any loss of life (Lingling, Jiexiu, and Lianyou 2008, 152-153).

Emerging Themes

The education of the key leadership in disaster management is an emerging theme. The literature does not offer clear evidence that there was a DM education requirement for key leadership. The Chinese disaster management system required the governments and subordinate departments to form temporary headquarters for emergency responses. Multiple studies pointed out the problems in coordination and execution despite the fast initial establishment of disaster response headquarters. It appears that having the disaster response as the secondary assignment detached the government officials from their roles in particular emergency response plans. As the national top to bottom administrative and political leadership has a defined role and tasks in the DM

system, the quality of their performance in the emergency response is a technical element of the DM system. On the other hand, a lack of education and training requirement for the administrative and political leadership in the DM-related topics falls within the DM's organizational elements. This theme closely links to the lack of enforcement in disaster management proficiency at lower levels under the training heading.

The poor risk communication and risk awareness for the population in hazard zones is following the theme. Although the relevant authorities labeled the Wenchuan area as the low seismic hazard zone, there was no visible risk communication to the local population or local governments. No one presented the risk from earthquake to Wenchuan citizens, governmental officials, and medical staffs. Therefore, they were unaware of the danger and oblivious of required actions to reduce the risk and mitigate the disaster. The ability of society to provide self-protection and to react to an occurring disaster in a way which will reduce the risk of harm plays a significant role in the reduction of casualties (Zhang, Yi, and Zhao 2012, 2225). Multiple cases are depicting both how the lack of disaster awareness related education had adverse effects on peoples' lives and how an educated reaction saved lives. An absence of a requirement for the DM system to communicate the risk to the general population makes this theme an organizational element suitable for cross-case analysis.

The 2011 Great East Japan Earthquake

Organization

Data Analysis

The overall disaster management in Japan was very well defined. The long history of meteorological and seismic disasters shaped the community-based disaster risk

management (DRM) system. Over the years, the government got heavily involved in the DRM incorporating the communities into the national disaster management system (Ranghieri and Ishiwatari 2014, chap. 6). Japan's DM system was multi-sectoral, functionally divided, a layered system which incorporated the risk reduction, disaster prevention, disaster mitigation and preparedness, disaster response, and recovery (Ranghieri and Ishiwatari 2014, chap. 7). The Basic Disaster Countermeasures Law set conditions for the establishment of the national DM system (Cabinet Office 2015b, 6-8).

Under the law, the State Council established a Central Disaster Management Council (CDMC) as a permanent body responsible for the DM-related policymaking. In the extension of CDMC are the prefectural disaster management councils with a similar role at their respective levels of governance (Umeda 2013, 4). The CDMC includes all ministries, the heads of designated public corporations, and the academic experts who work under the leadership of the Prime Minister (Ranghieri and Ishiwatari 2014, fig. 7.1). The Ministry of State for Disaster Management under the CDMC's guidance established the Basic Disaster Management Plan (BDMP), which served as the foundation for the development of all other national and prefectural level DM plans. In line with this, the government organizations and public corporations developed their Disaster Management Operation Plans, while the prefectures developed Local Disaster Management Plans (Umeda 2013, 4; Ranghieri and Ishiwatari 2014, chap. 7). The BDMP with the subordinate and supporting emergency response plans was to enable the unified, coordinated and graded response. The BDMP describes the duties of the government, governmental and public organizations, as well as the sequence of phases in the DM

system. Under the law, the CDMC establishes the disaster response headquarters as necessary.



Figure 5. Japan's Disaster Management System

Source: Ranghieri and Ishiwatari 2014, 73.

Under the law and as outlined by the BMDP, the prefectures and municipalities carried the primary responsibility for the local response. It was a system of gradual or layered response where the lowest levels of governance would respond and provide the information about the disaster to the higher levels of governance. If the municipal DM

capabilities could not cope with the situation, they could request assistance from prefectures. The prefectures could request the assistance from the neighboring prefectures, but more importantly, they could claim it from the national CDMC (Umeda 2013, 4-7; Cabinet Office 2015b, 9-11). Also, the municipalities and prefectures had a responsibility to conduct risk management and reduction, disaster prevention, and mitigation measures. Hence the local authorities were responsible for the establishment of shelters, local food, and necessity stocks (Umeda 2013, 6). When deemed necessary, the national level government could provide additional funding and resources to support the local authorities.

Resources-wise, the Japanese DM, had an extensive network of various organizations to serve in each phase of the DM. After the 1995 Kobe earthquake, the Government of Japan understood that the local capabilities could easily be overwhelmed by the size of a disaster. Hence in the wake of the earthquake, the government established the Inter-prefectural Emergency Police Force (IEPF) and the Emergency Fire Response Teams (EFRT) to serve as the nationwide primary professional response force (Ranghieri and Ishiwatari 2014, chap. 14; Cabinet Office 2015b, 10). The mobilization of the IEPF and EFRTs on the national level occurs when affected prefectures are unable to cope with the consequences of the disaster (Cabinet Office 2015b, 10). These units perform the rescue and limited lifesaving operations.

The specially staffed Disaster Medical Assistance Teams (DMAT) provide the wide area medical support to the local medical facilities, act independently as necessary, and provide the medical evacuation with the SDF (Cabinet Office 2015b, 10). The SDF is not a primary response force but often act in support of other responders. The SDF

usually gets involved in the disaster response upon request from the governor of the affected prefecture. Another supporting organization is the Technical Emergency Control Force (TAC-FORCE) under the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). The TAC-FORCE serves as the technical advisory body to the affected municipalities to help them assess the damage, identify preventive measures against additional damage, and undergo the response (Ranghieri and Ishiwatari 2014, chap. 14). Next, to the presented governmental organizations, the Japanese Red Cross Society (JRCS) plays a significant role as the largest and most widely present NGO. As the official player in the DM system, the JRCS maintains a notable medical support capability with its DMATs (Ranghieri and Ishiwatari 2014, chap. 14). Japan's DM community-based system involves different volunteer organizations, which under their official status, receive the necessary rescue training, and perform annual drills to maintain proficiency (Ranghieri and Ishiwatari 2014, chap. 6).

Despite the long tradition and significant experience in the DM activities, the response to the GEJE by Japan's DM authorities displayed unexpected deficiencies. The disaster response plans did not predict multi-hazard disasters. No agency ever assessed the risk of multi-hazard disaster. Besides, the Fukushima Daiichi Nuclear Power Plant's risk assessment was not a part of the national risk assessment. The Tokyo Electric Power Company (TEPCO) as the owner and the operator of the power plant made its risk assessments that Nuclear and Industrial Safety Agency (NISA) the regulatory body accepted them mostly without questioning (National Diet of Japan 2012, 27-28). The combination of these facts caused the response plans to fall apart when the disaster hit.

The entire DM system across all levels of governance had the existing emergency response plans. However, a single disaster type plans could not work in the severely degraded environment. Plans vaguely described the roles of the governmental agencies, designated public organizations, and other responders leading to the duplicated efforts, collisions, and gray areas (Ranghieri and Ishiwatari 2014, 74). Some areas did not have updated plans creating a disconnection with the higher level plans. Other plans lacked the clarity on coordination, communications, initial actions and required timings for performance, food, and necessity supplies stockpiling, equipment for the response and other areas (Ranghieri and Ishiwatari 2014, 74). A significant problem with the plans presented the fact that the lower levels of governance had to request support from the higher levels officially. So when hardest hit municipalities lost the entire DM capability and communication means, the prefectures lost the precious time waiting for the request and eventually dispatching the survey teams to gain the situational awareness. The same applies to intra-prefectural coordination (Ranghieri and Ishiwatari 2014, 74-76).

The coordination among various national organizations, agencies, governmental authorities at all levels, and international organizations was less than optimal. In some instances, there was no coordination whatsoever, especially between the local authorities and international organizations (Ranghieri and Ishiwatari 2014, 3-4, 8). Despite the DM framework, the individual ministries and agencies, including SDF and National Police Agency, deployed independently to the disaster response without the coordination of efforts (Howitt 2012, 6). The lack of effective coordination revealed deficiencies in the emergency response plans and somewhere a lack of proficiency in the execution of those plans. The coordination, among other things, also played a role in the Fukushima

Daiichi's meltdown as the complex network of authorities for control and oversight prevented the efficient coordination and timely information exchange.

Some authors observed the overly bureaucratic response which reduced the capability of central headquarters to deal with the continuous influx of information and necessity to make quick decisions (Carafano 2011, 3; Lochbaum et al. 2014, 15-31). The bureaucracy was present in the overall mechanism of control for the nuclear power plants; multiple ministries with their agencies, independent agencies, and prefectures were all responsible for the different, overlapping, and sometimes conflicting tasks of monitoring, control, and the promotion of nuclear power. The complexity of such a mechanism contributed to the multiple failures, leading in the end to the nuclear meltdown at Fukushima Daiichi (Lochbaum et al. 2014, 15-16). Probably the most shocking revelations about the Fukushima Daiichi's meltdown relates to the failure of TEPCO, both regulators NISA and Nuclear Safety Commission (NSC), and the Ministry of Economy, Trade, and Industry (METI). These organizations all jointly failed to correctly develop and impose the safety mechanisms that would enable (1) the assessment of damage to the power plant, (2) the prevention of collateral damage if the disaster occurs, and (3) the development of publicly available evacuation plans in a case of radioactive release (The National Diet of Japan 2012, 16-17).

In addition to the lack of appropriate safety measures, an improper action by the Central Disaster Response Headquarters under the Prime Minister on one side and TEPCO officials on other, ambiguity and a lack of expertise, all contributed to the outcome (The National Diet of Japan 2012, 12-37). The Commission formed by the National Diet of Japan concluded in its official report that the failures by multiple

organizations and the Government, and a general lack of a concern for the general public by TEPCO, turned the Fukushima Daiichi's meltdown into a man-made disaster (The National Diet of Japan 2012, 16). A lack of contingency plans and a poorly executed coordination resulted in the delayed evacuation near the power plant and exposure to the radiation of several thousand citizens.

The Prime Minister announced a Nuclear Emergency Situation at 19.03 hours on 11 March 2011, several hours after the tsunami hit the Fukushima Daiichi nuclear power plant. This declaration of emergency came almost 2 hours after the Prime Minister was notified about the deteriorating situation at the power plant, which required such a declaration (Lochbaum et al. 2014, 23-24). The Fukushima prefecture established the disaster response headquarters as per the corresponding emergency plan. However, the plan did not envision the nuclear emergency as a result of a natural disaster. Therefore, the prefectural government was not sure what to do. The loss of communications significantly contributed to the problem. Regardless, the prefectural government ordered the evacuation of citizens who lived in a radius of 2 kilometers from the power plant. Just 30 minutes later, the Central Disaster Response Headquarters (CDRH) ordered an evacuation in a range of three kilometers. Over the following four days, the (CDRH) issued several evacuation orders expanding the all-out evacuation zone from three, to ten, and then to 20 kilometers in a single day. Some evacuees moved to zones with higher levels of radiation (The National Diet of Japan 2012, 38). In total, 148,000 people evacuated from the area surrounding the power plant.

The evacuation prompted the establishment of evacuation centers throughout the country in the public schools, gymnasiums, and other available spaces as soon as people

started moving the humanitarian and sanitary situation deteriorated in many of those centers. There were problems with food and water, sanitary supplies, transportation, overall information about the evacuation and hazards (Ranghieri and Ishiwatari 2014, chap. 18). It is worth noting that people handling the incoming disaster response supplies initially did not have knowledge or experience in the logistics. Such a situation resulted in a chaotic distribution of many necessary goods (Ranghieri and Ishiwatari 2014, 146). The overall confusion ruled in many evacuation centers as the people moved in without an established support system. Both authorities directing the evacuation and authorities receiving evacuees lacked the information and a clear picture on what is the desired end state.

The evacuation was difficult as people and hospitals struggled to find transportation and accommodations. Especially troublesome are reports of forgotten patients confined to bed in Futaba Hospital near the Fukushima Daiichi; the hospital staff left them on 12 March 2011 to be evacuated by the SDF. Due to the series of bureaucratic errors and a lack of communication, the SDF arrived at the hospital two days later, only to find four patients dead. Fourteen more patients died during the evacuation, while SDF accidentally left an additional 35 patients in the hospital reaching back to them on 16 March 2011 (Lochbaum et al. 2014, 117-118).

Out of approximately 602,000 people who lived in the areas hit by the tsunami, some 580,000 successfully evacuated out of the hazard zones (Ranghieri and Ishiwatari 2014, 101). However, of those who perished, many stayed within the hazard zone for a variety of reasons. Some reasons include a lack of timely tsunami warnings or the absence of an updated tsunami warning. Severed communication lines and the loss of

electrical power affected the emergency and warning systems which depended on the existing hard lines uncovering the lack of emergency communication and back-up power capabilities (Ranghieri and Ishiwatari 2014, 125-126). On the other hand, many lost their lives after reaching the designated shelters and tsunami evacuation areas. Several prefectures had between 39.7 and 51.5 percent of their shelters and tsunami evacuation areas hit by the tsunami leading to the severe loss of life (Suppasri et al. 2013, 1009-1010).

Emerging Themes

The organizational and bureaucratic complexity of disaster management as a theme. Despite all the legislative framework and the emergency response plans, the bureaucratic complexity affected the response. The entire system depended on the process of formal requests for assistance. Also, the bureaucratic lines of communications and the organizational complexity prevented the efficient coordination leading to delayed information sharing as in case of the nuclear crisis at Fukushima Daiichi. The coordination in such an environment delayed the initial response in some affected areas as the neighboring prefectures did not have an obligation to step in and initiate the response without the invitation.

With all the observed issues, the emerging theme is complicated or superficial emergency response plans. The sheer existence of emergency response plans at various levels of governance was not enough to drive the response efficiently. Many plans dealt with different types of disasters separately preventing the efficient response in a multi-hazard environment. Additionally, it seems that plans did not prescribe the coordination outside the respective municipality or prefecture. The plans at the lower levels

somewhere collided with the plans of the higher levels of governance confusing the roles of individuals and organizations. Plans did not predict the long-term evacuation. The evacuation, in this sense, was a movement of the local population from the immediate hazard zone to the nearest shelter where they would stay until the situation allows them to return to their homes. In this instance, the tsunami destroyed houses and residences of many people rendering their evacuation a long-term endeavor. In the case of Fukushima evacuees, it turned to permanent resettlement. This theme corresponds to the organizational features due to the absence of coordination mechanisms, clarity on roles and duties, and evacuation plans.

Coordination as a theme closely relates to the organizational structure of DM and the proper integration of all DM elements into a single system. The coordination of the response from the top level to down was problematic to say at best (Howitt 2012, 15). The coordination mechanisms were weak in the sense that all information sharing was vertical first, and then it would get disseminated down from the Central Disaster Response Headquarters. The events surrounding the Fukushima Daiichi's meltdown revealed the same weakness as the multiple ministries, regulatory agencies, TEPCO, and prefectures dispersed their efforts along own lines without coordinating actions and effects. In the integrated DM system where there is no division among stakeholders on single-type disaster response, the coordination becomes an organizational requirement. Unlike Chinese DM system in which responding bodies, in theory, did not need to coordinate with other DM agencies when responding to a single type disaster, Japan's integrated DM system demanded continuous coordination.

A lack of collaborated risk assessment is another emerging theme. While the overall system included years of lessons learned from multiple disasters, there was no risk assessment related to the multi-hazard disaster. Examples for this emerge from the failed re-issue of tsunami warning as no one contemplated that the earthquake might affect the effectiveness of the early warning system. Another example is related to the earthquake and tsunami damaging the communications and electrical power network, which then resulted in an unusable mobile radiation monitoring posts. Finally, the earthquake damaged the power supply to the nuclear power plant, but different sockets and short cables prevented the connection of back-up power supply. All this implies that there was no collaborated risk assessment. The theme fits into the organizational features of the DM because it depicts the entire essence of the DM system based on single disaster readiness and response. Such a DM system cannot successfully deal with multi-hazard disasters.

The evacuation planning and execution is the final emerging theme under the organization. The evacuation in the GEJE relates both to the individual self-evacuation before the tsunami and the mandated evacuation around the Fukushima Daiichi nuclear power plant. The former evacuation is an excellent example of how risk awareness can ease the response to a hazard and reduce the risk. Thousands of citizens self-evacuated or received help to evacuate before the tsunami hit. However, the evacuation did not envision such a large number of evacuees. The number of evacuees in 2,182 shelters surpassed 386,000 a week after the earthquake (Umeda 2013, 22). Such a large number of evacuees placed a strain on the responding organizations who at times struggled to provide satisfactory sanitary conditions (OCHA 2011, 2; Carafano 2011, 2).

Then, some people, unfortunately, evacuated to shelters which were destroyed by the tsunami. There were also communities and schools without evacuation plans or evacuation practice, which ended in a horrific loss of life. Also, finally, the evacuation around the Fukushima Daiichi was a product of pure improvisation. The evacuation orders dispatched citizens into the unknown without any information on where and for how long they were supposed to go. Many had to relocate several times as the evacuation zone increased in size. The evacuation placed severe strain on responders and organizations which tried to provide enough basic needs for survivors and evacuees. The transportation was scarce; the evacuating authorities offered little information, accommodation was inadequate for such a large number of people in total 148,000 people evacuated just due to the Fukushima Daiichi nuclear crisis. The theme describes the DM's organizational features as there was a lack of evacuation planning and preparedness.

Training

Data Analysis

The community-based DRM system provided widespread training opportunities to various organizations, agencies, volunteer groups, and individuals. The overall society embraced the culture of preparedness, following the evacuation drills and rescue training were a part of citizens' lives (Ranghieri and Ishiwatari 2014, 3). Next, to the professionalized emergency response police and fire fighting units, Japan had at its disposal the volunteer fire corps. These units consist of the members of local communities to provide an immediate response to any disaster. Those units received

regular training to maintain their proficiency while they benefited significantly from the knowledge about the local area (Ranghieri and Ishiwatari 2014, 69).

When it comes to the ability of DM responders to perform in line with the existing emergency response plans, the literature does not offer instances in which the responders acted contrary to the plans' provisions. The interesting situation emerged with regards to the population older than 60 years. The long-term nursing facilities regularly trained and prepared for the evacuation of their patients. On the contrary, the local governments had very little knowledge about their elderly citizens and were not well prepared to conduct their evacuation (Ranghieri and Ishiwatari 2014, 164). There were also instances where the confidence of people in their proficiency to respond to single type disasters led to complacency. Later, when the disaster struck, these communities struggled to execute the response (Carafano 2011, 4). However, all these instances refer to the inadequate emergency response plans, not to the failure of responders to follow those plans.

The Fukushima Daiichi personnel was seemingly very well trained in executing the daily tasks and performances. This picture began to shatter soon after the crisis in the power plant emerged. The TEPCO's disaster policy was that a chance for the disaster was so small that it was impossible for anything serious to occur (Lochbaum et al. 2014, 16). With that mindset, the power plant's personnel conducted only fire drills to maintain their emergency preparedness (The National Diet of Japan 2012, 70). However, those drills had little value in an emerging crisis. When the loss of power triggered the crisis, the workers at Fukushima Daiichi had to execute the extreme safety measures they had never tried or trained before (Lochbaum et al. 2014, 20). Therefore, they referred to the

manuals. However, the manuals were vague and incomplete, something the management would have known had they ever conducted the training. Once the workers understood the procedure, then they had to find those safety valves in devastated reactor buildings. In addition to these difficulties, the shift of workers who got involved into the crisis was not entirely familiar with the design of reactor at Unit 1 leading to delayed actions (Lochbaum et al. 2014, 25).

Emerging Themes

For the training element of this case, two closely intertwined themes emerge, first weak enforcement of the disaster response proficiency the response, secondly a lack of emergency response training within the DM organization. The first theme relates to the governmental agencies which failed to enforce the disaster response proficiency to the lower organizational levels and non-governmental stakeholders. The theme reflects an organizational feature of the DM because there was a precise enforcing mechanism within the DM system that would ensure the compliance of all concerned parties with the DM requirements. The nuclear crisis revealed a significant portion of issues related to disaster response proficiency. Although the TEPCO and Fukushima Daiichi's personnel represent only a small sample in the overall population hit by the triple disaster, a lack of preparedness combined with their actions significantly contributed to the deterioration of conditions. An inability or possibly the unwillingness to enforce required safety and risk reduction measures by the regulatory agencies and national disaster management authorities has led to the chain of events that resulted in the nuclear disaster (Lochbaum et al. 2014, chap. 2).

The second emerging theme is the lack of emergency response training within the DM system. This theme also refers to the Fukushima Daiichi crisis as there was no substantial information to attribute the lack of training to larger response forces and efforts. The TEPCO was a corporation that played an active role in Japan's DM. The theme falls under the category of DM's organizational features as the literature presents no clear evidence that the TEPCO and Fukushima Daiichi's personnel had to train for all emergencies. This theme connects to failures of the Fukushima Daiichi workers to employ the basic emergency procedures and prevent the escalation of the crisis. However, in line with the theme from the previous paragraph, not all blame goes to the workers. Still, a lack of training in emergency response has the potential to significantly degrade the response efforts. Therefore, it is a valid theme for the cross-analysis.

Material

Data Analysis

From the material side, Japan's disaster management system used technologically contemporary equipment and materials. The designated emergency rescue forces fielded the professional emergency response related equipment and vehicles, achieving necessary capability in response to multiple types of disasters. The emergency response plans mandate that the municipalities or prefectures which request the assistance in the disaster response need to provide the logistical support to the incoming emergency response forces (Ranghieri and Ishiwatari 2014, chap. 14). While such systems perform well in incidents and smaller disasters, it could hardly work in the instance of GEJE. The almost destruction of many municipalities left those places without disaster management facilities, communications, storage sites, and supplies. Areas that suffered such

destruction could not support the incoming emergency response forces with radio equipment, fuel, and other logistical items (Ranghieri and Ishiwatari 2014, chap. 14). In towns like Otsuchi, the tsunami killed most members of the local response team, making the initial response non-existing. Eventually, the neighboring cities had to dispatch their personnel to act as the primary responders in such situations (Mimura et al. 2011, 814). In such instances, the incoming emergency response teams faced fuel shortages which at times significantly limited their effectiveness.

Similarly, many local fire emergency response teams lost their radio equipment or base radio locations when the tsunami destroyed their headquarters. On top of that, the earthquake significantly damaged nations mobile telephone and radio network crippling communications for several days (Ranghieri and Ishiwatari 2014, chap. 15). Without radio equipment, the electrical power, and the mobile telephone network they could not communicate except in face to face interaction.

In addition to the severed communications to the outside world, the earthquake also damaged all communications within the Fukushima Daiichi, making the interaction possible only face to face. Troubles kept on mounting with a lack of adequate extension cables which would provide some electrical power; systems lacked spare batteries, all while additional tremors kept causing insecurity (Lochbaum et al. 2014, chap. 1). Later in the response, when the workers desperately tried to pump fresh water into the reactor vessels and spent fuel pools, they could not get a sufficiently powerful external pump. The pump needed to be able to deliver high amounts of water under the high pressure, and to a height of five floors above the ground. The workers required such pumps simply

because no one contemplated the complete system failure (Lochbaum et al. 2014, chap. 1).

The citizens of nearby areas who evacuated the vicinity of Fukushima Daiichi were utterly unaware of the explosion in the Unit 1 building and the possible risk for them. Despite living in the proximity of the nuclear power plant, the citizens did not have any protective equipment that would protect the eventual evacuation. Pre-positioned radioactivity monitoring stations offered the only protection. Unfortunately, most of those stations were non-operational due to the loss of power or tsunami washed them away (The National Diet of Japan 2012, 36). Similarly, the NISA personnel arrived at the pre-planned emergency headquarters external site outside of the Fukushima Daiichi. Those headquarters would coordinate and support the response to the nuclear accident. However, the NISA personnel discovered that the site did not have power, telephone, food, and water. The most troublesome feature was a complete lack of air filter that would protect the site from the radioactive fumes (Lochbaum et al. 2014, 16-17). Following the deterioration of the situation, the Government ordered the evacuation of immediate vicinity around the Fukushima Daiichi. However, there were no ready shelters, no prepositioned stocks to protect and sustain the evacuees.

The shortages of food and water, cloth, blankets, and medical supplies soon occurred. The emergency response plans envisioned the evacuation procedures for citizens to reach local shelters and survive the disaster. Unfortunately, the plans did not envision large stocks of supplies necessary for the long-term, large-scale evacuation (Ranghieri and Ishiwatari 2014, 106). When the tsunami destroyed local facilities, and when the crisis at Fukushima forces people into evacuation centers, a lack of stocked

supplies became an acute problem to some 386,000 evacuees (Ranghieri and Ishiwatari 2014, 156-157).

Emerging Themes

Several studies point out that the radioactivity monitoring stations and mobile telephone network stations lacked robust and resilient back-up power systems. The loss of monitoring capabilities near Fukushima Daiichi significantly affected the delayed response to the radiation release. Similarly, the loss of communications hindered communication efforts across the entire Tohoku region for days. However, the back-up systems for the networks of concern existed, albeit not as resilient as they should be. Therefore, this theme is not an organizational element of DM, but a technical one, so it does not qualify for the cross-case analysis.

A lack of prepositioned stocks to sustain the survivors and support the disaster response is the most important theme related to the material. This theme corresponds to the organizational features of DM as no study or report pointed out the existence of preexisting organized stocks. Several studies point out the lack of prepositioned stocks in response to GEJE as a noteworthy lesson (Ranghieri and Ishiwatari 2014, 131, 156-157). The lack of prepositioned stocks hindered the efficiency of emergency response forces as they run out of supplies and could not resupply from the local sources. Similarly, the prepositioned stock would have made the evacuation, the stay at the temporary evacuation centers, and recovery for survivors and evacuees much easier. There is no doubt that the appropriately composed, stored, protected, and when necessary, delivered prepositioned supplies and equipment would increase the efficiency of disaster response.

Closely related to the lack of prepositioned stocks is the lack of material base for the emergencies at critical infrastructure. The absence of precise requirements for such setup and a lack of regular checkups to confirm the existence of a material base for the emergency at critical infrastructure places this theme into organizational features of the DM. Critical infrastructure like the Fukushima Daiichi nuclear power plant cannot base there and the safety of the general public on assumptions that systems are secure and fail proof. As the GEJE revealed, even the most ordinary materials as spare batteries can become scarce, but the most important resource. A number of both disconnected and connected events caused the nuclear meltdown in Fukushima Daiichi. However, the fact that the workers could not connect the external power generators due to short cables and incompatible sockets uncovers the level of the material base for emergencies. Equally disturbing is the state of NISA's external headquarters site that appeared to be an empty shell and as such could not provide the basis for operations of its purpose. From the local community side, surprising is the lack of protective equipment for citizens who lived near the power plant.

Leadership and Education

Data Analysis

As soon as the earthquake struck, Prime Minister Kan established the Emergency Disaster Response Headquarters in the building of the Cabinet Office (Ranghieri and Ishiwatari 2014, 125). The Prime Minister immediately ordered the mobilization and the deployment of SDF. Japan's community-based DM system naturally included the administrative and executive leadership at all levels. In a system set up gradually, the local governments and local leadership play a significant role (Ranghieri and Ishiwatari

2014, 73). The local administration was responsible for both the local disaster risk management and disaster management. On that note, the communication of various risks to communities was not sufficient enough to prevent many possibly preventable deaths and unnecessary hardships (Ranghieri and Ishiwatari 2014, 3; The National Diet of Japan 2012, 18-20).

The leadership at all levels allowed the various entities to communicate the information of questionable accuracy via social media. Also, several entities ordered the evacuation around the Fukushima Daiichi without clear directions to where the people should go. Those entities issued evacuation orders while jumping over the other bodies which held the authority to issue the evacuation orders. That resulted in an evacuation of some groups to the areas with higher radiation dose, where the authorities forgot about them for weeks. A lack of relevant and trustworthy information led to public outcry and anxiety (The National Diet of Japan 2012, 18-19, 76-79). Misinformation about the radiation spread fear throughout the Tohoku region, even as far as Tokyo 230 kilometers to the southwest. Ultimately, people who react to too many false alarms will eventually stop responding to credible alarms and warnings.

An absurd situation aroused in the vicinity of Fukushima Daiichi where the local community asked for the construction of a nuclear power plant in the area only to have TEPCO mislead them about the nuclear power plant's risks. In late 1950, the local government officials made a secret deal with TEPCO for the construction of the Fukushima Daiichi nuclear power plant. The agreement was initially kept secret due to the fear of local officials that citizens might not accept the construction in their region. However, the construction of the power plant brought prosperity to the area, and all

possible ecological and health consequences fell into oblivion (Lochbaum et al. 2014, 40). For years TEPCO kept saying to the Fukushima prefecture citizens that the Daiichi was perfectly safe and that there were no risks associated with the operation of the plant. No one ever questioned such statements. Citizens were not aware of any possible risks. Moreover, the local governments played along by not taking any precaution measures but having the evacuation drills as a way to fulfill the formality, instead of preparing for the possible event and the subsequent evacuation. The evacuation of citizens out of the area was not even a requirement by the Safety Guideline issued by NISA (The National Diet of Japan 2012, 18-19, 76).

The local governments distributed the hazard zone maps in most cases as a way to communicate the risk of a tsunami. However, with years, the amount of mid-aged citizens who used to take part in the annual evacuation drills significantly dropped, while the elderly and children were still taking part in the drills. This explains a considerably more significant number of school-aged children among survivors in some communities as schools there tended to practice evacuation drills and educate children more than others (Ranghieri and Ishiwatari 2014, 326). On the other hand, there are instances where almost entire schools perished because they never planned or practiced the evacuation drills.

The public education system did not mandate the evacuation plans and drills practice. However, living in the earthquake and tsunami prone region, many schools continued to educate children on the evacuation procedures and drills (Ranghieri and Ishiwatari 2014, 326). The drills and exercises also included education for the general population. Such exercises led to lessons learned and local improvements of the evacuation drills, locations, and facilities (Ranghieri and Ishiwatari 2014, chap. 19). On

the other hand, there were areas where the local administration did not establish any evacuation plans, nor they performed evacuation drills.

Emerging Themes

A theme of poor risk communication and risk awareness emerge as a consequence of so many people losing their lives despite the warnings. Although the loss of electrical power and communications significantly contributed to the dissemination of the tsunami early warning and later the updated tsunami warning, many perished due to the lack of risk awareness. Citizens who did not want to evacuate, or returned to their homes, or got stuck in the traffic were all unaware of the risk. In years before the tsunami, the number of people taking part in tsunami drills significantly reduced, leaving school-aged children and elderly to participate (Ranghieri and Ishiwatari 2014, 100-101). This meant that only able to perform tsunami evacuation drills were elderly and children, limiting the evacuation ability to the vulnerable portion of society, which required assistance to perform those drills. The researchers recognized that the hazard zone maps provided a false sense of security. As a consequence, those citizens did not evacuate believing that they are out of the danger zones, which subsequently led to their deaths (Ranghieri and Ishiwatari 2014, chap. 26).

Despite being the earthquake and tsunami prone region, the authorities did not communicate the risk evenly. The deficiencies in response to the nuclear crisis at Fukushima Daiichi are in line with poor risk communication. Not only did TEPCO and regulatory agencies fail to communicate the risk of radioactive release to the Fukushima prefecture citizens before the crisis, but then Japan's government was unable to disclose it once the radioactive isotopes spread to air (Lochbaum et al. 2014, chap. 3, 104-105).

Such a situation initially resulted in an understated risk understanding, but later in panic and anxiety as the lack of information sparked the speculations about the effects of small dose radiation (Carafano 2011, 8).

Several other themes emerge about the leadership, but they do not fall within the organizational features of the DM. Themes that reflect the individual choices and decisions, made under the pressure of events in the multi-hazard environment with degraded communications, do not necessarily represent deficiencies in the DM system. Additionally, the literature does not offer substantial information to identify other themes correctly. Therefore, such themes do not qualify for the cross-case analysis.

The 2012 Superstorm “Sandy” in the USA

Organization

Data Analysis

The US Government utilizes the National Preparedness System to achieve the desired level of national security and resilience. The National Preparedness System integrates five core missions to achieve the National Preparedness Goal: prevention, protection, mitigation, response, and recovery. The critical part of the National Preparedness System is the National Response Framework (NRF). The NRF is the national doctrine on how the US as a nation builds, sustains, and responds to events (DHS 2013b, 1). The NRF is, therefore, a guide to the US nation on how to respond to incidents – natural and manmade disasters and emergencies, regardless of the size, scope, or complexity. The NRF corresponds to serious incidents regardless of the level of governance, integrating the whole community, capabilities, plans, and agencies into the most efficient response (DHS 2013b, 2). The response itself includes capabilities

necessary to save lives, to protect the environment and properties, meet basic human needs for those affected, stabilize the incident, restore services, and set safety conditions for the recovery. The NRF describes roles, responsibilities, principles, and coordinating structure for capabilities in the response and describes how the response as the mission area fits within the prevention, protection, mitigation, and recovery (DHS 2013b, 4-5).

Following the establishment of the US Department of Homeland Security (DHS), the need for integrated response across the levels of governance led to the creation of the National Response Plan in 2004. In 2008 the DHS replaced the National Response Plan with the first version of National Response Framework (NRF) incorporating into it lessons learned from the hurricane Katrina (DHS 2013b, 3). Figure 6. shows how the NRF guides the planning from the top level down to the individual states and their disaster management related departments and agencies.

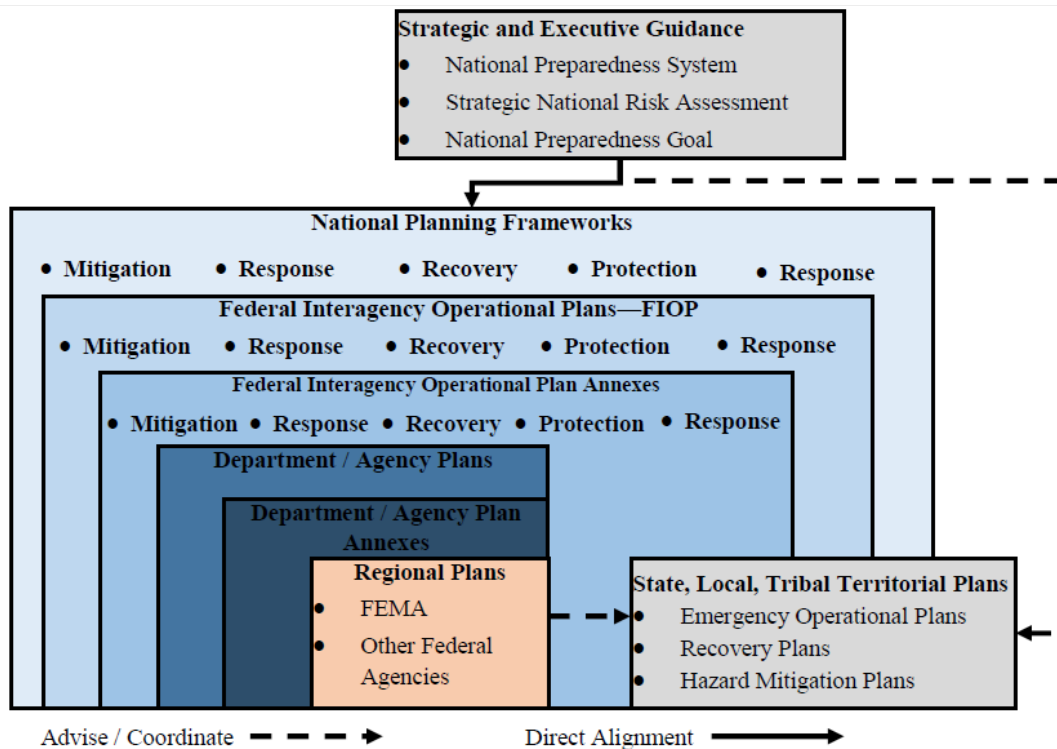


Figure 6. The Integration of Planning and Disaster Management

Source: DHS 2016, 49.

Five guiding principles for the NRF reflect the integration of the whole community. The principle of engaged partnership means that the response includes the whole community to bring multiple, diverse, and mutually supporting capabilities (DHS 2013b, 5-6). The principle of tiered response means that the response ends with the lowest level, which possesses necessary capabilities without requiring the higher levels of governance to commit resources (DHS 2013b, 6). The principle of scalable, flexible, and adaptable operational capabilities requires the responding body to remain flexible to meet the changing needs of the response; if available capabilities fail to deliver the intended response, then employ appropriate capabilities from other sources within NRF (DHS

2013b, 6). The principle of unity of effort through unified command requires the responding organizations to direct the efforts towards a single common goal. The NRF achieves the unity of effort through the Incident Command System (ICS), which brings all organizations included in response to work within a common framework (DHS 2013b, 6). The last principle is the principle of readiness to act. This principle requires all organizations or individuals to act in response to an incident; it requires the responders to act in the face of the risk through the disciplined, trained, procedural, and timely action (DHS 2013b, 6-7).

The NRF utilizes the National Incident Management System (NIMS) to set the standard operating framework for all levels of governance, organizations, agencies, and individuals in preventing, protecting against, mitigating, responding, and recovering from incidents (DHS 2017, 1). NIMS provides basic structures, vocabulary, and processes to guide the personnel to work together efficiently during incidents. Unlike the NRF, which includes the whole community, the NIMS corresponds only to the emergency responders and those responsible for making decisions during the incident (DHS 2017, 2). The guiding principles for the NIMS are flexibility, standardization, and unity of effort.

During the response to Superstorm Sandy FEMA and other federal and state agencies encountered several issues that affected the planning and the flow of operations (DHS 2013a, 10-16). In 2013 FEMA issued an After Action Report for hurricane Sandy pointing out several areas for improvement. The NRF described the US DM system as a Whole-Community integrative system. Such an establishment required numerous departments and agencies to contribute their representatives to the NRCC and the subordinate regional coordination centers building the Incident Command System (ICS).

The FEMA used to organize ICS in specific responses to meet the mission requirements best. This could take three different organizational constructs: (1) functional with the organization around the specific function; (2) geographic with the organization divided by regions; and (3) combined that includes features from both functional and geographical structures (DHS 2013a, 12).

In response to Sandy, FEMA adopted the combined ICS structure to allow for both functional capability and centralized decision making, and a geographical representation (DHS 2013a, 12). For instance, the New Jersey Joint Field Office (JFO) had under it several functional sections and branches, such as geographic operations section, mitigation branch, emergency services branch, and program operations section. Sections further divided into geographic or functional branches (DHS 2013a, 13). The geographic branches then divided into divisions under the Division Supervisors. In addition to this structure, FEMA deployed liaison officers (LNO) to assist the local leadership in facilitating the quick exchange of information and needs (DHS 2013a, 12). However, LNO's roles and authorities remained unclear throughout the response concerning Division Supervisors creating confusion about the chain of command, communication, and requests (DHS 2013a, 12-13). Furthermore, the JFO's combined structure created tension between staff at Program operations section and geographic division supervisors as JFO staff strived to maintain centralized decision making. On the other hand, Division Supervisors had increased situational awareness in their areas of responsibility and strived to increase efficiency by controlling the FEMA programs on the local level (DHS 2013a, 13).

FEMA maintains Regional Response Coordination Centers (RRCC) as standing multiagency coordinating bodies that serve to support the response until the establishment of Unified Coordination Group (UCG), such as a JFO (DHS 2013a, 14; DHS 2013b, 40-42). When the incident requires Federal involvement, FEMA and the state jointly establish UCG under the leadership of State Coordinating Officer (SCO) who receives support from assigned Federal Coordinating Officer (FCO). SCOs are the direct representatives of the state Governors and work together with FCO to plan and execute the response that reflects the Governor's priorities. FEMA then transfers the control and coordination authority from RRCC to UCG within 72 hours of the declaration of emergency (DHS 2013a, 14). The RRCC for FEMA Region II which normally covers states of New York and New Jersey retained the control over the Sandy response for a prolonged period despite the establishment of UCG, creating the conflicts of actions and efforts (DHS 2013a, 14).

To overcome the conflicts of authorities, FEMA transferred the Region II RRCC's responsibilities for New York and New Jersey to the NRCC in Washington DC. However, with the authorities transferred to the NRCC, Emergency Support Functions (ESF) personnel from departments other than FEMA experienced uncertainty about from whom to take response tasks. Do they receive tasks from the RRCC, NRCC, or their home agency (DHS 2013a, 14)? FEMA established a separate coordinating body under the leadership of FEMA Deputy Administrator. That body resembles what was previously known as an Area Coordination Group (ACG). The ACG worked over the existing JFOs intending to coordinate the Federal response better in the field and serve as a pivot between NRCC and FCOs (DHS 2013a, 14-15). The role and structure of JFOs

remained, with the difference that the ACG would deconflict specific issues arising between JFOs and recommend the solution to the NRCC. Unfortunately, the roles and authorities of such an improvised coordination body remained unclear to the most Federal, state, and local officials (DHS 2013a, 14-15).

FEMA identified the mission assignment process as yet another feature as the area that needed improvement. The process enabled FEMA to issue the missions in the response and recovery operations to other participating federal partners. The mission assignments were, in essence, work orders that FEMA used to direct other agencies to complete a specific task with clearly delineated funding, control, and guidance (DHS 2013a, 11). The written mission assignments allowed the refund to the tasked agencies. However, the process was complex and time consuming to the point that more than 40 percent mission assignments issued between 26 October and 20 November 2012 took more than one day to process (DHS 2013a, 11). Several mission assignments had to be corrected several times before the tasked agency could use them (DHS 213a, 14). Also, other agencies and partners could not see those mission assignments, which resulted in several duplicated efforts (DHS 2013a, 14).

The overall emergency response required a timely and coordinated response with the unity of effort to reduce redundancy. FEMA and other national, state, local, territory, and tribal authorities develop their emergency operations plan. Possessing the plans before the emergency reflects the existence of deliberate planning, which in turn drives the crisis action planning when the emergency occurs (DHS 2013a, 15). Unfortunately, up to 64 percent of FEMA's deployed planners never used the local hurricane plans. This was by personal choice, or they did not have access to the plans (Dipace 2014, 81).

The mandatory evacuation of citizens remained a continuous issue throughout the response. Both New York and New Jersey issued some evacuation orders, although, New York City issued a mandatory evacuation order for the expanded Zone A – an area encompassing large portions of the coastal and lowland NYC. NYC urged citizens to evacuate to predesignated shelters in an attempt to save lives and to prevent endangering lives of first responders (Gibbs and Holloway 2013, 8-10). Although NYC engaged extensively in informing citizens about the incoming hurricane through multiple communication and media means, even delivering warnings in 25 different languages, many people stayed in place (Gibbs and Holloway 2013, 8-10). It seems that the communication of risk included only the immediate pre-hurricane period. On the other hand, while the state regulations require hospitals to be able to shelter in place and continue operations, conflicting regulations hindered the efficiency of hospitals' back-up systems (Gibbs and Holloway 2013, 8; Powell, Hanfling, and Gostin. 2012, 2569-2570). In the end, five hospitals and 30 nursing homes had to evacuate either during or immediately after the storm relying on limited evacuation assets and endangering their patients (Gibbs and Holloway 2013, 8).

Emerging Themes

The first emerging theme is the organizational and bureaucratic complexity of the DM system. While the entire system was set up to control work from the bottom up, from the incident through the region to the headquarters, in reality, it did not work like that. The FEMA leadership, as well as the local and state agencies, experienced continuous conflicts about the roles, authorities, and the chain of command. The complexity of system entangled with numerous agencies across several levels of governance led to the

slower implementation, long processes, poor mission visibility, conflicting efforts, decentralized execution, and the top to bottom control.

The vast array of local and state agencies in the response dissolved some efforts because lower levels did not fully integrate and sometimes acted on their own. The mid-mission improvisations that FEMA introduced to increase the efficiency of the system only contributed to the complexity and bureaucracy. Furthermore, FEMA recognized that ESF partners did not report timely or accurately on their preparedness to execute the respective function in any given response (GAO 2015, 4). That led to several setbacks and delays in the response, partially because FEMA did not have the authority to control the preparedness. A good example comes from the Public Assistance programs for which FEMA allocated significant funds. However, accessing those funds and getting approval through a bureaucratic maze became a source of wide-spread anxiety and dissatisfaction as the process took a long time to complete with limited information on resolve (DHS 2013a, 23).

The organizational and bureaucratic complexity best reflected in the DM's decentralized structure, which was a result of the federal nature of the government. The state authorities maintain a high degree of independence in organizing internally. Their interaction with the Federal government begins with the Governor's request for assistance from the Federal government. The POTUS approves the request and declares the emergency, which releases the federal agencies and resources, usually under FEMA's coordination. The legislation limits and discourages the POTUS's unilateral decision to declare the emergency in any state. Such an establishment leaves the efficiency of

possible response and the DM system to the Governor's ability to accurately assess the situation and the readiness to act, potentially resulting in late disaster response.

A theme closely linked to the complexity is a lack of collaborated risk assessment. Several studies pointed out that FEMA utilized outdated information to set the Flood Insurance Rate Maps (FIRM), which further contributed to the mitigation measures (Hatzikyriakou and Lin 2017, 955). On the other hand, the NYC Hurricane Evacuation Zone Map from 2012 includes many areas well beyond the 1983 FIRM showing that the city was aware of possible flooding beyond the outdated FIRM (NYC-ARECS 2012). The most damage to the infrastructure, such as power line substations and wastewater treatment facilities occurred within NYC's three evacuation zones (Knowlton and Rotkin-Ellman 2014, 8-12). The logical conclusion would be that NYC should have protected such critical facilities in line with the self-imposed hurricane flood threat assessment. The lack of collaborated risk led to the extended fuel shortage in NYC as the surge affected the fuel supply chain; the NYC was supposed to maintain the two-week worth of fuel supply for official vehicles (Gibbs and Holloway 2013, 134). However, due to the several factors, the city's emergency vehicles fuel stockpile needed the replenishment by 4 November 2012, just six days after the surge (Dipace 2014, 90). Similarly, the telecommunication providers relied on the hardline to provide services; cell towers did not have back-up power sources leading to the failure of communications (Gibbs and Holloway 2013, 24). The situation best describes the lack of collaborated risk assessment among different agencies and across levels of governance; therefore, this theme qualifies for the cross-case analysis.

Poor cross-agency and cross-level communications emerge as a theme. The senior federal leadership as per NRF played a vital role in the overall system; however, they tended to take individual actions without informing the NRCC about it. The system did not predict the necessity to establish communication mechanisms of the senior federal leadership with NRCC (DHS 2013a, 10). The bureaucracy and poor communication caused misunderstanding in the implementation of senior leaders' decisions and the inability of planners to deliver desired planning products (DHS 2013a, 10, 15). The best example comes from the POTUS's decision to increase the federal cost share in response to 100 percent – states and local officials received conflicting messages from FEMA about the decision (DHS 2013a, 10). Somewhere, the local Emergency Medical Services were unable to communicate with hospitals due to the mismatched frequencies, interoperability issues, and a lack of redundancy. Multiple agencies from all levels reported the same problem (ACEP 2015, 8).

The evacuation planning and execution present itself as the theme that naturally follows abovementioned themes. While the refusal of citizens to evacuate caused several problems later during the response, it did not help that, the NYC issued the mandatory evacuation order too late (Gelinas 2013). Once the people stayed in place, it was difficult to reach them and evacuate to the shelters. There is no evidence to suggest the existence of any plan on how to support the vulnerable groups such as disabled persons, weak elderly, children with special needs, and others. Nothing suggests that the NYC knew where such individuals live, how to evacuate them, and how to meet their needs in the blackout if they were unable to evacuate on their own as the NYC administration mandated. Interesting enough, hospitals received orders to shelter in place based on

lessons learned from the hurricane Irene. However, the implementation of those lessons was partial and far from complete – several hospitals never identified the evacuation procedures, thus experienced serious challenges when had to evacuate patients in the middle of the storm (ACEP 2015, 9).

Training

Data Analysis

FEMA identified the lack of compliance with the prescribed NRF procedures and requirements on behalf of Emergency Support Functions (DHS 2013a, 10). There were 13 ESF covering different functional areas to enable a structured and expert approach to any particular challenge in the response. FEMA recognized that the ESF adopted the department-centric approach, working on their own instead of collaborating (DHS 2013a, 10). Such an approach was contrary to the overall idea of Whole Community. FEMA found out that this approach emerged from the lack of training of ESF personnel who were unaware of NRF's requirements (DHS 2013a, 10-11). FEMA recognized a lack of trained personnel to perform the duties of Division Supervisor; however, that was a technical feature as the half of the necessary personnel was in a training phase when the Sandy hit (DHS 2013a, 13).

FEMA deployed over 1,700 Community Relations Specialists (CRS) to assist the population with the application for FEMA assistance, explain how programs work, and check the status of an application. Due to the insufficient number of available personnel to cover all communities efficiently, FEMA assigned this task to the untrained and inexperienced personnel from other branches after only three hours of training (DHS 2013a, 20). The lack of training and experience at more than 70 percent of the personnel

led to the lack of confidence and inability to answer questions about FEMA's programs (DHS 2013a, 20).

Emerging Themes

The incomplete integration of all contributing agencies as a theme. The FEMA identified the inconsistency in the application of prescribed processes in the NRF (DHS 2013a, 10). Notably, agencies failed to apply the inter-agency integrated functional capability to achieve a multi-sectoral approach to their tasks and response efforts. The department-centric approach dissipated efforts preventing the quicker resolution of the crisis. FEMA, on the other hand, did not have mechanisms to check on other departments' preparedness or to enforce the implementation of standards.

The second theme is the lack of training within the organization. The response to the Superstorm Sandy brought to light a lack of training within the FEMA as individuals struggled to work in the system and perform assigned duties. While the high demand for personnel placed FEMA under strain, the truth is also that a three-hour training is insufficient to prepare a person to work efficiently in the high stress environment. An attempt to execute the crisis planning without referring to the local emergency plans displays the lack of continuous training. Properly trained FEMA official would know how to initiate the processes, starting with the local emergency plans. One of the issues that impeded the evacuation of patients from several hospitals was a lack of evacuation and evacuation equipment associated with training by the medical staff (ACEP 2015, 9, 13). The medical personnel presents the very foundation of the DM.

Material

Data Analysis

One of the strong features of the US DM systems is the existence of the significant prepositioned stocks that provide flexibility in planning and response. FEMA managed to mobilize a significant amount of material resources and preposition them in the areas expecting the surge well in advance of the Superstorm. FEMA continued to bring in to the affected areas much need commodities throughout the entire response phase (DHS 2013a, 4-6). States and local communities also mobilized their resources and prepared shelters to accommodate the evacuees and survivors (Gibbs and Holloway 2013, 16). The issues arose when the blackout and the surge led to the fuel shortage in NYC. To accommodate the fuel needs for emergency vehicles, FEMA worked with several partners delivering sufficient supplies for the operations (DHS 2013a, 6). The Army Corps of Engineers (ACE) provided pumping capabilities that helped extract the water from tunnels and subway in NYC (DHS 2013a, 6).

The available sources did not offer enough information to identify material elements that were impeding the response. The material base was robust and able to provide the necessary commodities to FEMA and partners rendering the response less painful. The cross-case analysis does not include the material element analysis for Sandy.

Leadership and Education

Data Analysis

The NRF includes the senior national, state, tribal, or local leadership in the Incident Command Structure (ICS) assigning them a specific role to play in the DM activities. Unfortunately, the senior leadership sometimes bypassed the established chains

of command and communications, leaving the NRCC oblivious of the leadership's actions (DHS 2013a, 10). The unilateral decisions made by the senior federal or state leadership without the consultancy with FEMA experts occasionally challenged the coordination and chain of command (DHS 2013a, 10). For instance, the New York state Governor declared the emergency and requested the federal assistance just a day before the landfall limiting the time for the evacuation and the preparation.

Similarly, the evacuation order mandated hospitals to shelter in place, as they were supposed to be able to do. Still, some hospitals decided to evacuate before the storm because their management feared that the existing disaster mitigation measures might not be sufficient (Powell and Hanfling 2012, 2569). Several hospitals and nursing homes that made the decision not to evacuate trusting their mitigation and back-up measures had to evacuate in the middle or immediately after the storm revealing numerous deficiencies (Powell and Hanfling 2012, 2569). On top of all that, even the FEMA leadership displayed the tendency not to adhere to the established procedures and to interpret the roles and authorities in their way leading to the turf battles (DHS 2013a, 13-14).

Emerging Themes

The decision making detached from the disaster management system emerges as a theme. The theme reflects the tendency of both appointed and professional disaster management leadership to take unilateral decisions without further coordination. Such decision making leads to the ambiguity, information loss, effort duplication, resource dislocation, and gray areas, all potentially affecting the speed and efficiency of the response. While this is somewhat expected behavior on behalf of the elected senior leadership due to the nature of their function that requires them to display leadership and

perform well, it is harmful behavior for professional DM staff. This theme qualifies for the cross-case analysis because the NRF aims to integrate the leadership and achieve the unity of effort, but lacks mechanisms to achieve the full integration of elected and appointed disaster management personnel.

The previous theme, of detached decision making, leads to the emergence of the theme of leadership's proficiency in the DM. FEMA is a highly professionalized governmental agency that serves as the structure for the national DM system. Other participating governmental agencies and departments are functionally oriented, therefore might be less oriented towards the DM system and the role they have in the DM. Naturally, the leadership then orients less towards the DM; creating a situation in which the same leadership needs to learn and re-learn their roles and authorities in the DM in every new disaster. The leadership needs to be able to communicate their intentions to the subordinate DM personnel and to be aware of the effects their decisions might have on the response. The leadership must weigh the need for performance against the needs of citizens, working with, and next to other leaders to reduce the suffering and expedite the response. This theme qualifies for the cross-case analysis because there are no organizational requirements for the senior leadership to follow the instructions and advice of professional FEMA personnel.

The risk communication is another emerging theme. While the states issued the evacuation orders mandating citizens to evacuate to predesignated shelters, vast numbers of citizens remained in place. NYC went to length in trying to reach citizens in the areas on the hurricane's path, but only a day before landfall, probably too late. Still, most of their efforts failed. The fact that the majority of people believed the storm's effect would

spare them indicates a lack of continuous risk communication. If people were not aware of what flood zone they lived in and were not aware of possible dangers, then it is likely that one part of them stayed just because they felt relatively safe. Of course, there were also other reasons for people not to evacuate. This theme fits the organizational features that impede the response as it shows a lack of continuous risk communication and education throughout the year.

Cross-Case Analysis

The step that follows the within-case analysis is the cross-case analysis where all three selected cases compare against each other to identify similarities and differences (Creswell 2007, 163). In this research, however, the cross-case analysis includes exclusively similarities that emerged as themes from the within-case analysis. The within-case analysis did not include any external themes or patterns trying to remove biases from the research. The research studied each case completely individually without any attempts to identify the same or similar themes. However, the limited literature significantly affected the depth of within-case analysis because most of the literature rarely provided details, but instead focused directly to the identified lessons. Regardless, the research covered multiple sources providing enough supporting information to complement the picture and accurately identify the most prominent themes. The within-case analysis organized both the data and themes under the selected DOTMLPF-P domains to set conditions for the cross-case analysis. The identified themes, then compare against each other in Table 2. to recognize those that permeate all three selected cases. The detailed explanation of cross-case analysis follows the table showing the results and their mutual relationship.

Table 2. The Cross-Case Analysis

	Themes	2008 Wenchuan Earthquake	2011 GEJE	2012 Superstorm Sandy	Shared themes
Organization	Organizational and bureaucratic complexity	X	X	X	X
	No collaborated risk assessment	X	X	X	X
	Decentralization affects collaboration	X			
	Evacuation planning and execution	X	X	X	X
	Complicated and unrealistic response plans	X	X	N/A	
	Coordination		X		
	Cross-agency & cross-level communication			X	
Training	Enforcement of disaster response proficiency	X	X		
	Lacking training within DM	X	X	X	X
	Integration			X	
Material	Prepositioned stocks	X	X		
	Rescue tools and equipment	X			
	Medical evacuation airplane	X			
	Communication assets	X			
	Material readiness of the critical infrastructure		X		
Leadership and education	Leadership proficiency in DM	X		X	
	Risk communication and risk awareness	X	X	X	X
	Decision making detached from DM			X	

Source: Created by author.

Organization

Out of seven identified themes under the organization, three are common to all three studied cases. These themes are: (1) organizational and bureaucratic complexity, (2) no collaborated risk assessment, and (3) evacuation planning and execution. The organizational and bureaucratic complexity of the national disaster management systems should not come as a surprise in geographically large countries whose territorial and administrative system includes multiple levels. While Japan is significantly smaller country than PRC and USA, its geographical diversity and administrative division still impose some complexity. For the Wenchuan earthquake, this theme encompasses the necessity of all organizations to seek approval from the nation's top political body and then to respond with the organization that is responsible for a single disaster. In the GEJE, this theme relates to the necessity to request the assistance, which in major natural disasters, might be impossible to achieve. Furthermore, communication within the DM system is formal and vertical, slowing information sharing. In the Superstorm Sandy case, the complexity shows different response partners across levels of governance, trying to implement challenging procedures while second-guessing roles and authorities.

The cross-case analysis identified the lack of collaborated risk assessment like one of the organizational features that impede the response to natural disasters. The multi-sectoral and multi-level feature of disaster management systems has its foundation in the functional division of responsibility. Each participating partner deals with a specific function adding an expert value to the DM system. The system then depends on the coordination and collaboration to achieve multi-sectoral expertise and capabilities in response to disasters that spill across functional boundaries. However, as all three cases

showed, a lack of collaboration in the risk assessment can lead to the unfathomed second and third order consequences. The emerging consequences might not only impede the response to the original disaster but possibly require a separate disaster response as in the case of Fukushima Daiichi. In Superstorm Sandy, this theme touches the proximity of many important structures to the Ocean or their vulnerability to flooding despite sitting in the known flood hazard zone. Another theme is the lack of understanding of what second-order effects will the loss of power have on the entire population and the responding efforts. In the Wenchuan earthquake, a lack of collaborated risk assessment led to a poor seismic hazard zoning, which ended in collapsed public buildings and heavily damaged infrastructure.

The evacuation planning and execution showed up in some form or shape in all three cases. While the selected cases present completely different stages for evacuation in terms that two evacuations followed after the unpredictable disasters, and the third preceded the predictable disaster, the impact on the disaster responses was significant. Both PRC and Japan struggled to accommodate vast numbers of evacuees, while the USA struggled to evacuate citizens to safety in time, only to devote significant resources to evacuate or support those who remained behind. Massed evacuations that overwhelmed the planning scope and the execution capabilities marked the evacuation portion of all three cases.

The fourth theme also partially emerged from the cross-case analysis, namely the complicated and unrealistic response plans. The within-case analysis easily induced this theme from the cases of the Wenchuan earthquake and GEJE. However, the literature did

not offer a sufficient amount of necessary information to conduct the minimum of analysis required to identify this theme in response to Superstorm Sandy.

Training

The cross-case analysis identified only one theme common to all three cases. The lack of training within the DM system transcends all three cases showing severe impacts on the responses. In the Wenchuan earthquake that refers to the skills to perform in the disaster environment for medical personnel and PLA members. For the GEJE training within the DM, the theme refers to the apparent lack of emergency related training for the Fukushima Daiichi personnel – not that there was not training, but it covered only what the leadership felt was the likely emergency. For the Superstorm Sandy, this theme relates to the numerous difficulties FEMA and other agencies encountered due to the lack of adequately trained personnel.

Material

The cross-case analysis failed to identify any common themes, primarily because the within-case analysis of the Superstorm Sandy did not reveal any specific features on the material side that impeded the response. The two other cases shared a single common theme – lack of prepositioned stocks. This theme could relate to other major disaster responses outside of USA as FEMA and states have established robust prepositioned stocks.

Leadership and Education

Under the leadership and education, the cross-case analysis identified a single common theme that relates to the general population, rather than the leadership. The poor

risk communication and subsequent low risk awareness emerged in all three studied cases. The leadership and authorities DM either partially or entirely failed to communicate the risk of possible hazards to the concerned population leading to the inadequate preparedness and failure to comply with the mitigation measures. This, in turn, resulted in significant casualties, increased stress on the responders and DM system, and prolonged recovery. The examples from the GEJE where entire communities or schools avoided casualties due to the increased risk awareness delineates the importance of continuous risk communication.

Assertions

The within-case and cross-case analyses of the selected studies were thorough and freed from personal biases enough to offer a meaningful amount of comparable data. While the within-case analysis brought forward 18 themes from all four selected DOTMPLF-P domains, the cross-case analysis confirmed that five of those transcend across all three disasters. All three disasters experienced difficulties due to (1) the organizational and bureaucratic complexity, (2) no collaborated risk assessment, (3) challenges in evacuation planning and execution, (4) training within the disaster management system, and (5) poor risk communication and risk awareness. The four additional features present themselves as significantly present in at least two disasters: (1) complicated and unrealistic response plans, (2) a lack of enforcement of disaster response proficiency, (3) a lack of prepositioned stocks, and (4) leadership's insufficient proficiency in disaster management. The multiple case study infers, with reasonable accuracy, the existence of common organizational features that impede the response to natural disasters.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Introduction

The purpose of this research was to bring to light common organizational features that affected the national response to major disasters. The research used the multiple case study design to extract and compare the data from the three major natural disasters that occurred in the period 1 May 2008 to 30 November 2012. The study covered the 2008 Wenchuan earthquake in China, the 2011 Great East Japan Earthquake, and 2012 Superstorm Sandy in the USA. While the significant time passed since the studied disasters and the respective national authorities harvested valuable lessons from the disasters, it is likely that other national disaster management systems share the same features. The research question that the case study sought to answer is: What are the common organizational features that impede the initial response of the national disaster management authorities in response to major disasters? Supporting questions were shaping the research seeking to set conditions for finding an answer to the primary research question. What triggers the response to a major disaster on the nation state level? How do developed countries who have dealt with major disasters set up and manage disaster response system? The chapter, nor the research, provide a remedy for the identified issues but aims at drawing attention to their presence.

Conclusion

The research confirmed the existence of several organizational features that impede the initial response of the national disaster management authorities and which

transcended the three selected disasters successfully answering the research question. The research initially extracted several different organizational features that affected each selected disaster response individually, amounting to total 18 different features. Then, the research compared the identified features among the disasters and recognized five organizational features that are common to all three disaster responses. The common organizational features that impede the initial response of the national disaster management authorities are: (1) the organizational and bureaucratic complexity, (2) no collaborated risk assessment, (3) challenges in evacuation planning and execution, (4) training within the disaster management system, and (5) poor risk communication and risk awareness. The different geographical, national, cultural, and political environments contributed significantly to the accuracy and relevance of the research.

Answers to the supporting questions are broad due to the significant differences in the cultural and political environment. However, the encompassed disaster management systems displayed similarities in the overall structure. All three systems included multiple governmental departments and agencies across all levels of governance, encompassing at least three levels of governance. Some of these systems involved specific and selected NGOs as the partner in planning and response, diversifying the capabilities and increasing the responsiveness of the system. All three disaster management systems had some dedicated disaster management agency or council responsible for overall planning and coordination. While such bodies were permanent coordination bodies, their roles in the disaster response differed from each other due to the political, legislative, and cultural backgrounds of the nation. All three systems heavily relied on their military forces to provide transportation, manpower, and other resources as needed. Military forces were

not the primary response force in either of the DM systems. However, the military provided either specialized capabilities to primary responders or took direct action in disaster response when the scale of the disaster overwhelmed the primary responders. Another shared similarity, which at the same time offers the answer to the second supporting question, was the gradual response to emergencies.

The gradual response started at the lowest level of governance with every next level of governance getting involved when the lower level was unable to respond adequately. The gradual response emphasized the need for centralized planning with the decentralized response; centralized planning would ensure that all parts of the system executed their tasks without unnecessary dissipation of resources while providing the fastest response with the best mix of capabilities. The gradual response enabled almost instantaneous mobilization of the provincial response resources in China and swift mobilization of the Intra-prefectural response forces in Japan. However, such setup also displayed deficiencies that ultimately had a significant impact on the later response. In the instance of China, the lowest levels of governance were not able to put the response plans into action, either because of a lack of resources and knowledge or because the disaster consequences incapacitated them. Similarly, in Japan, local responders and authorities were overwhelmed by the disaster. The widespread destruction also caused the loss of communications and resources for the response. In Superstorm Sandy, the lower levels of governance suffered from the over-exercised independence in decision making, leading to the late initiation of the response and difficulties in coordination. Despite these challenges, the gradual response system still offered the quickest response and the best

assessment of needs and requirements for the support from the higher levels of governance.

Significance of Study Findings

The significance of the study findings comes from the recognition that several organizational features of the disaster management systems are common to geographically, culturally, and politically different countries. The significance increases with the fact that those are features that affect the initial response to the major disasters. The existence of such features opens the possibility of collaborated learning among countries.

The findings also help the recognition of recurring patterns that affect the readiness and threaten to impede the initial response without having to face those patterns during the next response. The findings offer limited insight into common challenges that the DM planners can recognize even in the dormant DM systems. The findings provide a meaningful start for those countries that are developing the respective disaster management systems to initiate the improvements of their DM systems before the next disaster reveals the system's weaknesses.

The findings additionally offer a platform for future research. While the research identified only five common organizational elements that impede the initial response, several other issues could potentially span across several DM systems. Especially troublesome are deficiencies related to the human aspect of the DM system where a lack of training, a lack of professional education, a reduced awareness, and the individual interpretation of roles and requirements, either combined or separately, affect the response.

Recommendations for Future Research

The study included only three disasters and remained focused only on common organizational features among national disaster management systems. The expansion of the research to other features could lead to an increased understanding of the underlying issues that impede the response and suggest improvements. The research strongly suggests that there are several more features that transcend across at least two selected case studies offering a basis for future research. These features are: (1) complicated and unrealistic response plans, (2) a lack of enforcement of disaster response proficiency, (3) a lack of prepositioned stocks, and (4) leadership's insufficient proficiency in disaster management.

Future researches should primarily deal with the human domain of the DM systems. While this research extrapolated common organizational elements that impede the initial response to the disasters, evidence suggests that the performance of the human domain in the responses significantly affected each selected response. Challenges in communication, coordination, information sharing, and decision making were mostly the result not of an organizational setup, but of the performance of professional and elected personnel that took part in the response.

The future research should, however, focus on the contemporary disaster management systems that had already changed since 2012 when the last studied disaster occurred. Incorporating the changes that occurred would reveal to what extent those changes fixed the organizational features that impede the initial response. It would also reveal the existence of any other unidentified features that could reveal themselves after the systems changed.

Summary

This chapter provides the answers to both the research question and supporting questions. The thesis proves the existence of the common organizational features that impede the initial response of the national level disaster management authorities to major disasters. The chapter provides insight into the significance of the study findings by revealing the different environment in which the selected disasters took place. Finally, the chapter offers the recommendations for the future research pointing out the several organizational features that emerged as potentially present in the studied disaster management systems.

REFERENCE LIST

- Alexander, David. 2015. "Disaster and Emergency Planning for Preparedness, Response, and Recovery." Oxford Research Encyclopedia of Natural Hazard Science. September. Accessed 17 January 2019. <http://oxfordre.com/naturalhazardscience/view/10.1093/acrefore/9780199389407.001.0001/acrefore-9780199389407-e-12?print=pdf>.
- American College of Emergency Physicians (ACE). 2015. *Lessons Learned from Hurricane Sandy and Recommendations for Improved Healthcare and Public Health Response and Recovery for Future Catastrophic Events*. Accessed 5 May 2019. <https://www.acep.org/globalassets/uploads/uploaded-files/acep/by-medical-focus/disaster/lessons-learned-from-hurricane-sandy-webpage.pdf>.
- Bai, Victor. 2013. "Emergency Management in China." In *Comparative Emergency Management: Understanding Disaster Policies, Organizations, and Initiatives from Around the World*, edited by David A. McEntire, Chapter 25. Emmitsburg, MD: FEMA Emergency Management Institute. Accessed 25 March 2019. <https://training.fema.gov/hiedu/aemrc/booksdownload/compemgmtbookproject/>.
- Blake, S. Eric, Todd B. Kimberlain, Robert J. Berg, John P. Cangialosi, John L. Beven II. 2013. *Tropical Cyclone Report: Hurricane Sandy*. Miami: National Hurricane Center. Accessed 18 March 2019. https://www.nhc.noaa.gov/data/tcr/AL182012_Sandy.pdf.
- Cabinet Office of the Government of Japan. 2015a. *Disaster Management in Japan*. March. Accessed 10 February 2019. http://www.bousai.go.jp/1info/pdf/saigaipamphlet_je.pdf.
- . 2015b. *White Paper on Disaster Management in Japan 2015*. Accessed 31 January 2019. http://www.bousai.go.jp/kyoiku/panf/pdf/WP2015_DM_Full_Version.pdf.
- Carafano, James Jay. 2011. *The Great Eastern Japan Earthquake Assessing Disaster Response and Lessons for the U.S.* Washington, DC: The Heritage Foundation. Accessed 18 March 2019. <http://report.heritage.org/sr0094>.
- Carle, A. Beth. 2015. "Nuclear Meltdown in Fukushima: Human Accident or Natural Disaster?" Case study, National Center for Case Study Teaching in Science, University at Buffalo, State University of New York, 24 September. Accessed 17 November 2018. <http://sciencecases.lib.buffalo.edu/cs/files/fukushima.pdf>.

- Chairman of the Joint Chiefs of Staff (CJCS). 2016. Chairman of The Joint Chiefs of Staff Instruction 3010.02E, *Guidance for Developing and Implementing Joint Concepts*. Washington, DC: Office of the Chairman of the Joint Chiefs of Staff. Accessed 12 April 2019. <https://www.jcs.mil/Portals/36/Documents/Library/Instructions/CJCSI%203010.02E.pdf?ver=2017-02-08-173223-657>.
- Chan, Emily Ying Yang, and Polly Po Yi Lee. 2016. *A Public Health Evaluation of 2008 Sichuan Earthquake in China*. Collaborating Centre for Oxford University and The Chinese University Hong Kong for Disaster and Medical Humanitarian Response. Accessed 12 October 2018. http://ccouc.org/_asset/file/1sichuan.pdf.
- Creswell, John W. 2007. *Qualitative Inquiry and Research Design: Choosing Among Five Approaches*. 2nd ed. Thousand Oaks: Sage Publications, Inc.
- . 2014. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Thousand Oaks: Sage Publications, Inc.
- Department of Logistics and Resource Operations (DLRO). 2016. “Reading F102RA: Joint and Army Capability Development.” Consolidated Extracted Reading, US Army Command and General Staff College, Fort Leavenworth, KS, June.
- Dion-Schwarz, Cynthia, Sarah E. Evans, Edward Geist, Scott Warren Harold, V. Ray Koym, Scott Savitz, and Lloyd Thrall. 2016. *Technological Lessons from the Fukushima Dai-Ichi Accident*. Santa Monica: RAND Corporation.
- Dipace, Michael S. 2014. “The National Response Framework: A Cross-Case Analysis.” Master’s thesis, US Army Command and General Staff College, Fort Leavenworth, KS.
- Earthquake Investigation Committee of the Technical Council on Lifeline Earthquake Engineering. 2014. *Wenchuan, Sichuan Province, China, Earthquake of 2008: Lifeline Performance*. Edited by Alex K. Tang. Reston: American Society of Civil Engineers, ProQuest Ebook Central.
- Federal Emergency Management Agency (FEMA). 2012. “FEMA Urges Residents to Take Steps to Prepare as Hurricane Sandy Approaches.” News Releases. 27 October. Accessed 23 April 2019. <https://www.fema.gov/news-release/2012/10/27/fema-urges-residents-take-steps-prepare-hurricane-sandy-approaches>.
- . 2018. “FEMA Fact Sheet: Mitigation Assessment Team Results – Hurricane Sandy.” Sandy Recovery in Region II. Last updated 19 June. Accessed 2 April 2019. <https://www.fema.gov/mat-results-hurricane-sandy>.
- Gelinas, Nicole. 2013. “New York’s Sandy Scorecard.” *City Journal* (Winter). Accessed 25 April 2019. <https://www.city-journal.org/html/new-york%E2%80%99s-sandy-scorecard-13530.html>.

- Gibbs, Linda, and Cas Holloway. 2013. *NYC Hurricane Sandy After Action Report and Recommendations to Mayor Michael R. Bloomberg*. Accessed 3 May 2019. https://www1.nyc.gov/assets/housingrecovery/downloads/pdf/2017/sandy_aar_5-2-13.pdf.
- Hatzikyriakou, Adam, and Ning Lin. 2017. "Simulating Storm Surge Waves for Structural Vulnerability Estimation and Flood Hazard Mapping." *Natural Hazards* 89, no. 2 (November): 939-962. Accessed 9 April 2019. <https://link.springer.com/article/10.1007%2Fs11069-017-3001-5>.
- . 2018. "Assessing the Vulnerability of Structures and Residential Communities to Storm Surge: An Analysis of Flood Impact during Hurricane Sandy." *Frontiers in Built Environment* 4, no. 4 (February): 1-13. Accessed 9 April 2019. <https://www.frontiersin.org/articles/10.3389/fbuil.2018.00004/full>.
- Headquarters, Department of the Army (HQDA). 2012. *Army Doctrine Publication 3-28, Defense Support to Civil Authorities*. Washington, DC: Government Publishing Office.
- . 2013. *Army Regulation 71-32. Force Development and Documentation*. Washington, DC: Government Publishing Office.
- Howitt, Arnold M. 2012. "The Tohoku Disaster: Responding to Japan's 3.11 Earthquake, Tsunami, and Nuclear Accident." Lecture, Harvard Kennedy School, Cambridge, MA, 14 November. Accessed 12 March 2019. <https://www.hks.harvard.edu/centers/research-initiatives/crisisleadership/events/2012-events>.
- Hui, Dennis Lai Hang. 2009. "Politics of Sichuan Earthquake, 2008." *Journal of Contingencies and Crisis Management* 17, no. 2 (June): 138-140. Accessed 2 October 2018. <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1468-5973.2009.00571.x>.
- Information Office of the State Council of the People's Republic of China. 2009. "China's Actions for Disaster Prevention and Reduction." Chinese Government's Official Web Portal, 11 May 2009. Accessed 17 September. http://english1.english.gov.cn/official/2009-05/11/content_1310629.htm.
- Japan Society of Mechanical Engineers. 2014. "Report of the JSME Research Committee on the Great East Japan Earthquake Disaster." *Lessons Learned from the Great East Japan Earthquake Disaster*, 29 August. Accessed 14 November 2018. <https://www.jsme.or.jp/english/documents/lessons-learned-from-earthquake/>.
- Khan, Samia, and Robert VanWynsberghe. 2008. "Cultivating the Under-Mined: Cross-Case Analysis as Knowledge Mobilization." *Forum: Qualitative Social Research* 9, no. 1, art. 34 (January). Accessed 28 February 2019. <http://www.qualitative-research.net/index.php/fqs/article/view/334/729>.

- Knowlton, Kim, and Miriam Rotkin-Ellman. 2014. *Preparing for Climate Change: Lessons for Coastal Cities from Hurricane Sandy*. New York: NY: Natural Resources Defense Council. Accessed 2 April 2019. <https://www.nrdc.org/sites/default/files/hurricane-sandy-coastal-flooding-report.pdf>.
- Koshimura, Shunichi, and Nobuo Shuto. 2015. "Response to the 2011 Great East Japan Earthquake and Tsunami Disaster." *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 373, no. 2053 (October). Accessed 21 December 2018. <https://doi.org/10.1098/rsta.2014.0373>.
- Kunreuther, Howard, and Michael Useem, eds. 2010. *Learning from Catastrophes: Strategies for Reaction and Response*. Upper Saddle River: Wharton School Publishing.
- Ladislav, Sarah. 2013. "Hurricane Sandy: Evaluating the Response One Year Later." Center for Strategic and International Studies, 4 November. Accessed 23 November 2018. <https://www.csis.org/analysis/hurricane-sandy-evaluating-response-one-year-later>.
- Lingling, Jiang, Wang Jiexiu, and Liu Lianyou. 2008. *People's Republic of China: Providing Emergency Response to Sichuan Earthquake*. Technical Assistance Consultant's Report to the People's Republic of China Ministry of Civil Affairs. Accessed 12 October 2018. https://reliefweb.int/sites/reliefweb.int/files/resources/0D109A786BEC65A2C12575600043192A-Full_Report.pdf.
- Lixin, Yi, Ge Lingling, Zhao Dong, Zhou Junxue, and Gao Zhanwu. 2012. "An Analysis on Disasters Management System in China." *Natural Hazards* 60, no. 2 (January): 259-309. Accessed 14 October 2018. <https://doi.org/10.1007/s11069-011-0011-6>.
- Lo, Shiu Hing. 2014. *The Politics of Crisis Management in China: the Sichuan Earthquake*. Lanham: Lexington Books, ProQuest Ebook Central.
- Lochbaum, David, Edwin Lyman, Susan Q. Stranahan, and the Union of Concerned Scientists. 2014. *Fukushima: The Story of a Nuclear Disaster*. New York: The New Press.
- McLeod, Gary, George Nacouzi, Paul Dreyer, Mel Eisman, Myron Hura, Krista S. Langeland, David Manheim, and Geoffrey Torrington. 2016. *Enhancing Space Resilience Through Non-Materiel Means*. Santa Monica, CA: RAND Corporation. Accessed 2 April 2019. https://www.rand.org/content/dam/rand/pubs/research_reports/RR1000/RR1067/RAND_RR1067.pdf.
- Mimura, Nobuo, Kazuya Yasuhara, Seiki Kawagoe, Hiromune Yokoki, and So Kazama. 2011. "Damage from the Great East Japan Earthquake and Tsunami - A Quick Report." *Mitigation and Adaptation Strategies for Global Change* 16, no. 7 (October): 803-818. Accessed 13 October 2018. <https://doi.org/10.1007/s11027-011-9297-7>.

- Ministry of Defense of Japan, The National Institute for Defense Studies (NIDS). 2012. *China Security Report 2012*. December. Accessed 23 February 2019. <http://www.nids.mod.go.jp/english/publication/chinareport/index.html>.
- Mori, Nobuhito, and Tomoyuki Takahashi. 2012. "Nationwide Post Event Survey and Analysis of the 2011 Tohoku Earthquake Tsunami." *Coastal Engineering Journal* 54, no. 1 (March): 1-27. Accessed 8 November 2018. <https://doi.org/10.1142/S0578563412500015>.
- Murtha, T. Anthony, Major. 2009. "Defense Support to Civil Authorities- Surveying Institutional Challenges." Monograph, School of Advanced Military Studies, US Army Command and General Staff College, Fort Leavenworth, KS.
- National Diet of Japan. 2012. *The Official Report of the Fukushima Nuclear Accident Independent Investigation Commission: Executive Summary*. Accessed 1 October 2018. https://www.nirs.org/wp-content/uploads/fukushima/naic_report.pdf.
- New York City Amateur Radio Emergency Communications Service (NYC-ARECS). 2012. "New York City Hurricane Evacuation Zone Map – 2012." Accessed 7 May 2019. <http://nyc-arecs.org/evac-map.html>.
- NBC Universal. 2009. "China's Catastrophic Quake." 8 May. Accessed 2 October 2018. <https://www.nbcnews.com/slideshow/chinas-catastrophic-quake-30604613>.
- Palinkas, Lawrence A, Sarah M. Horwitz, Carla A. Green, Jennifer P. Wisdom, Naihua Duan, and Kimberly Hoagwood. 2015. "Purposeful Sampling for Qualitative Data Collection and Analysis in Mixed Method Implementation Research." *Administration and Policy in Mental Health* 42, no. 5 (September): 533-44. Accessed 10 April 2019. doi:10.1007/s10488-013-0528-y.
- Powell, Tia, Dan Hanfling, and Lawrence O. Gostin. 2012. "Emergency Preparedness and Public Health the Lessons of Hurricane Sandy." *JAMA* 308, no. 24 (December): 2569-2570. Accessed 12 December 2018. <https://jamanetwork.com/journals/jama/article-abstract/1392488>.
- Rauhala, Emily. 2011. "How Japan Became a Leader in Disaster Preparation." *Time*, 11 March. Accessed 3 October 2018. <http://content.time.com/time/world/article/0,8599,2058390,00.html>.
- Ranghieri, Federica, and Mikio Ishiwatari, eds. 2014. *Learning from Megadisasters: Lessons from the Great East Japan Earthquake*. Washington, DC: World Bank. Accessed 23 November 2018. doi:10.1596/978-1-4648-0153-2.
- Rice, Lindsay L. 2014. "An Analysis of Public Perception and Response to Hurricane Sandy." Master's thesis, University South Florida, Tampa, FL. Accessed 15 December 2018. <https://scholarcommons.usf.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=6310&context=etd>.

- Ritchie, Hannah, and Roser Max. 2018 “Natural Catastrophes.” Our World in Data. Accessed 26 September 2018. 28 September 2018. <https://ourworldindata.org/natural-catastrophes>.
- Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988. Public Law 100-707. US Code 42 (2015), §§ 5121 et seq.
- Saban, Ireni Liza. 2014. *Disaster Emergency Management: the Emergence of Professional Help Services for Victims of Natural Disasters*. Albany: State University of New York Press, ProQuest Ebook Central.
- Shen, Ji, Junxing Kang, Yingkang Shi, Youping Li, Yuanfeng Li, Lin Su, Jianlin Wu, Shangwei Zheng, Jie Jiang, Weijian Hu, Yong Yang, Xuefeng Tang, Jin Wen, Ling Li, Jiantong Shen, and Dake Zhong. 2012. “Lessons learned from the Wenchuan Earthquake.” *Journal of Evidence-Based Medicine* 5, no. 2 (May): 75-88. Accessed 9 October 2018. <https://doi.org/10.1111/j.1756-5391.2012.01176.x>.
- Shoomaker, Eric. 2013. “Eating an Elephant One Bite at a Time: Lessons in Leading Big Projects from Initiation to Completion.” Lecture, Uniformed Services University, Bethesda, MD, 14 March. Accessed 17 April 2019. <https://www.usuhs.edu/sites/default/files/media/medschool/ppt/eatinganelephant1.pptx>.
- Special Initiative for Rebuilding and Resiliency (SIRR). 2013. *A Stronger, More Resilient New York*. New York, NY: City of New York. Accessed 7 March 2019. <https://www1.nyc.gov/site/sirr/report/report.page>.
- Suppasri, Anawat, Nobuo Shuto, Fumihiko Imamura, Shunichi Koshimura, Erick Mas, and Ahmet Cevdet Yalciner. 2013. “Lessons Learned from the 2011 Great East Japan Tsunami: Performance of Tsunami Countermeasures, Coastal Buildings, and Tsunami Evacuation in Japan.” *Pure and Applied Geophysics* 170, no. 6-8 (June): 993–1018. Accessed 3 October 2018. <https://doi.org/10.1007/s00024-012-0511-7>.
- Talbot, David. 2008. “China Lacks Earthquake Early-Warning System.” *MIT Technology Review*, 14 May. Accessed 28 September 2018. <https://www.technologyreview.com/s/410127/china-lacks-earthquake-early-warning-system/>.
- Taylor, Alan. 2018. “10 Years Since the Devastating 2008 Sichuan Earthquake.” *The Atlantic*, 9 May. Accessed 17 November 2018. <https://www.theatlantic.com/photo/2018/05/10-years-since-the-devastating-2008-sichuan-earthquake/560066/>.
- Texas A&M Engineering Extension Service (TEEX). 2012. *New Jersey Transit Corporation’s Hurricane Sandy After Action Report*. Accessed 18 April 2019. <http://njtransitresilienceprogram.com/wp-content/uploads/2015/10/TEEX-After-Action-Report.pdf>.

- Thompson, Derek. 2014. "Why Do the Smartest Cities Have the Smallest Share of Cars?" *The Atlantic*, 22 January. Accessed 17 April 2019. <https://www.theatlantic.com/business/archive/2014/01/why-do-the-smartest-cities-have-the-smallest-share-of-cars/283234/>.
- Torres, Anthony, Benjamin Lowden, Kazuki Ito, and Sabrina Shuman. 2015. *Lessons from Hurricane Sandy: Analysis of Vulnerabilities Exposed by Hurricane Sandy and Potential Mitigation Strategies in the Northeastern United States*. Accessed 3 May 2019. http://climateknowledge.org/figures/Rood_Climate_Change_AOSS480_Documents/AOSS480_2015_Sandy_Climate_Case_Study_Narrative.pdf.
- Turabian, Kate L. 2018. *A Manual for Writers of Term Papers, Theses, and Dissertations*. 9th ed., Rev. Ed. Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams, Joseph Bizup, William T. Fitzgerald, and the University of Chicago Press Editorial Staff. Chicago: University of Chicago Press.
- Umeda, Sayuri. 2013. Japan: Legal Responses to the Great East Japan Earthquake of 2011." Legal Reports, The Law Library of Congress, September. Accessed 13 November 2018. <https://www.loc.gov/law/help/japan-earthquake/index.php>.
- US Department of Commerce, National Oceanic and Atmospheric Administration (NOAA). 2019. "Hurricane Sandy." National Weather Service. Accessed 10 February 2019. <https://www.weather.gov/okx/hurricanesandy>.
- US Department of Defense (DOD). 2012. "Pentagon Provides Sandy Response Update." DOD News. 9 November. Accessed 1 December 2018. <https://archive.defense.gov/news/newsarticle.aspx?id=118496>.
- US Department of Energy, Office of Electricity Delivery and Energy Reliability (DOE). 2013. *Overview of Response to Hurricane Sandy - Recommendations for Improvement*. 26 February. Accessed 26 April 2019. https://www.energy.gov/sites/prod/files/2013/05/f0/DOE_Overview_Response-Sandy-Noreaster_Final.pdf.
- US Department of Homeland Security (DHS), Federal Emergency Management Agency (FEMA). 2016. *Protection Federal Interagency Operational Plan (FIOP)*. Washington, DC: DHS, FEMA, August.
- . 2011. *Draft: Implementation of the National Incident Management System (NIMS) and Incident Command System (ICS) During Response and Recovery Operations*. Washington, DC: DHS, FEMA, 11 May.
- . 2013a. *Hurricane Sandy FEMA After-Action Report*. Washington, DC: DHS, FEMA, 1 July.
- . 2013b. *National Response Framework*. 2nd ed. Washington, DC: DHS, FEMA, 01 May.

- . 2016. *National Response Framework*. 3rd ed. Washington, DC: DHS, FEMA, June.
- . 2017. *National Incident Management System*. Washington, DC: DHS, FEMA, 10 October.
- US Department of Interior, Bureau of Geological Survey (DOI). 2013. *Meeting the Science Needs of the Nation in the Wake of Hurricane Sandy - a U.S. Geological Survey Science Plan for Support of Restoration and Recovery: U.S. Geological Survey Circular 1390*, by Herbert T. Buxton, Matthew E. Andersen, Michael J. Focazio, John W. Haines, Robert A. Hainly, Daniel J. Hippe, and Larry J. Sugarbaker. Accessed 17 April 2019. <https://pubs.usgs.gov/circ/1390/circ1390.pdf>.
- US Government Accountability Office (GAO). 2015. *Testimony Before the Subcommittee on Emergency Preparedness, Response, and Communications, Committee on Homeland Security, House of Representatives*. GAO-16-90T, 22 October. Accessed 2 May 2019. <https://www.gao.gov/products/GAO-16-90T>.
- United Nations Office for the Coordination of Humanitarian Affairs, OCHA Regional Office in Asia Pacific (OCHA). 2011. *Japan Earthquake & Tsunami*. Situation Report no.16. 1 April. Accessed 3 October 2018. https://reliefweb.int/sites/reliefweb.int/files/resources/2408EA87B6B6BD2EC125786500453E4D-Full_Report.pdf.
- Washburn, Lindy, and Melissa Hayes. 2012. “Hurricane Sandy State of Emergency Declared.” Archive, Northjersey.com. Updated 4 October 2017. Accessed 28 April 2019. <https://www.northjersey.com/story/weather/2017/09/28/archive-hurricane-sandy-state-emergency-declared/714669001/>.
- Wang, Zhe, Emily Ying Yang Chan, Kevin Sida Liu, and May Pui-shan Yeung. 2016. *Policy Brief: The Disaster and Emergency Management System in China*. Collaborating Centre for Oxford University and The Chinese University Hong Kong for Disaster and Medical Humanitarian Response. May. Accessed 21 December 2018. http://ccouc.org/_asset/file/policybrief-disaster-andemergmxsysinchina-final20161020.pdf.
- Weng, Kelin, Qi-Fu Chen, Shihong Sun, and Andong Wang. 2006. “Predicting the 1975 Haicheng Earthquake.” *Bulletin of the Seismological Society of America* 96, no. 3 (June): 757-795. Accessed 23 February 2019. <https://doi.org/10.1785/0120050191>.
- Williams, James M. 2010. *Disaster Response Staff Officer's Handbook*. Edited by Karen Blakeman. Fort Leavenworth, KS: Combined Arms Center.

- World Health Organization Essential Medicines and Health Products Information Portal. 2004. "Purposeful Sampling for Qualitative Studies." How to Investigate the Use of Medicines by Consumers. Accessed 18 March, 2019. <http://apps.who.int/medicinedocs/en/d/Js6169e/7.3.html#Js6169e.7.3>.
- Yang, Aaron. 2017. "Mandate of Heaven: An Analysis of China's Government Disaster Response and CCP Performance Legitimacy." CMC Senior Theses, Claremont McKenna College, Claremont, CA. Accessed 19 December 2018. https://scholarship.claremont.edu/cmc_theses/1614/.
- Yang, Jun, Jinhong Chen, Huiliang Liu, and Jingchen Zheng. 2014. "Comparison of two large earthquakes in China: the 2008 Sichuan Wenchuan Earthquake and the 2013 Sichuan Lushan Earthquake." *Natural Hazards* 73, no. 2 (March): 1127-1136. Accessed 24 November 2018. <https://doi.org/10.1007/s11069-014-1121-8>.
- Ye, Shonshan, Guofang Zhai, and Jiyuan Hu. 2011. "Damages and Lessons from the Wenchuan Earthquake in China." *Human and Ecological Risk Assessment: An International Journal* 17, no. 3 (June): 598-612. Accessed 12 January 2019. <http://dx.doi.org/10.1080/10807039.2011.571086>.
- You, Chuanmei, Xunchui Chen, and Lan Yao. 2009. "How China responded to the May 2008 earthquake during the emergency and rescue period." *Journal of Public Health Policy* 30, no. 4 (December): 379-394. Accessed 11 November 2018. <https://link.springer.com/article/10.1057%2Fjphp.2009.30>.
- Yue, Cao. 2018. "A Turning Point in China's Disaster Preparedness." *Chinadialogue*. 06 August. Accessed 1 May 2019. <https://www.chinadialogue.net/article/show/single/en/10768-A-turning-point-in-China-s-disaster-preparedness>.
- Zhang, Lulu, Xu Liu, Youping Li, Yuan Liu, Zhipeng Liu, Juncong Lin, Ji Shen, Xuefeng Tang, Yi Zhang, and Wannian Liang. 2012. "Emergency Medical Rescue Efforts After a Major Earthquake: Lessons from the 2008 Wenchuan Earthquake." *Lancet*, no. 379 (March): 853-861. Accessed 24 December 2018. [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(11\)61876-X/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(11)61876-X/fulltext).
- Zhang, Xi, Lixin Yi, and Dong Zhao. 2012. "Community-based Disaster Management: a Review of Progress in China." *Natural Hazards* 65, no. 3 (February): 2215-2239. Accessed 12 April 2019. <https://doi.org/10.1007/s11069-012-0471-3>.