

Chapter 2

Disaster Theory

Abstract To find a conclusive definition for contemporary purposes and uses, we look at many of the various definitions of disasters through cataclysmic events, historical records, public policies, laws, and organizational usage. Our natural progression leads us to modern theories of disaster and Disaster Risk Management (DRM) that have had to tackle new types of disasters that are being brought about by the interconnectivity of societies, people, diseases, technology, etc., increasing in magnitude and complexity like what was seen in Fukushima, Japan, in 2011 and on-setting disasters like climate change. After looking at all the historical evidence, we come to a definition for the term disaster for modern usage and what it means for policy implications.

Keywords Concept of disaster • Disaster category • Natural disaster • Human-caused disaster • Social disaster • Disaster theory • Disaster response institution

2.1 Conceptual Foundation of Disaster

2.1.1 *Concept of Disaster*

There has been an ongoing debate on defining and conceptualizing a term for human-caused and natural calamities; a commonly used English word is “disaster.” The concept of disaster has been understood in different ways depending on the era and defined in various ways depending on the purpose of users, such as national governments, United Nations (UN) agencies, and scholars. The commonly used English word “disaster” originates from the Latin words “dis-astrum,” meaning “ominous star.” Disaster, as it is reflected in its origin, had been historically interpreted and used as a massive and sudden calamity due to the unfavorable position of a planet or star, implying “impossible to control,” because it is caused by God’s will (Etkin 2015). In other words, disaster had been mostly considered as a naturally occurring disaster, resulting from external components, such as typhoons and earthquakes. Currently, it has matured to include technological and social disasters, reflecting the evolutionary circumstances of the contemporary society.

The concept of disaster is various depending on nations, organizations, and scholars. In Korea, the Disasters and Safety Act defines disaster as “what causes

or is likely to cause any harm to the lives, bodies, and property of citizens and the State.” The first appearance of the definition of disaster in Korean law was in the Countermeasures against Typhoons and Floods Act (Act No. 1894), enacted on February 28, 1967, where the Korean word “jaehae” was defined as “damage caused by a flood, downpour, heavy snowfall, storm, or tidal wave, and other natural phenomena equivalent thereto.” In this Act, the English word “disaster” was interpreted to be the Korean word “jaehae,” meaning disaster triggered by natural hazard. This Act was fully revised into the Countermeasures against Natural Disasters Act (Act No. 4993) on December 6, 1995, defining “disaster” as “damage caused by a typhoon, flood, downpour, storm, tidal wave, heavy snowfall, drought, or earthquake (including tsunami), and other natural phenomena equivalent thereto.”

With regard to human-caused disasters, the Disaster Control Act, enacted (July 18, 1995) in the wake of the Sampoong Department Store collapse, defined the Korean word “jaenan” as “accidents that may cause any harm to the lives and property of citizens and the State, such as fire, collapse, explosion, traffic accidents, chemical, biological and radioactive accidents, and environmental pollution incidents, excluding natural disasters.” In this Act, the English word “disaster” was interpreted to be the Korean word “jaenan,” meaning disaster triggered by technological hazard. By doing this, this Act brought about a confusion of the concept of disaster in Korea until it was abolished in 2004, labeling the single English word “disaster” with two different terms: “jaehae,” meaning disaster triggered by natural hazard, and “jaenan,” meaning disaster triggered by technological hazard.

As the Disasters and Safety Act was enacted on March 11, 2004 (Act No. 7188), disaster, the Korean word “jaenan,” was redefined as “what actually causes or is likely to cause any harm to the lives, physical safety and property of citizens and the State” embracing the following three types of disasters:

- Natural disaster: disaster caused by a typhoon, flood, downpour, strong wind, wind and waves, tidal wave, heavy snowfall, lightning, drought, earthquake, sandy dust, red tide, ebb and flow, and other natural phenomena equivalent thereto
- Human-caused disaster: damage beyond the scale prescribed by Presidential Decree, such as a fire, collapse, explosion, traffic accidents, chemical, biological and radioactive accidents, and environmental pollution incidents, and other accidents similar thereto
- Social disaster: damage caused by the paralyzation of the State’s critical systems, such as energy, communications, transportation, finance, medical treatment, and water supply, etc., and by a spread of infectious diseases, etc.

The Act included social disaster as a category of disaster for the first time in Korea. Human-caused disaster and social disaster were combined into one word “social disaster” according to the Disasters and Safety Act (Act No. 11994), partially amended on August 16, 2013. Therefore, the currently used definition of disaster in Korea is “any of the followings, which actually causes or is likely to

cause any harm to the lives, physical safety, and property of citizens and the State,” with the following categorization:

- “Natural disaster” referring to disasters caused by typhoon, flood, downpour, strong wind, wind and waves, tidal wave, heavy snowfall, lightning, drought, earthquake, yellow dust, red tide, outbreak, ebb and flow, and other natural phenomena equivalent thereto
- “Social accidents” referring to damage beyond the scale prescribed by Presidential Decree, such as a fire, collapse, explosion, traffic accidents, chemical, biological, and radioactive accidents, environmental pollution incidents, and other accidents similar thereto and damage caused by the paralyzation of the state’s critical systems, such as energy, communications, transportation, finance, medical treatment, and water supply, and by a spread, etc., of infectious diseases under the Infectious Disease Control and Prevention Act, and contagious animal diseases under the Act on the Prevention of Contagious Animal Diseases.

In the United States (USA), Federal Emergency Management Agency (FEMA) distinguishes “major disaster” from “emergency” in the Robert T. Stafford Disaster Relief and Emergency Assistance Act (hereafter “The Stafford Act”).

“Emergency” means “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.”

“Major disaster” means “any natural catastrophe (including any hurricane, tornado, storm, high water, wind-driven 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 USA, which in the determination of the President causes damage of sufficient severity and magnitude to warrant major disaster assistance under this 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 (FEMA 2013).”

In Japan, “disaster” is defined as “damage caused by typhoon, downpour, heavy snowfall, flood, tidal wave, earthquake, tsunami, volcanic eruption, other abnormal natural phenomena or massive fire, explosion, and other causes” in the Basic Disaster Countermeasures Act.

All three countries have commonly referred to “disaster” as “what is triggered by three types of hazards: natural, technological and social hazards.” The differences of the three countries are that Korea considers “social disaster” as “damage beyond the scale prescribed by Presidential Decree,” while the USA differentiates emergency and major disaster depending on the scale of damage, and Japan puts more emphasis on natural disaster in their Acts.

Efforts to conceptualize disaster have also been done by international organizations and academia. United Nations Office for Disaster Risk Reduction (UNISDR) defines “disaster” as “A serious disruption of the functioning of a community or a

society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts. (UNISDR 2016).” Academically, disaster has also been variously defined. According to Fritz, “disaster is an event, concentrated in time and space, in which a society of a relatively self-sufficient subdivision of society, undergoes severe danger and incurs such losses to its members and physical appurtenances that the social structure is disrupted and the fulfillment of all or some of the essential functions of the society is prevented (Fritz 1961).” Quarantelli (1985) acknowledged disaster as occupying time and space, as a social phenomenon when society or a small community cannot perform all or part of its social functions due to the result of the impact occurring from natural or technological causes that cannot be managed by the knowledge or capability of the society or a small community Table 2.1 summarizes the various concepts of disaster as described above.

To conceptualize disaster more clearly, we will examine the terms related to disaster such as safety, security, risk, and crisis.

First, the English word “safe” originates from the Old French word “sauv” that means “free from danger,” which is derived from the Latin word “salvus” that means “in good health.” As the primitive Indian-European word “solwos” means “sound,” the word “solidus” means “consistent like solid” in Latin, and “sanah” in Sanskrit means “not wounded, in its original state, and sound.” In the scriptures of Zoroastrianism, “haurva” means “not wounded in its original state,” and the Persian archaic word “haruva” and Greek word “holos” mean “sound” (Lee 2007). The Merriam-Webster Dictionary’s definition of “safety” is “the condition of being safe from undergoing or causing hurt, injury; or loss or the state of not being dangerous or harmful (Webster Dictionary 2015).” The word “safety” is translated in Korea as “anjeon.” “Anjeon” is composed of two characters: “an” that means a comfortable state and “jeon” that means a whole and entire state. Since the nineteenth century, the word “safety” has been commonly used to proactively sort out the issues surrounding industrial disasters that had emerged as social issues.

Second, the term “security” originates from a combination of the Latin word: “se” that means “without” and “cura” that means “concern or care,” therefore indicating “no anxiety.” The term “security” is defined as “the state of being protected or safe from harm; things done to make people or places safe” in the Merriam-Webster Dictionary (Webster Dictionary 2015).” In Korea, the term “security” in the UN Charter of 1947 was translated as “anbo” and has been used as the meaning of “securing safety.” The security area in Korea includes the Northern Limit Line West Sea Border Incident, the President’s Vacuum of Authority, protection of Korean residents abroad, terrorism, and nonmilitary maritime disputes (Jeong 2009).

Third, the term “risk” originates from a Spanish nautical word, meaning “penetrating into the reefs.” As the term “risk” became widely used, its meaning expanded to a hardship that must be endured to obtain wealth. Researchers and government officials have developed diverse definitions of risk to fit the purpose and nature of the activities. The United Nations Development Programme defined

Table 2.1 Summary table of various disaster concepts

Commonality	Disaster is triggered by external factors such as natural phenomena, lack of technology, terror, etc.	
	Disaster means a condition where the damage cannot be overcome without national or external assistance due to lack of capacity or resources of the damaged community or local/state governments	
Uniqueness	Korea	A Presidential Decree regulates the magnitude of disaster, which can be financially supported by the national government
	USA	Disaster is classified into emergency and major disaster declaration depending on the magnitude of the damage
	Japan	Disaster caused by natural hazard was historically emphasized in Act
	UNISDR	A comprehensive approach considering human, physical, economic, or environmental losses and impacts is emphasized
	Fritz	Considers disaster as the disruption of the essential functions of the social system
	Quarantelli	Considers disaster as what is caused by natural or technological hazard that is beyond the knowledge of modern society

risk as “the probability of harmful consequences, or expected loss (of lives, people injured, property, livelihoods, economic activity disrupted or environmental damaged) resulting from interactions between natural or human induced hazards and vulnerable conditions” (UNDP 2004). In the National Infrastructure Protection Plan (NIPP 2013), Department of Homeland Security (DHS) considered risk elements as “threat nature and magnitude, vulnerability to a threat, and consequence that could result.”

Haddow et al. (2014) noted that risk is composed of (1) the probability and frequency of a hazard occurring, (2) the level of exposure of people and property to the hazard, and (3) the effects or costs, both direct and indirect, of this exposure. The Korean word for risk is “wiheom” or “wiheomdo.”

Finally, the origin of the word “crisis” is the Greek word “krinein (separate; critical moment);” and it has been used as the medical term of “decisive moment of life and death.” Quarantelli (1998) viewed that a crisis of a certain organization appears in the three following interrelated conditions: (1) a type of threat including organizational value, (2) sudden occurrence of an unexpected event, and (3) need to respond collectively as the outcome may seem more negative otherwise. The term “crisis” is defined as “a difficult or dangerous situation that needs serious attention” in the Merriam-Webster’s Learner’s Dictionary (Webster Dictionary 2015).

The Korean word for crisis is “wigi.” The term indicates a dangerous crucial moment or time and the state to make the final decision on a critical matter. The term “wigi” is a combination of the two characters: “wi” meaning danger and “gi” meaning chance. In the same context, Lee et al. (2004) defined crisis as an “incomplete state that desperately needs a significant change or the turning point to determine whether to proceed with, modify, or end an event or a behavioral process.”

Table 2.2 Terms related to disaster

Korean	English	Origin	Usage
Jaenan	Disaster	Dis (separation, destruction, and inconsistency) + aster (astrum in Latin, meaning star)	Unexpected calamity and ordeal
Anjeon	Safety	Originates from the Old French word “sauf” meaning “not damaged or not harmed,” or the Latin word “salvus” meaning “not damaged or healthy”	The condition of being safe from undergoing or causing hurt, injury
Anbo	Security	Originates from se (=without, liberation) + cura (=care, concern, or distress)	The state of being protected or safe from harm
Wiheom (do)	Risk	Originates from the Spanish word “risque,” known to be used from the mid-seventeenth century	A probability of harm that encompasses threat/hazard, vulnerability, and consequence
Wigi	Crisis	Originates from the Greek word “krinein” (separate)	Dangerous crucial moment or time

Jeong (2009) saw the word “crisis” as natural disasters such as typhoons, heavy snowfalls, and floods; human and technical disasters such as explosion, traffic accidents, and collapse; comprehensive risk situations in various contexts such as terrorist attacks, status of diplomatic relations with North Korea, failure of various policies, financial difficulties of firms, stores, and state, crimes, spread of diseases, and various scandals. The terms related to disaster can be summarized as Table 2.2.

Summarizing the discussions above, “disaster” can be conceptualized as follows:

- A state that cannot be recovered to the original state with the ability of the community due to great damages in human life and property
- Inclusive of disasters triggered by natural, technological, or social hazard¹

The term “disaster” will be used embracing natural, technological, and social disasters that the whole community need to cope together reflecting the characteristics of contemporary societies. Therefore, in this book, we will define “disaster” as “a status of community or nation’s being seriously damaged by natural, technological or social cause and difficult to recover from the damage with its own resources, requiring the whole community to cope together.” This definition is similar to the definition of disaster by UNISDR and consistent with the definition by laws in Korea, Japan, and the USA.

¹In this context, referring to “jaehae” as natural disaster and “jaenan” as human-caused disaster is not appropriate, which had been commonly used in Korea from 1995 to 2004; it is still partially used. Both “jaehae” and “jaenan” should be used as terms pointing out natural, technological, and social disasters. To be more precise, “jaehae” means the damage caused by hazards, and “jaenan” means the situation that creates or is likely to create damage.

2.1.2 *Categorization of Disaster*

Like the concept of disaster, its categorization is also very diverse. The typical one is a categorization by disaster cause. The other ways include categorization by the characteristics of the event, phase-related categorization, and categorization by surgical and medical disaster.

2.1.2.1 *Categorization by Disaster Cause*

In Korea, the current Framework Act on the Management of Disasters and Safety classifies disasters into natural and social disaster. Its original version enacted in 2004 classified disasters into natural, human-caused, and social disasters, but the same Act when it was amended in 2013 integrated “human-caused disaster” and “social disaster” into “social disaster.” Thus, disaster in the current Korean law is divided into “natural disaster” and “social disaster.” The categorization by disaster cause is a typical way about disaster type. Most of renowned organizations dealing with disaster data, such as Center for Research on the Epidemiology of Disasters (CRED) and Munich RE, and many scholars have used disaster cause as the principle of disaster categorization.

By Laws and Manuals in Korea

The official categorization of disasters in Korea is “natural disaster” and “social disaster” regulated by disaster-related laws, which are differentiated by causing phenomenon. The Countermeasures against Natural Disasters Act, formerly the Disaster Control Act and the Disasters and Safety Act, defined disaster-related terms as below:

- Countermeasures against Natural Disasters Act (Act No. 14113, amended on March 29, 2016)

The purpose of this Act is to prescribe necessary matters concerning natural disaster prevention or recovery and other countermeasures against natural disasters, in an effort to preserve national land and to protect lives, bodies, and properties of nationals as well as key infrastructures from disasters caused by natural phenomena, such as typhoons, floods, etc. This Act defined “jaehae” as any damage caused by “jaenan” and encapsulated “jayeon-jaehae,” meaning natural disaster and “pungsu-hae,” meaning disaster triggered by hydrological hazard as specific examples of “jaehae.”

Article 2 (Definitions) The definitions of the terms used in this Act shall be as follows:

1. *The term “jaehae” means any damage caused by “jaenan” under subparagraph 1 of Article 3 of the Disasters and Safety Act (hereinafter referred to as the “Framework Act”);*

2. *The term “jayeon-jaehae” means any disaster caused by typhoon, flood, heavy rain, strong wind, wind wave, sea wave, tidal water, heavy snowfall, lightning, drought, earthquake (including any earthquake-caused tsunami), yellow dust or other natural phenomena corresponding thereto, from among disasters falling under subparagraph 1;*
 3. *The term “pungsu-hae” means any disaster caused by typhoon, flood, heavy rainfall, strong wind, wind wave, sea wave, tidal water, heavy snowfall or other natural phenomena corresponding thereto.*
- Disaster Control Act (enacted on July 18, 1995, Act No. 4950 and abolished on June 1, 2004)

This Act, abolished when the Disasters and Safety Act was established on March 11, 2004, states that the purpose of the Act is to establish a disaster and safety control system of the state and local governments, establish a system for prevention of and countermeasures against disasters as well as emergency rescue, declare a special disaster area, and define matters such as emergency measures necessary for disaster management in order to protect the lives and property of citizens from disasters due to artificial causes. This Act was enacted to prepare for human-caused disasters, such as arson and building collapse, rather than natural disasters, such as drought and floods. Thus, it targets technological disasters, such as explosions, collapse of bridges, traffic accidents, and chemical, biological, and radioactive accidents, like the leakage of hazardous material and environmental pollution incidents.

- Framework Act on the Management of Disasters and Safety (enacted on March 11, 2004, Act No. 7188)

The Framework Act on the Management of Disasters and Safety that took effect in 2004 categorized disaster into natural, human, and social disaster and defined them as follows:

Article 3 (Definitions) The terms used in this Act shall be defined as follows:

1. *The term “disaster” means any of the followings, which actually causes or is likely to cause any harm to the lives, physical safety and property of citizens and the State:*
 - (a) *Disasters caused by a typhoon, flood, downpour, strong wind, wind and waves, tidal wave, heavy snowfall, lightning, drought, earthquake, sandy dust, red tide, ebb and flow and other natural phenomena equivalent thereto;*
 - (b) *Damage beyond the scale prescribed by Presidential Decree, such as a fire, collapse, explosion, traffic accidents, chemical, biological and radioactive accidents, and environmental pollution incidents and other accidents similar thereto;*
 - (c) *Damage caused by the paralyzation of the State’s backbone systems, such as energy, communications, transportation, finance, medical treatment and water supply, and by a spread, etc. of infectious diseases.*

2. *The term “overseas disaster” means those which actually cause or are likely to cause any harm to the lives, physical safety and property of citizens of the Republic of Korea outside the territory of the Republic of Korea, and which require the Government to take measures thereon.*

- Framework Act on the Management of Disasters and Safety (partially amended on August 16, 2013, Act No. 11994)

Types of disasters were categorized into natural and social disasters in the Disasters and Safety Act partially amended on August 16, 2013, defining them as follows.

The Korean government classifies 32 standardized disaster types on the standard crisis management manual as shown in Table 2.3 according to the statutory classification of disasters summarized above.

Article 3 (Definitions) The terms used in this Act shall be defined as follows.

1. *The term “disaster” means any of the followings which actually causes or is likely to cause any harm to the lives, physical safety and property of citizens and the State.*

(a) *Natural disasters: Disasters caused by a typhoon, flood, downpour (the Korean word “howoo”), strong wind, wind and waves, tidal wave (the Korean word “hae-il”), heavy snowfall, lightning, drought, earthquake, sandy dust (the Korean word “Hwangsa”), red tide (the Korean word “jeokjo”) outbreak, ebb and flow (the Korean word “josu”), and other natural phenomena equivalent thereto*

(b) *Social disasters: Damage beyond the scale prescribed by Presidential Decree, such as a fire, collapse, explosion, traffic accidents, chemical, biological and radioactive accidents, and environmental pollution incidents and other accidents similar thereto, and damage caused by the paralyzation of the State’s critical systems, such as energy, communications, transportation, finance, medical treatment and water supply, and by a spread, etc. of infectious diseases under the Infectious Disease Control and Prevention Act, and contagious animal diseases under the Act on the Prevention of Contagious Animal Diseases*

Enforcement Decree Article 2 (Scope of Disasters) “Damage beyond the scale prescribed by Presidential Decree” in subparagraph 1 (b) of Article 3 of the Disasters and Safety Act (hereinafter referred to as the “Act”) means the following harm:

1. *Harm to human life or property for which measures at the level of State or local government are required;*
2. *Other harm deemed by the Administrator of the National Emergency Management Agency to be necessary for disaster control, and which is equivalent to the harm referred to in subparagraph 1*

Table 2.3 Disaster types by the crisis management standard manual (MPSS 2017)

Disaster type		Definition
Natural disaster	Damage caused by storm and flood	Any disaster caused by typhoon, flood, heavy rain, strong wind, wind wave, sea wave, tidal water, heavy snowfall, lightning, drought, earthquake (including any earthquake-caused tsunami), yellow dust, or other natural phenomena corresponding thereto ※ Article 2 of the Countermeasures Against Natural Disasters Act
	Earthquake	Direct damage by earthquake ground vibrations (namely, ground vibrations caused by earthquakes) and fire, explosion, and disasters caused by other phenomena ※ Article 2 of the Earthquake Recovery Plans Act
	Eruption of a large volcano	Damage by volcanic activities caused by volcanic ash, pyroclastic flow, volcanic mudflow, volcanic gas, lava, volcanic earthquake, or flood and damage occurred by consequent fire, explosion, or other phenomena ※ Article 2 of the Earthquake Recovery Plans Act
	Red tide	Damage on cultured marine products and fishery production facilities due to a discoloration of seawater to red or light brown caused by an explosive growth in phytoplankton density ※ Article 2 of the Act on the Prevention of and Countermeasures Against Agricultural and Fishery Disasters 〔Methods regarding the monitoring, prediction of red tide, and damage prevention〕 (Directive of Ministry of Maritime Affairs and Fisheries)
	Drought	A prolonged shortage of water supply in a certain region due to a period of below-average precipitation or insufficient available water resources: it can be categorized as a meteorological drought, a hydrological drought, an agricultural drought, or a socio-economic drought depending on its usage
	Tidal wave	Damage by level rise due to the effects of tides, weather tidal waves, swells, and abnormal waves in coastal or estuarine waters
Social disaster	Forest fire	Trees, weeds, fallen leaves, etc. in a forest or in an area adjoining to a forest are burned by a fire artificially or naturally ignited ※ Article 2 of the Forest Protection Act
	Chemical accident	All situations that occur because a chemical flows out or leaks out to humans or the environment due to the fault of a worker as at the time he/she works, such as replacement of facilities, defects in facilities or deterioration of facilities, a natural disaster, a transport accident, etc. ※ Article 2 of the Chemicals Control Act

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Table 2.3 (continued)

Disaster type	Definition
Water pollution	Accident that oil, toxic substance, or sewage or wastewater is discharged to river, causing continuous large-scale suspension of water intake or perish of fishes and significant effects on the people’s living and natural ecosystem
Large-scale marine pollution accident	Accident caused by the crack of oil tank due to sinking, stranding, or collision of a ship resulting in a significant and extensive damage to the people’s living and natural ecosystem and requiring comprehensive measures at the government level
Utility-pipe conduit	Accident occurred on the facility installed underground for smooth maintenance, aesthetic improvement, preservation of road structure, and smooth traffic flow by accommodating underground facilities (electricity, gas, waterworks supply facilities, communication facilities, drainage system, etc.) commonly
Collapse of dam	Accident of leak or overflow occurred due to natural disaster such as large-scale flood or earthquake or structural defect of dam, concerning the collapse of dam
Large-scale subway accident	Accident occurred due to the collision, derailment, fire, explosion or flooding of electric train in operation, causing casualty or expecting the suspension of train operation for a long period of time
Large-scale high-speed railroad accident	Accident occurred due to the collision, derailment, fire, or explosion of high-speed train in operation, causing casualty or expecting the suspension of train operation for a long period of time
Large-scale fire at multiuse facility	Accident at a facility used by the many and unspecified general public concerning which has a high concern of large casualty and property damage in case of large-scale fire
Radiation exposure from a neighboring country	Situation requiring national protection measures due to a large-scale radiation exposure or radiation contamination exposure accident from a nuclear facility of neighboring country
Marine vessel accident	Accident occurred due to the collision, fire, explosion, stranding, sinking of vessel, loss of loaded cargo, or other hull damage
Large-scale casualty accident at workplace	Accident of large-scale casualty such as physical explosion related to tasks at the workplace, large-scale collapse accident at construction site, choking accidents due to oxygen deficiency, acute poisoning accident due to exposure to chemicals, or other equivalent accidents
Multiuse facility large building collapse accident	Accident at a facility used by the many and unspecified general public concerning large casualty and property damage in case of collapse of building

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Table 2.3 (continued)

Disaster type	Definition
Disaster and accident at correctional facility	Accident concerning many casualties due to fire, typhoon, heavy rain, riot, rampage, and group escape of prisoners at a prison, detention center, and branch installed according to the Administration and Treatment of Correctional Institution Inmates Act
Domestic animal disease	Disease of domestic animal due to viruses of foot-and-mouth disease, highly pathogenic avian influenza (HPAI) virus, and new domestic animal disease
Infectious disease	Any infectious disease classified in Group 1 of infectious diseases, Group 2 of infectious diseases, Group 3 of infectious diseases, Group 4 of infectious diseases, Group 5 of infectious diseases, designated infectious diseases, infectious diseases under surveillance by the World Health Organization, infectious diseases spread through bioterrorism, sexually transmitted infectious diseases, zoonoses, and nosocomial infectious diseases ※ Article 2 of the Infectious Disease Control and Prevention Act
Information and communication infrastructure	Disturbance, paralysis, or destruction of critical information and communications infrastructure due to natural and social disaster
Financial information	Paralysis of essential national financial information function due to natural disaster, strike, terrorism, and electronic infringement on the financial information system which is the key national infrastructure
Safety of nuclear facility	Disaster caused by radiation leak or radioactive contamination from a nuclear power plant and research reactor facility
Electric utility	Serious impediment to national life and paralysis of national functions due to anxiety about the electricity demand and supply caused by increased demand, defected facilities, and social conflicts
Demand and supply of oil	Serious hazard to the national safety and the stability of national economy due to imbalance between demand and supply of oil caused by foreign oil producing countries
Health and medical services	Serious hazard to national health due to the paralysis of healthcare system
Drinking water	National crisis situation such as suspension of drinking and industrial water supply due to water pollution, destruction of facility due to natural and artificial disasters, and strike and cyber terror
Cargo transport	Situation which may cause or lead a significant crisis in the national logistics system due to refusal of

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Table 2.3 (continued)

Disaster type	Definition
	people in cargo truck transport business to cargo transport as a group without justifiable grounds resulting in suspension or setbacks of cargo transport
GPS signal interference	Service interruption of national infrastructure due to intentional or unintentional interruption of GPS signal reception for national core infrastructure and service using GPS
Cosmic radio wave	Disaster related to radio wave occurred due to change in electromagnetic energy existing outside of the earth’s atmosphere

By CRED and Munich RE The CRED is a research institute founded in 1973 by Lechat, a professor in Belgium and has been studying international disasters and disputes for over 30 years. It has been a World Health Organization (WHO) Collaborating Center since 1980 and is operating an international disaster database called Emergency Events Database (EM-DAT). The disaster classification system of EM-DAT is in four levels: generic group, subgroup, main type, and subtype. Generic group, the highest level of the system, classifies disaster into natural and technological disasters. The natural disaster category is divided into six subgroups: biological, geophysical, climatological, hydrological, meteorological, and extraterrestrial disasters. Each subgroup in turn covers 12 disaster types and more than 32 subtypes. More detailed information can be found in the EM-DAT report (CRED 2008).

NatCatSERVICE provided by Munich Re Group in Germany is another database related to disasters that wins global recognition, using a natural disaster classification system similar to EM-DAT. NatCatSERVICE enters all natural disasters that cause human and physical damages regardless of scale, but it does not mention artificial/technological disasters (Munich Re 2011).

In 2009, CRED and Munich RE developed and presented a joint standard classification system for natural disasters (CRED and Munich RE 2009). This can be considered the international standard classification system for natural disasters. This system classifies disasters into five levels, dividing disaster into two generic disaster groups of natural disasters and technological disasters. Natural disasters are then divided into six disaster groups, geophysical, meteorological, hydrological, climatological, biological, and extraterrestrial, each of which is then classified into main type, subtype, and sub-subtype. However, this system is limited in that it cannot present a detailed classification system for artificial/technological disasters, as Munich RE does not have the classification for such disasters.

Threat and Hazard Identification and Risk Assessment The Threat and Hazard Identification and Risk Assessment (THIRA) is a four-step common risk assessment process that has been designed by the DHS in the USA. This process helps the whole community identify risks, and enables the community to build local resilience to the risks. According to THIRA, threats and hazards are divided into three

Table 2.4 Threat and hazard types used in THIRA (DHS 2013)

Natural	Technological	Human-caused
Avalanche	Airplane crash	Biological attack
Animal disease outbreak	Dam failure	Chemical attack
Drought	Levee failure	Cyber accident
Earthquake	Mine accident	Explosives attack
Epidemic	Hazardous minerals release	Radiological attack
Flood	Power failure	Sabotage
Hurricane	Radiological release	School and workplace violence
Landslide	Train derailment	
Pandemic	Urban conflagration	
Tornado		
Tsunami		
Volcanic eruption		
Wildfire		
Winter storm		

types as listed in Table 2.4. The natural hazards are the types that result from acts of nature, such as flood, earthquakes, drought, pandemics, epidemics, or more. The technological hazards are the types that result from the accidents or the failures of systems and structures, such as transportation accidents, collapse, hazardous materials spills, or more. The human-caused incidents are the types that result from the intentional actions of an adversary, such as terrorism, sabotage, cyber incident, chemical attack, biological attack, or more.

2.1.2.2 Innovative Disaster Classification Prism for Effective Disaster Response

Classification of disasters by their cause has been useful for deciding governmental actions toward disaster recovery because it clearly indicates the responsibility of who will pay for what, e.g., supporting disaster victims and/or providing disaster relief. However, the categorization is not useful for disaster response because the response way is not different depending on its cause. Therefore, a new prism is needed.

Kim et al. (2015) have analyzed the occurrence of large-scale disasters in Korea since 2005 and the government's response to them and have proposed new optics for classifying disaster types for advancing disaster responses. To this end, two important elements were considered: the evolutionary or devolutionary pattern of the magnitude of disaster damage and the roles and responsibilities of responding agencies.

Regarding the first element of the pattern of disaster damage, three types can be derived: (1) events with measurable prediction of large-scale damage, (2) events

with unpredicted high social shocks with quick evolution and devolution independent of its magnitude, and (3) events slowly evolving to large scale.

Large-scale damage caused by typhoons, torrential rain, and heavy snowfall can be predicted according to weather forecasts and precedence. Train crashes and building collapses are types of disasters that suddenly evolve and devolve, leaving not only physical damage but also a shock to the social fabric. Finally, foot-and-mouth disease, infectious disease, and red tide are disasters that commence on a small scale, or with little notice, but over time become considerable disasters that require large-scale disaster response tactics. The reason why this classification is important is that the response system, such as the timing of the operation of the Central Disaster and Safety Countermeasure Headquarters (CDSCHQ)² and the Central Disaster Management Headquarters (CDMHQ),³ is different depending on the progress or evolution of the damage.

Secondly, the scope of the overall coordination that CDSCHQ should undertake varies depending on whether there are one or more disaster management authorities. The role of the coordinating authority becomes important for typhoons, torrential rain, and heavy snowfall, since they are types of disasters that simultaneously cause damage to various facilities, which will result in various agencies, such as the Ministry of Construction, the Ministry of Agriculture, the Ministry of Environment, etc., engaging the disaster together. For effective response to these types of disasters, it is important for the coordinating authority to support the human and material resources necessary for the various disaster responses by the disaster management agencies. On the other hand, for the disasters such as aircraft accidents, infectious diseases, and dust storms, expertise and experience are concentrated in specialized disaster management authorities, meaning it is efficient for the agencies responsible for those disasters to respond.

The category by Kim et al. (2015) is very useful in developing an optimum disaster response system fitting the disaster cause and evolutionary path. In this book, we will propose the disaster category for effective disaster response based on the category by Kim et al. (2015) as outlined in Table 2.5.

²In accordance with Article 14 of the Disasters and Safety Act, the CDSCHQ will be established and be responsible for the response and recovery measures when nationwide disasters occur. The Minister of MPSS, the Minister of Foreign Affairs (limited to cases of overseas disasters), or the Chairperson of the Nuclear Safety and Security Commission (limited to cases of radioactive disasters) will serve as the head of the CDSCHQ. In case of major disasters, when a pan-government-integrated response is required, the Prime Minister will serve as the head of the CDSCHQ.

³In accordance with Article 15–2 of the Disasters and Safety Act and attached Table 2.3 of the Enforcement Decree of the same Act, where any disaster occurs or is likely to occur, the head of a disaster management supervision agency will promptly establish and operate the CDMHQ.

Table 2.5 Disaster response framework tailored to disaster type classification

	Event: predictable huge damage	Event: instantaneous huge damage	Event: evolving to huge damage
Multi-primary response agencies	Based on forecasts, the CDSCHQ is established in advance in order to coordinate pan-government response, and various primary response agencies prepare for disaster response based on their roles and responsibilities. Typhoon, storm, and heavy snow are included in this type of event	In case of instant disaster with multi-primary response agencies, such as earthquakes, the CDSCHQ and CDMHQ are established simultaneously; the CDSCHQ coordinates pan-government disaster response, and each CDMHQ takes charge of damage control as its responsibility	Each primary response agency takes charge of its own responsibility in the early stage of the event. As the damage evolves, the CDSCHQ is installed and takes charge of overall coordination of government’s response. This type of event includes draught
Single primary response agency	Based on forecasts, the CDSCHQ and the CDMHQ are established simultaneously and before the event. The CDSCHQ coordinates pan-government disaster response, and the CDMHQ takes charge of damage control. This type of event includes catastrophic yellow dust containing hazardous elements and heavy particles and nuclear accidents in neighboring countries	In case of instant disaster with single primary response agency, such as dam failures, major rail accidents, and maritime accidents, the CDSCHQ and the CDMHQ are established simultaneously; the CDMHQ takes charge of response, and the CDSCHQ coordinates the pan-governmental support	Primary response agency takes charge of its own responsibility in the early stage of the event. As the damage evolves, the charge is transferred to the CDSCHQ. This type of event includes infection, animal disease, red tide, and green tide

2.1.2.3 Categorization by Other Principle

Dombrowsky (1998) suggested event-related concept and phase-related concept as disaster categorization. The event-related concept is composed of time, space, and severity, while the phase-related concept is composed of pre-emergency phase, emergency phase, warning, and post-emergency phase.

Methods of classifying disasters include one in terms of emergency and medicine. In the field of emergency and medicine, disaster is classified into surgical and medical disasters. The purpose of this categorization is to treat efficiently patients during disasters by securing effectiveness of first aid on-site and hospital treatment. Surgical disasters are mostly those in which victims are injured, and they refer to disasters in which damage from physical disasters appears in the form of injury. Medical disasters or disease disasters refer to chemical disasters that cause hindrance to respiratory organs and metabolic systems due to the leakage of chemicals, radioactive matters, or toxic agents. This classification method has significance in that it is possible to predict the conditions of the patients in disasters and effectively manage medical resources accordingly (Kim and Lim 1995).

2.2 Disaster Theories and Progress of Disaster Management in Modern Times

2.2.1 *Disaster Theories in Modern Times*

Contemporary society is becoming vulnerable to new types of disasters, such as new epidemics including Ebola virus and Middle East respiratory syndrome coronavirus (MERS-CoV), new animal diseases including bovine spongiform encephalopathy (BSE) and HPAI, and complex disasters such as the Tohoku earthquake and tsunami in 2011 along with typical types of disasters like typhoon, fire, and building collapse. In addition, the characteristics of complexity in modern times require new and innovative approaches that are different from current response ways.

There has recently been much research in various fields, such as sociology and science of public administration, in order to understand what increases disaster complexity in modern times. This section will review representative disaster theories and find how these theories explain major disasters that occurred in Korea and around the world. Based on this understanding, we will recommend the desirable policy change for effective disaster response in Korea. Representative theories, such as Heinrich's Law, Normal Accident, Risk Society, and Complexity Theory, will be reviewed in the following section.

2.2.1.1 **Heinrich's Law: Remembrance of the Sampoong Department Store Collapse in 1995 in Korea**

Herbert William Heinrich, who was an assistant superintendent at an American insurance company, presented an important study in 1931 based on his analyses of a wide range of accidents. He coined the notion of Heinrich's Law, which states that, for every major accident, there have been 29 preceding minor accidents and 300 signs of anomaly (Heinrich 1950). Heinrich's Law is therefore also known as the Law of 1:29:300. In other words, an accident that is large enough for people to notice is only a small tip of an iceberg and is always antedated by countless other accidents and happenings that warn of the upcoming disaster.

Through a scientific statistical approach on industrial disasters that were once believed to take place unexpectedly, Heinrich found that massive disasters occurred due to negligence on minor defections. Originally, the Heinrich's Law was applied to industrial disasters, but it is now extended to rules related to accidents, disasters, and failures throughout all kinds of areas in contemporary society. The 1:29:300 rule is meaningful in that it sets up a rule to explain quantitatively the process of an evolutionary incident, starting from a small accident and resulting in a catastrophic event.

He also applied the Domino Theory to disaster areas and indicated that in order for disasters to take place, an inappropriate "direction of flow" occurs sequentially:

many causes interact with complexity, and those causes generate interwoven influences.

As a result, phenomenon called disaster or accident takes place, and ultimately it causes human and physical disasters, which is a major argument of the Domino Theory. The Theory emphasizes fundamental elements before accidents to take place and explains there are three potential elements as follows:

The first condition – human genetic component or socially undesirable phenomena

The second condition – flaws caused by the first condition

The third condition – unsafe actions, mechanical and physical, according to the second condition

Among the three conditions that cause a disaster, the first condition of inherited elements or social environment and the second condition of inherited or acquired human defects are hard to be rectified; however, the risk by the third condition can be significantly reduced through safety education and strengthened safety devices. In other words, Heinrich insisted that if the third condition is effectively eliminated, disaster can be prevented before it occurs (Heinrich 1950). The 1995 Sampoong Department Store collapse accident in Korea is a typical example of the Heinrich's Law. The accident happened because no countermeasures had been taken even though there were many signals before the accident. The department store opened its business with inborn structural problems during the construction process: about 76 tons of installation equipment was installed on the rooftop, which was four times more than its original design load, and reinforcing bars were out of place. Along with problematic construction, poor management was another cause of the accident: minor symptoms such as cracks in the ceilings and damage to the floor of the rooftop (potential elements of 300) were overlooked by staff and maintenance crews. In addition, although customers and employees raised several concerns about the general health of the building, such as vibrating sound from an air conditioner and many cracks in the wall, no specific actions were taken, even after receiving evaluations from experts (29 small accidents). Neglecting potential elements eventually led to one huge accident with 1000 casualties (one massive accident) (Lee et al. 2008).

We found that most of the major social disasters, such as the Seongsu Bridge collapse, the Sampoong Department Store collapse, the Daegu Subway fire, and the Sewol Ferry sinking accident, have common things to cause the disasters: improper alteration of use, insufficient safety culture, insufficient safety inspection, and insufficient safety infrastructure. Heinrich's Law indicates the direction of disaster response that Korea should follow: institutional reforms for strengthening disaster and safety management, improvement of safety inspection, expansion of safety education, and enhancement of disaster and safety infrastructure.

2.2.1.2 Normal Accident: How Disaster Occurs in a Complex System

In the 1984 book *Normal Accidents*, Charles Perrow, a Professor of Sociology at Yale University, insisted that complex systems, such as nuclear power plants, chemical factories, aircrafts, ships, dams, and gene manipulation, hold a risk of tragedy. Thus, there are some unavoidable accidents called normal accidents that have a high probability of occurring regardless of safety measures and devices (Perrow 1984). Charles Perrow proposed the Normal Accident Theory based on the empirical evidence of the Three Mile Island (TMI) Nuclear Power Plant accident that took place in Pennsylvania in 1979, the first nuclear power plant crisis to have occurred. Perrow (1984) defines a normal accident, which he also refers to as a system accident, as “an event that involves the unanticipated interaction of multiple failures, reflecting the characteristics of high-risk system in which multiple and unexpected interactions of failures are inevitable.”

Perrow’s Theory insists that accidents in today’s cutting-edge technological societies are closely related with complex technological and mechanical structures with built-in risks and those risks are therefore a normal part of our lives. An extremely complex system, in which individual technologies interact with one another closely and inseparably through an endless loop, is prone to catastrophe caused by a series of breakdowns whenever one of the interwoven elements begins to dysfunction. It is nearly impossible for humans to predict such technical failures (Park 2011).

Perrow noted that conflicts of interests might exist between a given organization and its members and that organizations are also subject to external political and social environments. Technical solutions are therefore not enough, particularly as it is impossible to ensure the total control and containment of risks in such highly complex private facilities as nuclear power plants and petrochemical factories, at which minor errors can lead to complete failures (Perrow 1984).

The Three Mile Island accident is considered as the typical example of normal accident. This brought widespread panic to the USA as large portions of one of the reactor’s cores partially melted, releasing radioactive gases and hazardous iodine into the surrounding environment. The direct cause of the accident was officially recorded as a mistake by operational staff; however, the complexity of the disaster is a hidden root cause of the catastrophic event. Therefore, as Perrow indicated, complex systems with built-in intensive risk, such as nuclear power plants, require that centralized and decentralized management should be considered simultaneously.

There have been a lot of industrial accidents around the world. Accidents, such as the India Bhopal Chemical Factory accident, the Chernobyl Nuclear Power Plant radiation leak, and the BP Gulf oil spill, indicate that industrial safety measures need constant improvement through comprehensive understanding about high-risk technology and systems.

Some scholars criticized that the Normal Accident Theory overemphasizes the vulnerability of high-risk facilities; the High Reliability Theory is a typical example

of the critics. Professors from UC Berkeley and Weick, an organizational theorist, proposed the High Reliability Theory based on research of organizations fraught with disaster risk, such as National Aeronautics and Space Administration (NASA), the nuclear industry, aviation, nuclear carriers, SWAT, and massive petrochemical facilities in the USA. The High Reliability Theorists insist that sophisticated quality controls, a settled safety culture, built-in safety by cross-check, and continuous education and training can prevent disasters at high-risk facilities.

Irrespective of these critics, Perrow's Normal Accident Theory provides a beneficial lens through which we may view and analyze risks in contemporary society. Because the Theory explains risks as a matter of organizational characteristics of the ecosystem, it overcomes the shortcomings of the science and technology-centered approach. It provides sociological explanations for organizational risks that are likely to cause massive collateral damage, such as in petrochemical factories and nuclear power plants (Jeong 2009).

After the earthquake that occurred on September 12, 2016 in Korea, social interest in the safety of high-risk facilities such as nuclear power plants and old industrial complexes has increased. In accordance with Etkin (2015), who noted that careful thought should be given to the construction of complex tightly coupled systems, the Korean government should entirely overhaul the safety of risky facilities such as nuclear power plants, industrial complexes, and chemical plants. Moreover, there is a need for society-wide attention and efforts to provide a more sophisticated safeguard system.

2.2.1.3 Risk Society: Increased Risk in Line with Civilization

Around the 1980s, an in-depth exploration on new risks that occurred in modern society was conducted by European scholars, such as Luhmann, Giddens, and Beck (Lee 2005). Ulrich Beck, the German sociologist, suggested the concept of risk society as a solution to structural and deep-rooted problems of industrial societies, including science and technical safety issues, which started in the mid-1980s (Lee et al. 2008). In his book *World Risk Society* (1999), Ulrich Beck argued that the modern society is a "risk society" replete with risks all throughout and emphasized the multiplication of cross border risks and international dangers that single nation-states cannot tackle on their own (Beck 1999). During his lecture at Seoul National University in 2008, Beck pointed out the similarities between the Asian Financial Crisis in the 1990s and the Chernobyl Nuclear Plant accident in 1986, stressing the importance that all nations must work together to reduce the global risk on the basis of a common understanding that they are facing the same global risk. Beck also considers this emerging risk as a result of the de-bounding of traditional national boundaries in the spatial, temporal, and social dimensions. Beck defined risk society as a society where socially produced risk is inherently accompanied by socially produced wealth (Oh 2013). He also insisted that industrial society should be addressed through a comprehensive perspective, which includes social, historical, and technological views (Beck 1986).

As the world entered into a contemporary society, new types of risks, combined with secondary, supernatural, and artificial uncertainty, had arisen, and those risks were beyond a dimension of traditional response methods (Lee 2005). The background with such phenomena includes a complex structural change that is understood as the term of postmodernity. Generally, risk, unlike danger that indicates direct and physical loss, is based on the probability of prediction or control: a new concept of “uncontrollable risk” needs urgent attention because this type of risk denies the applicability of currently available risk theories and risk control mechanisms, arising new threats (Beck 1986).

The concept of risk society by Beck has a critical meaning to Korea’s DRM. The increased risk can be also found in urbanization in Korea. Lee et al. (2008) emphasized the increased risk due to urbanization by showing the increased disaster risk following urban development with the change of green space to paved road.

Korea has also suffered from newly emerging disaster risks, such as Severe Acute Respiratory Syndrome (SARS), foot-and-mouth disease, and MERS-CoV. Therefore, an innovative and cooperative approach to disaster risk suggested by Beck needs to be reflected in designing resilient future.

2.2.1.4 Complexity Theory: Interconnectivity and Complexity of Disaster

Complexity Theory began from researching complex natural phenomena such as meteorology. Just as Lorenz proved with the butterfly effect, the contemporary society embedded with complex network needs to take different countermeasures against disaster. The Fukushima Nuclear Power Plant accident of Japan, a great flood in Thailand, and new types of epidemics such as MERS-CoV are representative examples of disasters that the contemporary society is newly facing. The Complexity Theory is useful for understanding the characteristics of contemporary disasters and finding appropriate countermeasures.

On March 11, 2011, the fourth strongest earthquake struck Japan, since Japan started to observe earthquakes, with a mega tsunami and aftershock that caused more than 20,000 deaths. Also, the earthquake destroyed the nearby Fukushima nuclear power plants and caused radiation leakage. This disaster showed signs of complex disaster. Due to the Fukushima accident, air, soil, ocean, and underground water were exposed to radioactivity, and damages from contamination influenced largely not only Japan but also the whole world continuously.

The 2011 severe flood in Thailand is a typical example that a disaster that happened in one country affected the regional economy. Due to a heavy rain, combined with low topographic characteristics of Thailand and high tide of seawater, two thirds of the land in Thailand, including parts of Bangkok, was flooded, causing significant damage to the entire manufacturing industry. The 2011 flood did not affect just Thailand. For example, many Japanese companies’ production facilities located in the central region, having developed the area for the manufacturing of automotive and electronic goods, were inundated during the

flood. The intensity of the flooding caused all of the facilities to be shut down, which caused tremendous economic loss for both countries. Additionally, the shutdown of the automotive plants caused a reduction of Japanese auto and parts deliveries to other major markets like Japan, the USA, and Europe. In case of the electric and electronic industry, hard disks became in short supply due to flooding of hard disk manufacturing factories. Due to this, the production of semiconductors by Intel became inadequate, resulting in a short supply of semiconductors to the world's semiconductor market. Moreover, it caused a price increase of computers worldwide. Also, since the severe flood occurred right before the tourist season, the number of tourists in the fourth quarter decreased by approximately 20%, and additionally induced damages occurred in other industries, such as transportation and food services. Due to the influence of the heavy flood, the estimated economic growth rate of Thailand in 2011 was lowered from 3.8% to 2.1% (Korea Institute for International Economic Policy 2011). Table 2.6 shows the summary of damage that occurred to the Japanese economy due to the heavy flood in Thailand. This table shows that the flood was not just problematic for Thailand but indicates that a disaster occurring in one country does influence other countries.

The contemporary society is facing new types of epidemics and animal diseases, such as SARS (2002), H1N1 virus (2009), foot-and-mouth disease (2010), and MERS-CoV (2014), which did not exist in the past, and such symptoms have a high possibility of becoming more frequent due to increase in trade and traveling with foreign countries.

Pelling (2003) argued that Complexity Theory possesses a very important lesson to understanding ways to cope with disasters. For example, one of the characteristics of Complexity Theory is “emergence,” which shows a trait of disasters that take place with unexpected causes at an unexpected place. According to Drabek and McEntire (2003), “emergence” appears while people change organizations in the process of making temporary organizations and responding to disaster situations. Beck's Risk Society and Perrow's Normal Accident Theory share the similar understanding with Complexity Theory in that the emerging risk in modern society is closely related with its increased complexity. Therefore, the core elements of Complexity Theory, such as nonlinearity, self-similarity, fractal, self-organization, and emergence, are essential in understanding disaster characteristic and innovating disaster response methods in modern society.

2.2.2 Progress of DRM Since the Twentieth Century

As disasters started to become complexed and intensified, scholars and stakeholders began to look for new theories and methods to improve disaster risk knowledge and organizational capabilities. Starting in the 1970s, several theories, such as Petak's four-phase model, McLoughlin's Comprehensive Disaster Management Procedures, and the New Public Administration Theory, were developed to deal with

Table 2.6 Effects on the Japanese economy due to the heavy flood in Thailand

Classification	Field	Details
Trouble in the factory operation	Toyota	Four main areas in Japan reduced production by 10%
	Nippon Steel Corporation	Adjusted release of the crude steel in Japan due to effect of reduced automobile production
	Honda	Suspended the operation of four-wheeled vehicle plant in Malaysia
	Toshiba	Had trouble in Hard Disk Drive (HDD) production
	Pioneer	Had trouble in the production of car navigation system, relocated from Thailand to Malaysia
Deteriorated business results	Canon	Expects 50 billion yen decrease in sales
	Automobile	Possibility of sales decrease of 240 billion yen for five automobile companies
Suspended distribution	Nippon Express	Suspended the transport based on flooded areas
Paid insurance	Tokio Marine and Fire Insurance Co., Ltd.	Began investigation to provide insurance to Japanese client companies

these new complex and intensified disasters and to help modernize and reform institutions that were becoming too antiquated to deal with modern disasters. Organizations such as the USA's FEMA, created in the 1970s, used the progressing knowledge and concepts to help it mature in the 1990s, and the UN and world stakeholders, who came together in the early 2000s to produce the Hyogo Framework for Action (HFA), used the foundations' insights to increase disaster resilience around the world. Investigating the historical progress of such knowledge and the evolution of response organization is important in figuring out what logical steps should be made for a resilient future as well as in strengthening organizational capabilities to better deal with complex and intensified disasters.

2.2.2.1 Petak's Four-Phase Model on Disaster Management

In 1985, Petak proposed a four-phase model to identify the role of governments and stakeholders in each disaster management phase. He divided pre-disaster management and post-disaster management according to the progress of disasters and countermeasures and explained disaster management procedures in a time-sequential manner:

1. Disaster mitigation
2. Disaster preparedness
3. Disaster response
4. Disaster recovery

Petak emphasized that the clear delineation of roles and responsibilities of all levels of governments and stakeholders is essential for effective disaster management

PREVENTION OF DISASTERS (Chapter IV)	<ul style="list-style-type: none"> ■ (Article 25-2) Disaster Preventive Measures by Heads of Disaster Management Agencies ■ (Article 31) Safety Measures for Disaster Prevention ■ (Article 33-2) Evaluation, etc. of Disaster Management Systems, etc.
PREPARATION FOR DISASTERS (Chapter V)	<ul style="list-style-type: none"> ■ (Article 34) Saving and Management of Disaster Management Resources ■ (Article 34-5) Preparation and Operation of Risk Management Manuals in Disaster Field ■ (Article 35) Disaster Preparedness Drills
DISASTER RESPONSE (Chapter VI)	<ul style="list-style-type: none"> ■ (Article 36) Declaration of State of Disaster ■ (Article 38-2) Formulation of Master Plans for Creating Disaster Prediction and Alert System ■ (Article 39) Request, etc. for Mobilization
RESTORATION OF DISASTERS (Chapter VII)	<ul style="list-style-type: none"> ■ (Article 59) Formulation and Implementation of Disaster Restoration Plans ■ (Article 60) Declaration of Special Disaster Areas ■ (Article 66) Support, etc. to Disaster Areas, including Subsidies from National Treasury

Fig. 2.1 Four-phase contents in the Disasters and Safety Act

(Petak 1985). Petak’s model influenced the basic structure of the Framework Act on the Management of Disasters and Safety (hereafter “Disasters and Safety Act”) in Korea, which is shown in Fig. 2.1.

2.2.2.2 Performance-Centered DRM by New Public Administration Theory

The New Public Administration Theory emphasizes that a government can provide better public service to citizens by adopting business management principles to public management (Rosenbloom and Goldman 1998). The Theory aims to overcome the problems of a typical bureaucracy and to improve the efficiency of the public sector by adopting business management skills and by emphasizing output and outcome of public policy rather than the input to implement the policy (Rosenbloom and Goldman 1998). The Theory was accepted through the National Performance Review project during the Clinton Administration, and laid the foundation for FEMA’s reformation (Waugh and Streib 2006). The demand for the reformation of FEMA started from Hurricane Hugo, which hit North Carolina and the Virgin Islands in 1989, causing \$15 billion in damages. In the aftermath of Hurricane Hugo, the Loma Prieta earthquake struck California, a fire broke out in Oakland, and Hurricane Andrew struck Florida and Louisiana, dealing a massive blow to the two states. Disappointed by FEMA’s ineffective response to these massive natural disasters, political groups and citizens in the USA raised the need to improve FEMA’s performance, which was endorsed by the Clinton Administration in 1993 (Anna et al. 2006).

James Lee Witt, appointed as director of FEMA by President Clinton, emphasized disaster mitigation and shifted from recovery-oriented policy to prevention-oriented policy. Additionally, he insisted that disaster mitigation investment should be based on the assessment of the effectiveness. Consequently, government policy has continued to embrace this line of thinking. To quantify the future savings of hazard mitigation activities, the Multihazard Mitigation Council (MMC) of the National Institute of Building Sciences (NIBS) analyzed three major hazard mitigation grant programs: the Hazard Mitigation Grant Program, Project Impact, and the Flood Mitigation Assistance Program.

The independent study proposed the following significant findings: (1) for every dollar spent on mitigation, four dollars was saved from future spending; and (2) FEMA mitigation grants beget nonfederally funded mitigation activities (NIBS 2005).

The New Public Administration Theory affected the development of disaster management in Korea: the increased investment to structural and nonstructural measures for disaster mitigation and the evaluation of the effectiveness of disaster mitigation and recovery projects in the 2000s are typical examples of the effect of the Theory. Although the Theory receives criticism in that it does not consider the characteristics that disaster management has as a public service, it can provide a useful prism to improve the effectiveness of disaster management policy by focusing on the outcome or performance of the policy, rather than the input.

2.2.2.3 Public Governance: Cooperation-Based DRM

Public governance has been acknowledged as a way to improve public-private partnership in disaster management. In the Public Governance Theory, rules govern the behavior of actors not as the result of official authority or market equilibriums, but according to the consensual process among participants, based upon networks and cooperation. The concept of collaborative networks in disaster management entails the assumption that parties involved in disaster management have diverse cultural backgrounds and are bound to experience conflicts. Effective cooperation in this setting requires cultural sensitivity and mutual understanding from all participants. Collaborative networks, moreover, are becoming important because, in modern society with emerging and complex risks, it is not possible to ensure perfect preparations and resources for all possible disasters and because a specific organization or one single agency cannot perfectly control all response agencies involved in managing disasters (Waugh and Streib 2006).

The advantage of Public Governance Theory is that it strengthens shared responsibility by enabling diverse social groups to participate in the decision-making process so as to tackle uncertainty with social intellect and make policy decisions based on the social consensus. The Theory emphasizes cooperation, public participation, problem-solving, and openness as key principles of disaster management. It aims to form a collaborative risk governance system consisting of diverse actors, including governments, businesses, and civil society organizations, in which national government serves as facilitator in promoting the development of

a decentralized collaborative network among local governments, nonprofit organizations, and various public services.

However, there is an opinion that the Public Governance Theory is hard to be applied to emergency response. In other words, in an urgent disaster response process where there is not enough time to make a consultation, the process of negotiation through mutual discussion and consultation is not appropriate (Waugh and Streib 2006). The argument seems reasonable, but recent researches have shown that interagency cooperation is becoming more important in an emergency situation. Moynihan pointed out that establishing network governance in advance are an essential element in achieving the two objectives of “interagency cooperation” and “coherent response” in a crisis situation for effective disaster response (Moynihan 2009).

Public Governance Theory is also important in the development of the disaster response system in Korea. The recent major disasters in Korea, such as the Mauna Ocean Resort Gymnasium collapse accident, the Sewol Ferry sinking accident, and the Middle East respiratory syndrome, taught Korea important lessons that cooperation among all relevant organizations, such as on-site response agencies, Local Disaster and Safety Countermeasure Headquarters (LDSCHQ), various line ministries involved in the CDMHQ, and the CDSCHQ, is essential for effective disaster response and relief. Therefore, the Korean government should develop an interagency cooperation plan and execute a joint field training program; demanding the participation of all relevant organizations specified above.

2.2.2.4 The Increased Necessity of Comprehensive DRM

In late 1970, more than 100 federal organizations related to civil engineering and defense had fragmented responsibilities for hazard mitigation and disaster response, resulting in no coordinating organization taking the full responsibility for the entire phase of disaster management. President Jimmy Carter created FEMA in 1979 for this reason. The establishment of FEMA made it possible to unify the fragmented responsibilities of emergency preparedness and response resources (Anna et al. 2006).

McLoughlin (1985) proposed an integrated emergency management model. Considering disaster as an incident or condition that threatens the survival of organizations, he was concerned with the fact that troubles in cooperation among related agencies repeatedly occurred during disaster response since various public and private groups had been engaged in disaster response without comprehensive coordination. He argued that a comprehensive and integrated emergency management system could sustain administrative capabilities during emergencies and protect property and life through a series of circulation processes under the cooperation of the federal, state, and local governments. This model emphasizes that each local government and the federal government should cooperate to protect life, property, and government functions through a program of mitigation, preparedness, response, and recovery (Cho 2015).

Quarantelli (1993) also emphasized that comprehensive disaster management is essential in modern times in order to build a comprehensive and unified organization that manages all types of disasters. He argued that a dispersed or separated approach, by which each line ministry is responsible for its own disaster; devoid of

a coordinating agency, cannot deal with complex and intensified disasters in modern times. Additionally, he asserted that a comprehensive and integrated method be used when managing disasters because:

First, disasters have become more complex and capable of destroying the functionality of typical community operations, meaning that dividing disasters into natural or human-caused ones is inadequate for effective response;

Second, there is an underlying commonality among governmental departments to respond to disasters; therefore, comprehensive measures are required for a unified effort;

Third, the planning process and its contents for disaster response by each department has commonality, thus, it is ineffective that each department develops its own response plan;

Finally, the shared response resources among the governmental departments reveals that a move to a comprehensive management format is feasible since vital resources are similar in each department (Quarantelli 1993).

2.2.2.5 Global Agenda on DRM: Shift from Technical Approach to Holistic Approach

Global cooperation for effective disaster relief had been a pivotal issue among the international society. To improve the international cooperation for disaster relief to affected nations, the United Nations established a responsible agency, labelled as “the United Nations Disaster Relief Organization (UNDRO),” in 1971. Since then, the international community has been working for developing a systematic disaster management framework; disaster response plan, disaster prevention measures, and scientific and technical solutions to disaster risk have been discussed and adopted. In particular, technical approaches, such as vulnerability analysis for disasters and early warning measures, have been tried. Additionally, the scientific approach played a key role in the evolution of disaster management through a variety of research on how to identify hazard and assess vulnerability (UNISDR 2013).

In 1989, the international society began to prepare the International Decade for Natural Disaster Reduction framework to promote more systematic disaster management (UNISDR 2013).

The international community established the UN Humanitarian Emergency Assistance and the International Search and Rescue Advisory Group (INSARAG) mechanism in 1991. Also in 1993, systematic mechanisms for disaster response were introduced by building the United Nations Disaster Assessment and Coordination (UNDAC) mechanism.

The international conference held in 1989 in Japan adopted the Yokohama Strategy that emphasized the paradigm shift from recovery-oriented policies to prevention-oriented policies. In 1999, the name of the international strategy for disaster reduction was adopted with the title “Safer World in the 21st Century: Disaster and Risk Reduction.” Since then, a comprehensive policy framework to cope with increasing global risk has been developed in earnest (UNISDR 2013).

In December 2004, a tsunami hit 11 countries in the eastern-western-southern Asian regions, such as Indonesia, Sri Lanka, and India. In the wake of the catastrophic event, national governments, international organizations, UN agencies, and other stakeholders agreed to adopt “the Hyogo Framework for Action (HFA): Building the Resilience of Nations and Communities to Disasters,” to mitigate global disaster risk for 2005–2015. With the HFA, disaster management moved toward building resilience based on social consensus and strengthening shared responsibilities among all stakeholders.

In March 2015, all national governments also agreed to the Sendai Framework for Disaster Risk Reduction 2015–2030 (SFDRR), which is the first major agreement on disaster management in line with post-2015 development agenda. The SFDRR aims for the significant reduction of disaster risk and losses with the following four priority actions: understanding disaster risk, strengthening disaster risk governance to manage disaster risk, increasing investment in disaster risk reduction for resilience, and enhancing disaster preparedness for effective response and to “build back better” in recovery, rehabilitation, and reconstruction.

The DRR-related global agenda in various fields will be further reviewed and analyzed in Chap. 5 in order to link them with disaster resilience in the future.

2.2.2.6 Civil Protection and Comprehensive Security

In the 2000s, massive disasters continued to occur throughout the world. National governments have reformed their disaster response system to deal with massive disasters. The USA reformed its DRM system after 9/11 in 2001, shifting from a typical natural and human-caused disaster management paradigm to comprehensive security (Park and Cho 2013). Within this context, since the 2000s, civil defense and civil protection became important concepts in disaster management. Civil defense was originally designed to protect citizens from calamities, such as war, but it was gradually expanded to encompass DRM, reducing civilian casualties during disasters. Alexander (2006) suggested that the role of the state and the civilian in disaster preparedness be shifted from Civil Defense to Civil Protection. This is because Civil Protection is an appropriate concept to reinforce the protection of people against external risks, meeting the need to protect people from typical disasters, such as natural and technological disasters, as well as emerging risks, such as new infectious diseases, terrorism, and cyber attacks, while Civil Defense was useful to cope with the invasion of an outside force which was a severe threat during the Cold War era.

One of the most important features of civil protection suggested by Alexander is a shift from providing public safety service by the government to encouraging public participation. When a national government provides public safety services, it usually prefers to use a top-down approach: command and control, a hierarchical decision-making system excluding citizen’s participation, strengthening law and order, and rules through the principle of confidentiality. However, the civil protection concept by Alexander put stress on a bottom-up approach: emergency preparedness and response ensuring public participation and cooperation, problem-solving approach, and openness principles. As a result, risk governance is the most

critical issue in civil protection, ensuring the cooperative interaction among the government, the private sector, and civil organizations to replace the existing hierarchical bureaucratic system. Alexander (2006) addressed Hurricane Katrina as a typical failure case of Civil Defense with a top-down approach, requesting a shift from a top-down approach to a bottom-up approach, along with improved risk governance.

2.2.3 Current Disaster Response Institutions

This section will describe disaster response institutions in Korea, the USA, Japan, and other nations. The analysis of one nation's disaster response institution requires huge efforts and a large amount of work. Due to limited time and space, this section will focus on the basic structure of disaster management organizations for normal times and emergency situations at national and local levels. The disaster response institutions in Korea, the USA and Japan will be analyzed first, and then those in Australia, Germany, Switzerland, and the United Kingdom (UK) will be analyzed.

Korea

In Korea, the Ministry of Public Safety and Security (MPSS) is responsible for the overall coordination of the nationwide disaster response based on the Disasters and Safety Act. After the presidential election on May 9, 2017, the Ministry of Interior (MoI) has been preparing for the revision of the Government Organization Act, which includes the establishment of Ministry of Public Administration and Safety (MoPAS) by integrating MPSS with MoI and the establishment of Korea Fire Service and Korea Coast Guard as independent agencies. The Act is expected to be reviewed and decided by the National Assembly in late 2017. In addition, the Crisis Management Center under the National Security Council in the Blue House (president's office) is expected to work as a control tower for national crisis, such as the Sewol tragedy. The Korean government has developed its disaster response system suitable for normal times and emergency situations at the national and the local levels. Organizations for normal times are composed of disaster management agencies, disaster-management supervision agencies, emergency rescue agencies, emergency rescue, and relief support organizations. In addition, central, City/Do, Si/Gun/Gu committees are being operated to deliberate matters on disaster and safety management under their responsibilities.

Disaster management agencies take charge of all phases of disaster management activities that are related to their responsibilities. The agencies include national administrative agencies, local governments, local administrative agencies, public institutions and organizations, and other organizations prescribed by Presidential Decree.

Disaster-management supervision agencies are responsible for disaster response when a disaster or an accident occurs in accordance with the responsibilities prescribed by Presidential Decree. For example, the Ministry of Education is responsible for disasters in schools and school facilities, the Ministry of Environment is responsible for environmental pollution accidents, and the Ministry of Employment and Labor is responsible for large-scale human accidents occurring in places of work. Table 2.7 shows the disaster-management supervision agencies by disaster or accident type in Korea.

Table 2.7 Disaster management supervision agency by disaster or accident type

Supervision agency	Disaster and accident types
Ministry of Public Safety and Security	<ol style="list-style-type: none"> 1. Pipe utility conduit disaster 2. Fire and hazardous material accident, ship and ferry accident on river 3. Great fire at multiuse facility 4. Disaster or accident, which is caused by flood (except tidal wave), earthquake, volcanic activity, lightning, and drought, not belonging to other disaster management authorities 5. Ship and ferry accident on sea
Ministry of Land, Infrastructure and Transport	<ol style="list-style-type: none"> 1. Pipe utility conduit disaster supervised by the Ministry of Land, Infrastructure and Transport 2. High-speed railway accident 3. Dam accident supervised by the Ministry of Land, Infrastructure and Transport 4. Road tunnel accident 5. Drinking water (limited to wide-area waterworks) accident 6. Land cargo transportation accident 7. Subway accident 8. Aircraft accident 9. Air transport paralysis and navigation safety facilities obstacle 10. Multi-cluster building collapse disaster and accident not belonging to another disaster management authority
Ministry of Trade, Industry and Energy	<ol style="list-style-type: none"> 1. Gas supply and leakage accident 2. Oil supply accident 3. Nuclear safety accidents (including outages due to strikes) 4. Accident of electric power 5. Accident in dam for power generation
Ministry of Environment	<ol style="list-style-type: none"> 1. Large-scale environmental pollution accident related to water quality 2. Accidents involving drinking water (including local waterworks) 3. Hazardous chemical leak accident 4. Algae outbreak (limited to green algae) 5. Yellow dust

Ministry of Oceans and Fisheries	1. Algae outbreak (limited to red algae)
	2. Tidal wave
	3. Environmental pollution accidents in the marine sector
	4. Marine vessel accident
Ministry of Science, ICT and Future Planning	1. Cosmic radio disaster
	2. Information communication accident
	3. Electric wave interference of GPS
Ministry of Agriculture, Food and Rural Affairs	1. Livestock disease
	2. Reservoir accident
Ministry of Health and Welfare	1. Infectious disease
	2. Health care accident
Korea Forest Service	1. Forest fire
	2. Landslide
Nuclear Safety and Security Commission	1. Nuclear safety accident
	2. Radiation leakage accidents in neighboring countries
Cultural Heritage Administration	Cultural property accident
Ministry of Education	Accidents at schools and school facilities
Financial Services Commission	Financial computing and facility accidents
Ministry of Justice	Accident at a correctional facility
Ministry of the Interior	Accident at a major government facility
Ministry of Culture, Sports and Tourism	Accident at stadiums and venues
Ministry of Foreign Affairs	Overseas accident
Ministry of Employment and Labor	Large-scale human accident at workplaces
Ministry of National Defense	Accident at defense facilities

Emergency rescue agencies are responsible for carrying out life rescue, first aid, and other necessary measures to protect the lives and property of citizens when a disaster is likely to occur or when a disaster occurs. The agencies in charge include fire HQs and coast guard HQs, under the MPSS, City/Do fire headquarters and Si/Gun/Gu fire stations, and regional headquarters of the Korea Coast Guard and coast guard stations. To support rescue activities, Presidential Decree prescribed emergency rescue and relief support agencies, which are equipped with human resources, installations, equipment, operation systems, etc., that are necessary for emergency rescue and relief service.

To deliberate and decide crucial matters related to disaster and safety management at the national level, the Central Safety Management Committee, chaired by the Prime Minister, is operated. In addition, the Safety Policy Coordination Committee, chaired by the Minister of Public Safety and Security; the Central Disaster Broadcasting Consultative Committee, chaired by a person appointed by the Minister of the Ministry of Science, ICT and Future Planning; the Central Private-Public Cooperative Committee, chaired by the Vice Minister of Public Safety and Security; and a civilian representative are being operated to advise, consult, deliberate, or sometimes decide disaster and safety management issues under their responsibilities. At regional and local levels, a City/Do Safety Management Committee, a Si/Gun/Gu Safety Management Committee, a City/Do Disaster Broadcasting Consultative Committee, and a Si/Gun/Gu Disaster Broadcasting Consultative Committee are operated.

When disaster occurs or is likely to occur, emergency response organizations are established and operated to take timely and proper measures at national, regional, and local levels. The emergency response organizations at the national level include the CDSCHQ, chaired by the MPSS; the CDMHQ, chaired by the head of the relevant disaster-management supervision agency; and the Central Emergency Rescue Control Group (CERCG), chaired by the head of the central fire headquarters for disaster occurring on land and the chief of the Central Rescue Center for disaster at sea, respectively.

The local emergency response organizations include the City/Do Disaster and Safety Countermeasure Headquarters (City/Do DSCHQ), chaired by mayor or governor, and the Si/Gun-Gu Disaster and Safety Countermeasure Headquarters (Si/Gun/Gu DSCHQ), chaired by the head of Si/Gun/Gu. For rescue activities, the Local Emergency Rescue Control Group (LERCG), chaired by the head of the fire headquarters and a chief of a fire station, is operated; when disaster occurs at sea, the head of a Si/Gun/Gu emergency rescue control group and the head of a City/Do emergency rescue control group shall be respectively construed as the chief of a regional rescue center and the chief of a metropolitan rescue center under Article 7 of the Rescue and Aid at Sea and in the River Act.

When disaster occurs or is likely to occur, the MPSS will immediately hold a situational meeting to supervise the initial response, rescue, and first aid operations. In particular, in the event of a major disaster, the Ministry will operate the CDSCHQ and coordinate the intergovernmental disaster response activities. In case of an

oversea disasters, the Minister of Foreign Affairs shall exercise the authority of the head of the Central Countermeasure Headquarters, and in cases of radioactive disasters, the chairperson of the Nuclear Safety and Security Commission shall exercise the authority of the head of the Central Countermeasure Headquarters, respectively.

In case government-wide integrated response is necessary, the Prime Minister may exercise the authority of the Central Countermeasure Headquarters. In such cases, the Minister of Public Safety and Security, the Minister of Foreign Affairs (limited to cases of overseas disasters), or the chairperson of the Nuclear Safety and Security Commission (limited to cases of radioactive disasters) shall be the vice head.

When a disaster occurs in a jurisdiction, the mayor or provincial governor and the head of a Si/Gun/Gu shall set up their own DSCHQ and coordinate the response and recovery operations. In order to efficiently operate the CDMHQ under Article 15-2 (1) of the Disasters and Safety Act, the head of the disaster-management supervision agency shall predetermine necessary matters for organizing, operating, etc. of the CDMHQ and exercise the authority of the head of the headquarters. Also, local disaster management headquarters shall be established to work as an action team of CDMHQ in the disaster area. The disaster response organizations during emergency situations is shown in Fig. 2.2.

The disaster response plan in Korea consists of three parts: the Standard Risk Management Manual, the Working-level Manual for Risk Response, and the Manual for Actions-at-scene. As of May 2017, 32 kinds of standard risk management manuals, 254 working-level manuals for risk response, and 5,032 kinds of manuals for actions-at-scenes have been prepared and utilized. The Standard Risk Management Manual, prepared by a disaster-management supervision agency, delineates roles and responsibilities of related agencies in disasters at the national level, which shall be the guidelines for preparing the Working-level Manual for Risk Response. The Working-level Manual for Risk Response is a document stipulating the measures and procedures necessary for responding to actual disasters in accordance with the functions and roles of the disaster-management supervision agency and support agencies, which are stipulated in the Standard Risk Management Manual. The Manual for Actions-at-scene, prepared by implementing agencies, such as local governments, stipulates in detail the procedures for actions to be taken by an agency that directly performs its duties at a disaster scene.

The Standard Risk Management Manual shall be prepared by each disaster management supervision agency that is regulated in Table 2.7. However, the Standard Risk Management Manual for disasters involving many disaster management authorities, such as typhoon and drought, can be prepared by the Minister of MPSS. The Working-level Manual for Risk Response shall be prepared by related support agencies that are designated by the Standard Risk Management Manual.

The Manual for Actions-at-scene shall be prepared by an agency designated by the Working-level Manual for Risk Response. The head of the Si/Gun/Gu may

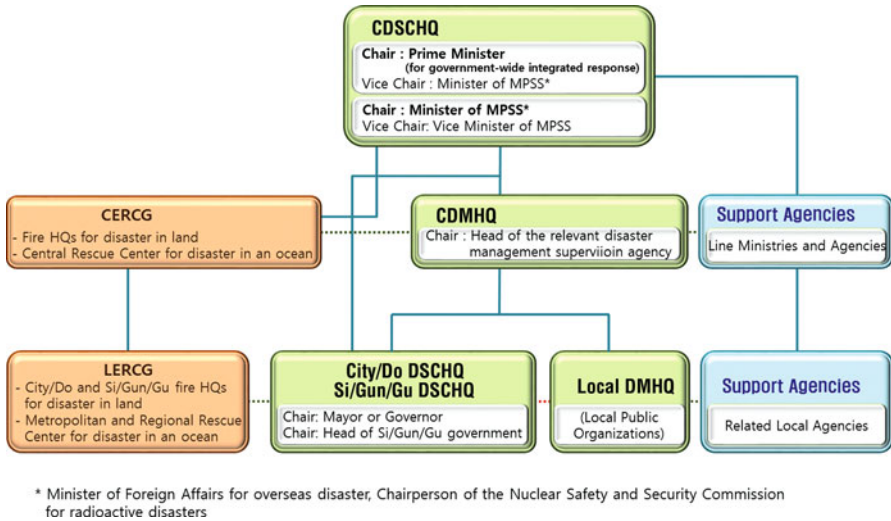


Fig. 2.2 Disaster response organizations in Korea

develop several disaster types of Manuals for Actions-at-scenes in consolidation as needed.

The manuals delineate roles and responsibilities of the disaster-management supervision agency, related support agencies, and implementing agencies. On the other hand, the operational functions of disaster response of each agency shall be designated by Action Plans for Disaster Response by Function under Article 43-5 of the Enforcement Decree of the Disasters and Safety Act. The 13 functions for disaster response, similar to the Emergency Support Function (ESF) of National Response Framework (NRF) in the USA, are described below:

1. Managing disaster situation
2. Supporting emergency livelihood stabilization
3. Supporting emergency communications
4. Emergency restoration of facilities damage
5. Restoring damaged energy supply facilities
6. Supporting disaster management resources
7. Traffic countermeasures
8. Supporting medical and disinfection services
9. Environmental arrangement at disaster scenes
10. Supporting and managing volunteer work
11. Maintaining social order
12. Searching, rescuing, and emergency support at disaster areas
13. Publicity of disaster management

In summary, the two axes of the disaster response plan in Korea are three levels of manual and 13 functional action plans. The manual describes the roles and responsibilities of primary response ministries and related agencies, and the

13 functional action plans describe how each agency performs its key response functions in line with its roles and responsibilities. The disaster response organizations during emergency situation are: CDSCHQ, City/Do DSCHQ and Si/Gun/Gu DSCHQ for overall coordination; CDMHQ and LDMHQ for the implementation of their own responsibilities; CERCG and LERCG for search and rescue; and support agencies.

United States of America

Both the establishment and evolution of FEMA and DHS in the USA had influenced the disaster management system in Korea; in particular, the establishment of the National Emergency Management Agency (NEMA) in 2004 and the establishment of the MPSS in 2014. In addition, the integrated disaster management formed by the DHS, the NRF, and the National Incident Management System (NIMS) has also influenced the evolution of the disaster response system in Korea.

DHS, established in 2003, is responsible for national security and disaster management. FEMA under DHS is in charge of all phases of disaster management, including national preparedness, public and private capacity assessment, mobilization of resources for emergency management and disaster relief, and long-term recovery plans. At the state level, the disaster management department focuses on strengthening the linkage between the federal government, the state, and the local governments and assisting the local government in disaster prevention, preparedness, response, recovery, and relief. When a disaster occurs, the Emergency Operations Center (EOC) commences operation and responds to disasters in accordance with a preestablished disaster response plan (EOP, Emergency Operation Plan, or CEMP, Comprehensive Emergency Management Plan). Local governments have a primary responsibility for the whole process of the localized disaster, prevention, preparedness, response, and recovery of disaster, and for the activation of EOP followed by executing the EOC to respond to disasters. When a disaster that exceeds the capacity of a local or a state government occurs, federal government's assistance and involvement is requested and is provided through the Joint Field Office (JFO). The USA performs disaster management through NRF and the NIMS.

Be that as it may, the catastrophic events on September 11, 2001 (9/11), and August 28, 2005 (Hurricane Katrina), saw the federal government's failure to provide proper support to state and local governments for effective disaster response. After that, there is an increasing demand for the federal government to respond to disasters proactively by federal emergency declaration to large-scale disasters and pre-deployment of federal resources to states. However, the basic principle of disaster management in the USA is still that local governments are primarily responsible for all disasters, with the support from state and federal governments concerning disasters that exceed the capacity of local governments. The disaster management organizations of the USA are summarized in Fig. 2.3.

The DHS was established in January 2003 to integrate the prevention of terrorism and the function of disaster management under one department's coordination

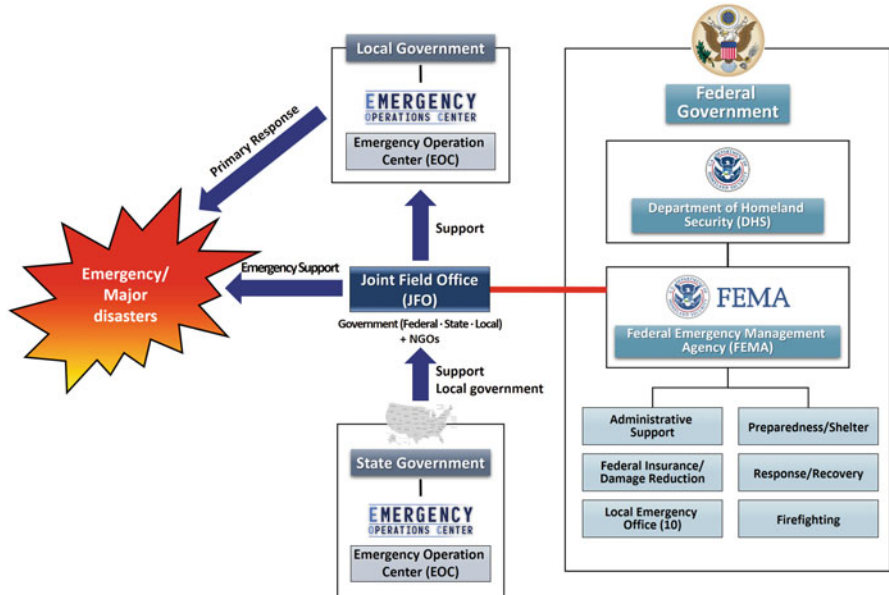


Fig. 2.3 Disaster management organizations of the USA

in the wake of the September 11, 2001 terrorist attacks and the mailing of anthrax spores. DHS took charge after the commencement of the National Strategy for Homeland Security and the Homeland Security Act. The DHS carries out tasks that include the suppression of terrorists’ attack, minimization of damage, prevention, preparation, response, and recovery in the emergency plans for all domestic and international dangers that threaten the USA. The DHS consists of the Office of Intelligence and Analysis (OIA), the Information Analysis and Infrastructure Protection (IAIP), the Chemical and Biological (CB) Weapon Management Service, the State Affair Safety Service, Secret Service (SS), and FEMA. FEMA, which is the most well-known organization among the various organizations of the DHS, is responsible for various tasks that include the disaster risk reduction at all levels, the reduction of property loss through various risk-based emergency management programs for the preparation, response, and recovery, and the protection of people’s lives and main facilities.

FEMA was established in 1979 as an organization coordinating the response and recovery of disasters during the Carter Administration. However, the initial phase-out of FEMA was not that high. It had grown into a member of the administrative cabinet and a ministerial level organization during the Clinton Administration through the establishment of an integrated response system and the strengthening of preventative and mitigation programs after failing to respond effectively to several large-scale disasters such as Hurricane Hugo.

Through the establishment of FEMA, various agencies related to disaster response were integrated into one agent under the direct control of the President and capable of comprehensively responding to various human-caused disasters and natural disasters. After the DHS was established, FEMA was incorporated and operated as a bureau under the DHS.

In the early days, under the DHS, FEMA's status was weakened since anti-terrorism and security were the first priority of the nation. However, after Hurricane Katrina, the importance of disaster management has been highlighted, and FEMA has also been strengthened as the independent deputy-minister level agency.

FEMA, headquartered in Washington, DC, operates local offices and provides regular disaster support personnel who can respond immediately in case of a disaster. The central organization for when an emergency occurs includes the JFO. The JFO is established by FEMA for coordinating between state governments and federal agencies after the President declares a state of emergency, and JFO plays a pivotal role in providing coordination between federal, state, and local governments and Non-Governmental Organizations (NGOs) and private sector accident supports. The head of a JFO is called the federal coordinating officer (FCO), who is designated by the President and carries out the comprehensive coordination and the management of support activities using the resources secured by the federal government.

In general, the state and local governments have an organization dedicated to disaster management: a disaster management department at the state level and an emergency office at the local level. A local emergency office (LEO) normally consists of divisions handling emergency operation, information and communication, administrative task related to disasters, prior identification of risk, and the modification and supplementation of a risk management plan. In the event of a disaster, the EOC is set up to coordinate or support the disaster response at the site and responds to the disaster in accordance with the Incident Command System (ICS). Disaster response plans in the USA are developed at the federal, state, and local levels. At the federal level, the NRF and the NIMS constitute overall responsibilities of the DHS, FEMA, line ministries, and other agencies. The purpose of the NRF was to connect government agencies with NGOs and the private sector and transparently assign and coordinate key roles and responsibilities nimbly. The NRF consists of the base document, the ESF annexes (ESF Annex), the support annexes, and the incident annexes. Table 2.8 shows the organization of the NRF.

The local disaster response plan is carried out through the preparation of an EOP by each area. The plan incorporates all aspects of disaster management in any given area, and it guides the roles and responsibilities of all related agencies for disaster response, depending on the size and complexity of a disaster. EOP consists of the basic plan enclosed with the annex including the ESF, the administrative and financial support plan, and the incident annex.

NIMS provides national response doctrine for the whole community to work together based on the principle of the NRF. The NIMS defines standardized

Table 2.8 Organization of the NRF (FEMA 2016)

Composition	Details
Base Document	Describe key roles and responsibilities around the nation and structures for implementing nationwide response policy and operational coordination for all types of domestic emergency events
Emergency Support Function Annexes	Specify the federal resources and capabilities to provide emergency support for 14 functional areas and identify coordinator, primary agency, and support agency for each functional area
Support Annexes	Describe common and basic supports to the majority of incidents: critical infrastructure and key resources support, financial management support, international coordination support, etc.
Incident Annexes	Describe the response methods for seven incident categories: biological, catastrophic, cyber, food and agriculture, mass evacuation, nuclear/radiological, and terrorism.

command and control principles to enable various response agencies to coordinate in the event of a terror and disaster. It provides a standardized response principle that allows federal, state, local governments, and nongovernmental organizations to respond consistently to a disaster regardless of the cause, size, location, or complexity of the disaster. To this end, it defines concepts, principles, organizations, rules, procedures, and terminology that provide a structured framework that is flexible, applicable, comprehensive, and geographically balanced for all types of disasters.

The on-scene commander of the NIMS directs and controls the response at the incident site, and the head of the EOC is responsible for supporting the incident site while coordinating and managing local resources from outside the incident site. The components of the NIMS include preparedness, communication and information management, resource management, technical support, continuous management, and maintenance.

In 2008, FEMA developed “State NIMS Integration” to facilitate states to adopt the NIMS. The guidelines require states to develop both an “Emergency Operation Plan” and a “Procedural Document.” The EOP is a response plan that adapts the disaster response principles and the emergency support functions specified in the NRF tailored to the situation of the state. The Procedural Document consists of general principles for disaster response, standard action procedures, on-site operation guides, and job aids. Each Standard Operating Procedure (SOP), the instruction for carrying out ESF tasks to enable the smooth support for disaster response in the field and how to carry out those disaster response tasks, contains the guiding principles listed in the ESF.

It can be drawn from FEMA’s actions that the modified US disaster management system would emphasize comprehensive, integrated, and mutual cooperation among the relevant organizations and stakeholders. To solidify this new emphasis, FEMA announced in 2007 seven guiding principles to cope with national emergencies: comprehensive, progressive, risk-driven, integrated, collaborative, coordinated, flexible, and professional (Emergency Management 2007).

The basic act for disaster management in the USA is the Stafford Disaster Relief and Emergency Assistance Act. It gives the state the right to request support from the federal government and the right of the federal government to supplement resources to requesting state. Additionally, it gives the President the right to declare emergency or major disaster in order to provide federal assistance. The Homeland Security Act and the Post-Katrina Emergency Management Reform Act are also important disaster-related laws.

Japan

Japan has been exposed to various natural and human-caused disasters, such as earthquake, typhoon, and hazardous material contamination. To cope with those threats, Japan has developed a comprehensive disaster management system at the national and local levels. The “Basic Act on Disaster Control Measures,” enacted in 1961, functions as the backbone of the disaster management system in Japan. The Japanese government enacted the law in the wake of Typhoon Vera (Isewan Typhoon), which caused 5041 deaths, 38,921 injures, and property damage of approximately 5.5 trillion yen. Since then, the “Basic Act on Disaster Control Measures” has become the foundation for carrying out all measures related to disasters including emergency countermeasures and recovery as well as the disaster prevention, and this law handles disaster prevention measures in each field comprehensively.

After the Great Hanshin-Awaji Earthquake on January 17, 1995, Japan revised the master plan for disaster prevention completely, and the “Basic Act on Disaster Control Measures” was partially revised to reflect the lessons learned from the earthquake. The Great Hanshin-Awaji Earthquake, which led to a full modification of the master plan for disaster prevention, resulted in 6434 deaths, 104,906 houses destroyed completely, and property damage of 10 trillion yen, which accounted for 2.5% of Gross Domestic Product (GDP) at that time. With the occasion of several huge disasters, the disaster management system in Japan has been appropriately modified so that a more systematic disaster response can be provided through central disaster prevention meetings.

A Central Disaster Prevention Meeting (Chairman, Prime Minister) consists of the Prime Minister, the Minister of Disaster Prevention, related ministers, the representatives of designated public agencies, and people with knowledge and experience designated by the Prime Minister. This meeting carries out the preparation and implementation of a master plan for disaster prevention and emergency measure plans and the examination of important items regarding disaster prevention according to the advice of the Prime Minister.

The Fire and Disaster Management Agency under the Ministry of Internal Affairs and Communications, which is equivalent to the Central Firefighting Headquarters in Korea, was established based on Article 3, paragraph 2 of the National Government Organization Act and Article 2 of the Firefighting Organization Act. The Fire and Disaster Management Agency under the Ministry of Internal Affairs and Communications takes charge of planning and drawing up firefighting administration procedures and policies of various laws and standards. This agency has no

direct right to command firefighting at the local level but handles tasks in an adversarial, instructional, and coordination role.

The General Affairs and Planning Department (Bureau) and disaster prevention sections in the General Affairs Division have been established to carry out cooperation and coordination tasks since the cooperation and coordination between relevant local divisions are important for disaster management. The local disaster prevention meeting is divided into prefectures and municipalities. The local crisis meeting of prefectures consists of heads of local administrative agencies, Self-Defense Forces, and superintendents of education with the prefecture governor as the manager. The head of the municipality takes charge of the municipality local crisis meeting. These two agencies take charge of contact and coordination between relevant agencies in case of a disaster and play a role in establishing and implementing a disaster prevention plan to handle each step effectively including disaster prevention, emergency disaster measures, and disaster recovery.

The local emergency organization is the local disaster relief center. The local disaster relief center is installed according to a local disaster prevention plan in case a disaster is expected or a disaster occurs. The local disaster relief center is responsible for carrying out disaster prevention and emergency disaster measures related to the relevant prefecture or municipality according to the local disaster prevention plan of the relevant prefecture or the local disaster prevention plan of the municipality. The central/local and normal times/emergency response institutions of Japan are summarized in Table 2.9.

The disaster management system in Japan has been established into central and local disaster management systems and regular and emergency disaster management systems to enable a smooth communication among divisions. Japan, where various disasters occur frequently, has established various systematic disaster response plans just as the disaster management system.

The disaster response plan consists of a “master plan for disaster prevention” for the central government and a “local disaster prevention plan” for the local level. The “master plan for disaster prevention” is a comprehensive long-term plan for disaster prevention prepared by the central crisis meeting, and it is based on the Basic Act on Disaster Control Measures. It is responsible for determining the comprehensive and long-term plan for disaster prevention, the key points for the disaster prevention task plan and the local disaster prevention plan, and the preparation standard for the disaster prevention task plan and the local disaster prevention plan.

Based on such disaster prevention plans, Japan has prepared for disaster prevention in three steps including prevention, emergency measures, and recovery and redevelopment. Each step contains the basic policy for disaster prevention, mutual linkage around the country between public agencies and local governments, and measures to share disaster prevention information between disaster prevention agencies and residents. The central disaster prevention plan and the local disaster prevention plan are executed identically.

Table 2.9 Disaster response institutions of Japan (Japan Cabinet Office 2017)

	Normal times	Emergency
National organization	1. Cabinet Office 2. Ministry of Land, Infrastructure, Transport, and Tourism, the Fire and Disaster Management Agency of the Ministry of Internal Affairs and Communications, the Nuclear Regulation Committee, etc., carry out disaster management work based on individual law	1. Emergency Disaster Countermeasure Headquarters
	※ Central Disaster Management Council Operation as a nonpermanent deliberation agency	2. Urgent Disaster Countermeasure Headquarters
Local organization	1. General Affairs and Planning Department (Bureau) and disaster prevention sections in the General Affairs Division	Local Disaster Countermeasure Headquarters
	※ Local Disaster Management Council as a nonpermanent deliberation agency	

Australia

Disaster management in Australia utilizes a comprehensive and integrated approach (EMA 2004). Each provincial and local government, in accordance with federal guidelines, establishes a disaster management act that puts forward how local disaster entities should actively and effectively prepare against regional risks. Such a decentralized legal system gives each state or local government the responsibility and the flexibility to carry out disaster countermeasures tailored to the characteristics of disasters, which have occurred or are to occur in each area of Australia.

One of the most influential events that moved opinion for the improvement of disaster management in Australia was a large-scale fire called the Tasmanian Bushfire that occurred on February 7, 1967. This large-scale fire resulted in 62 deaths, 7000 displaced from 1400 families, and 250,000 ha of land damaged. This fire made the Australian government recognize the importance of a disaster management system at the federal level, which resulted in the establishment of the Natural Disaster Organization (NDO) in 1974. This organization was strengthened in 2007 due to the needs of more systematic disaster preparedness, and its name was also changed to Emergency Management Australia (EMA). Currently, EMA performs its duty as the standard central organization for disaster management and, based on the Commonwealth Government Disaster Response Plan (COMDISPLAN), takes charge of planning and the coordination for disaster management at the state, district, and local governmental levels in Australia.

Disaster management in Australia is divided into four levels: federal, state, district, and local. The disaster management system is handled by EMA at the federal level, whereas Disaster Management Groups (DMG) – State/District/Local – manage the disaster management system at the state, district, and local levels. Figure 2.4 is a diagram showing the disaster management system in Australia.

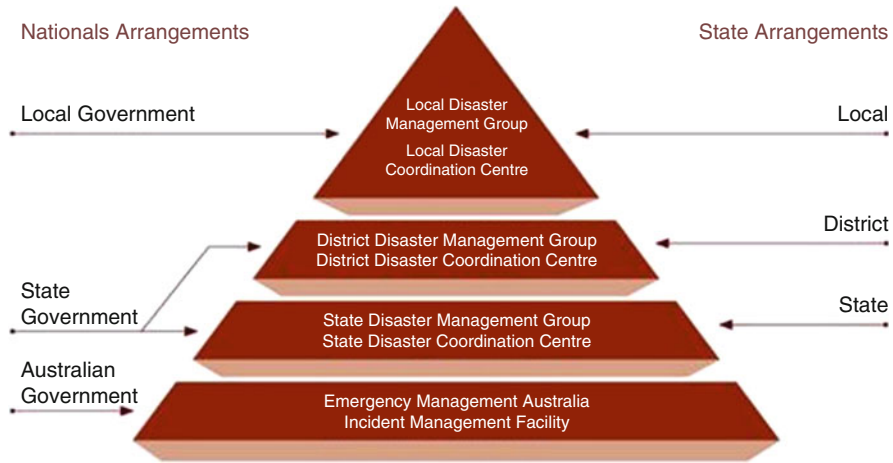


Fig. 2.4 The diagram of disaster management system in Australia (Queensland Government 2015)

At the federal level, the Australian government has established separate disaster management systems suitable for normal times and emergency situations, respectively. The EMA Division in the Attorney General's Department carries out normal disaster management: national disaster management, planning, coordination, 24-h disaster status monitoring, international support, and cooperation tasks.

In case of emergency situations, the federal government carries out disaster management through the Australian Government Crisis Coordination Centre (CCC), an emergency center coordinating disaster responses for all line federal departments and state, district, and local governments.

The state, district, and local governments in Australia also have two types of disaster management systems suitable for normal times and emergency situations, respectively. During normal times, the DMG is the primary organization to deal with disaster management, particularly focusing on prevention and preparedness, which is managed by the Department of the Premier and Cabinet (premier of state government), consisting of the premier of each state government, all state ministers, and the army commander of each state government. The DMG develops and operates disaster management plans, strategies, and policies and supports state, district, and local management groups. In case of an emergency, the manager of the DMG should appoint a disaster coordinator in advance for the cooperation and coordination between the federal government, other state governments, and relevant organizations within state governments.

On the other hand, the Disaster Coordination Centre-State/District/Local (DCC) was established to handle and operate a disaster management system during emergencies more systematically. The DCC consists of divisions representing each state government, the Bureau of Meteorology under the federal government, the Australian Defense Force, the Australian Red Cross, and the Australian

insurance parliament at the senior officer level, and is responsible for decision-making and coordination regarding support of resources to local, district, and state governments according to the level of the disaster situation occurrence.

The disaster response plans in Australia have also been separated into a federal level and a local-level disaster response plan. The disaster response plan of the federal government is the COMDISPLAN, which specifies competent disaster organizations in the six states and seven territories of Australia, and the contents and procedures for resource support and cooperation between state governments.

The disaster response plan at the state, district, and local levels is called the Disaster Management Plan (DMP) or Guideline-State/District/Local and consists of four parts: prevention, preparedness, response, and recovery for strategic policies to deal with disaster by delineating roles and responsibilities for each phase in disaster management. The roles and responsibilities of each department and agency are specifically described in 17 ESFs. For more specific response activities, the response phase is subdivided into four steps: alert, lean forward, stand up, and stand down.

Two record-breaking disasters have occurred in Australia since 2000. The Black Saturday bushfires that occurred on February 7, 2009, resulted in large-scale forest fire damage in the southeastern region of Australia. More than 400 forest fires occurred simultaneously resulting in a more significant damage occurrence, and these forest fires resulted in 173 deaths and forest loss of 430,000 ha (Victorian Bushfire Reconstruction and Recovery Authority 2009).

A series of floods called the Queensland Floods occurred in western Brisbane, Queensland, on December 31, 2010. These floods resulted in more than 33 dead, more than 3 missing, and approximately 29,000 homes and businesses flooded (Queensland Floods Commission of Inquiry, 2012). These floods were recorded as the largest floods within 100 years, and the continuous rain for 3 weeks made the damage greater. The Australian government is in the process of improving its disaster management system in the wake of these two catastrophic events, which is worthwhile to be monitored.

Germany

According to Germany's Basic Law, the primary responsibility for disaster management rests on local and state governments, and the federal government provides financial, human, and physical assistance to local and state governments when a large-scale disaster occurs that exceeds the capacity of the local government or the state government. In the event of a disaster beyond the capacity of the state, the state will be supported by police departments and military forces in the neighboring states. And if necessary, the state receives the support of the police department, military forces, and technical support from the federal government.

The Federal Ministry of the Interior (BMI, Bundesministerium des Innern) is in charge of coping with major disaster or nonmilitary crisis that require the intervention of the federal government. In particular, the Federal Office of Civil Protection and Disaster Assistance (BBK, Bundesamt für Bevölkerungsschutz und Katastrophenhilfe), established in May 2004 under the Ministry of the Interior, is

responsible for responding to disasters in an integrated manner through systematic cooperation with other federal, state, and local governments in the event of large-scale disaster. BBK has been expanded from the Federal Office of Administration (Bundesverwaltungsamt) as the importance of civil protection has increased in Germany, in the wake of the September 11 terrorist attacks in the United States in 2001 and the floods of the Elbe River in Germany in August 2002.

The main responsibilities of the BBK include the development of a comprehensive civil protection plan, dissemination of emergency information to citizens in crisis situations, critical infrastructure protection, and education and training for civil defense. The Joint Situation and Information Center (GMLZ, Gemeinsames Melde- und Lagezentrum von Bund und Ländern) in the BBK is responsible for monitoring disaster situations, disseminating disaster information, and international requests for help. When a large-scale disaster occurs in Germany, the Federal Ministry of Home Affairs calls up the Crisis Task Force (Krisenstab). The task force works jointly with relevant departments within the federal government, agencies under the Ministry of Interior, and state liaison officers. In the event of a major type of catastrophic event that can be a national crisis, the Ministry of Interior will form the joint task force with responsible ministries. For example, if a nuclear accident or an illegal use of radioactive materials happens, the BMI and the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB, Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit) will form the joint crisis management task force. When pandemics or biochemical terrorism occurs, the BMI and the Federal Ministry of Health (BMG, Bundesministerium für Gesundheit) will form the joint task force.

The German local system consists of the state (Länder) government, the city or county (Kreis) government, and the municipal government (Gemeinde). Disaster management organizations in Germany's local system are different depending on the characteristics of each region; however, departments dealing with internal affairs mostly take charge of disaster management. In recent years, there have also been a growing number of states establishing disaster risk protection departments (Gefahrenabwehr) by experiencing increased terrorism and massive natural disasters due to climate change. The central/local and normal times/emergency institutions of Germany are summarized in Table 2.10.

Each state government develops and operates its own disaster response plan. For example, Hessen is the state government that has the disaster response plan under the title of Katastrophenschutzpläne (Emergency plans). Katastrophenschutzpläne (Emergency plans) of Hessen specifies the contents regarding necessary information in the event of disaster and means to be used. Also, in case of a very severe disaster such as nuclear risk that targets a specific object, it is required to establish and operate Sonderschutzpläne (Special Protection Plans) separately. Figure 2.5 shows the Katastrophenschutzpläne (Emergency plans) in Hessen, Germany, and it shows the contents regarding the Sonderschutzpläne (Special Protection Plans).

The English translation of Fig. 2.5 is:

§31 Disaster Protection Plans

Table 2.10 Disaster response institutions of Germany

	Normal times	Emergency situations
Federal government	Federal Office of Civil Protection and Disaster Assistance (BBK, Bundesamt für Bevölkerungsschutz und Katastrophenhilfe)	Crisis Task Force (Krisenstab) under the Federal Ministry of Home Affairs Joint Crisis Task Force
State government	Disaster Management Bureau of Ministry of the Interior in state government	Disaster risk protection departments (Gefahrenabwehr)

**§ 31
Katastrophenschutzpläne**

Die Katastrophenschutzpläne müssen insbesondere die erforderlichen Angaben über die in einem Katastrophenfall verfügbaren Hilfskräfte, deren Alarmierung und Hilfsmittel enthalten. Sie sind mit den benachbarten Katastrophenschutzbehörden abzustimmen. Für besondere Gefahrenobjekte sind Sonderschutzpläne auszuarbeiten.

Fig. 2.5 Katastrophenschutzpläne in Hessen, Germany (Emergency plans) (HBKG n.d.)

The disaster protection plans shall contain, in particular, the necessary information on the emergency aid, the alarm, and the means of assistance available in a disaster. They must be coordinated with the neighboring disaster control authorities. Special protection plans are to be drawn up for special dangers.

United Kingdom

The UK, based on the tradition of local autonomy and accountability of citizen and local governments, utilizes a bottom-up disaster management system. In 2013, the Cabinet Office, a guide to Emergency Response and Recovery was released with eight core principles: anticipation, preparedness, subsidiarity, direction, information, integration, cooperation, and continuity (Cabinet Office 2013a). The basic act for disaster management in the UK is the Civil Contingencies Act (CCA), 2004.

The UK has developed its disaster management system suitable for normal times and emergency situations at the federal and at the local levels (Korean Association for Local Government Studies 2008). At the federal level, the Civil Contingencies Secretariat (CCS) was established in 2001 to take charge of the overall coordination of disaster management during normal times, whereas the Cabinet Office Briefing Room (COBR) and the Civil Contingencies Committee (CCC) take charge of disaster response in case of emergency situations.

The CCS is headed by the Permanent Secretary, vice-minister level official in the Cabinet Office, and it takes overall responsibility for disaster management in the UK. If needed, the Minister of the Home Office (or the Cabinet Office) reports to the National Assembly for sharing emergency information or hearings after hit by disaster. The CCS carries out the emergency response tasks including anti-terrorism and disaster restoration tasks and is responsible for identifying and making preparations for a crisis during an emergency situation.

The COBR and the CCC are activated for the federal government to act when catastrophic events occur. The activation process and procedures are decided depending on the level of emergency, specifically at level 2 and level 3; and at

Table 2.11 Disaster step as the standard of disaster management system in the UK ((Cabinet Office, 2013b))

Step	Disaster support system by step
Step 1 (significant)	The competent agency provides supports and cooperation at central government level
Step 2 (serious)	The national crisis committee is organized with the competent minister as the Chairman
Step 3 (catastrophic)	The national crisis committee is organized with the Prime Minister as the Chairman

level 2, the responsible minister takes the leading role as Chairman, and at level 3, the Prime Minister serves as Chairman. Table 2.11 shows the three levels for disaster response, in which the roles and responsibilities of each agency at the federal and the local levels are delineated differently.

The COBR and the CCC focus on cooperation between the federal and local governments and support tasks rather than command and control. Also, high-ranking officials can participate in the COBR, receiving and processing a report of situation, for prompt disaster management. Figure 2.6 shows the block diagram of COBR.

The CCA categorizes agencies for disaster response into two categories according to their roles and duties with different obligations. The category 1 responders are the agencies that have priority for response. The category 1 responders consist of police services, fire and rescue services, health bodies, maritime and coastguard agency, local authorities, and environment agency. The police normally control and coordinate the activities at and around the scene. There are, however, exceptions, for example, the fire and rescue service takes the responsibility at the scene of a major fire. Category 2 responders consist of a wide range of private sector bodies that have an important role, but not routinely involved in the core of multi-agency emergency response and recovery work. Utilities, telecommunications and transport providers, highways agency, strategic health authorities, and health and safety executives are included in the category 2 responders.

A Local Resilience Forum (LRF) is a private and public joint organization of local governments, military officials, corporations, and civic groups that analyzes risk factors and establishes the risk management plan. The main aim of the LRF is to assist multi-agency and multi-sectoral cooperation. The LRF has regular meetings at least once every 6 months to strengthen regional resilience, and category 1 responders should participate in the meetings. The LRF is not a legal entity, nor does the LRF have powers to direct its members. Nevertheless, the CCA and the regulations provide that responders, through the Forum, have a collective responsibility to plan, prepare, and communicate in a multi-agency environment. The police serve as Chairman for the LRF, and a manager is assigned to each of the 42 areas classified according to the police administrative district. A Regional Resilience Forum (RRF) is a high-level organization of the LRF to coordinate plans for large-scale emergencies that are difficult to handle locally and to coordinate with the central government. The RRF divides 42 areas into 9 local units, and a

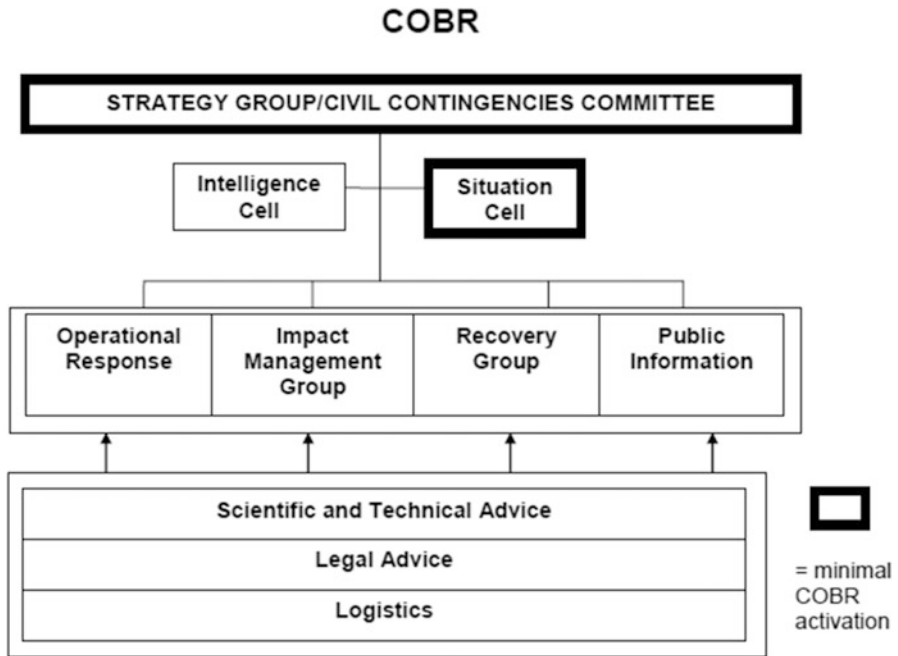


Fig. 2.6 Block diagram of COBR (Cabinet Office 2013a)

local government office is located in each local unit, and the Regional Director of Government Offices serves as Chairman.

The Strategic Coordinating Group (SCG) and the Regional Civil Contingencies Committee (RCCC) are local emergency organizations for coordinating multi-agency cooperation. The SCG is a type of accident response and recovery center consisting of government branches, military, police, fire, hospitals, and private local committees in the relevant area at the local level for accident response, and all government officials dispatched to the jurisdiction of the central government are under the direction and control of the local director. The RCCC is established when an emergency crisis exceeds the local level, and its composition and system are similar with the RRF. The disaster management in the UK is shown in Table 2.12.

The disaster response plan in the UK is also operated separately into national and local disaster response plans. The national disaster response plan in the UK is carried out through the National Contingency Plan (NCP). The NCP describes initial response, accident response, responsibility and compensation, role and responsibility of central government, international support, and cooperation for each type of disaster, and it becomes the foundation for the disaster plan of the central government.

The UK has also prepared a disaster response plan for flood under the NCP since flood occurs frequently, which is the Guidance for Accessing Specialist Flood Rescue Mutual Aid. The Guidance for Accessing Specialist Flood Rescue Mutual

Table 2.12 Disaster response institutions of the UK

	Normal times	Emergency situations
National level	CCS (Civil Contingencies Secretariat)	COBR (Cabinet Office Briefing Room) CCC (Civil Contingencies Committee)
Local level	1. RRF (Regional Resilience Forum)	1. RCCC (Regional Civil Contingencies Committee)
	2. LRF (Local Resilience Forum)	2. SCG (Strategic Coordinating Group)

Aid specifies the strategic approach of the government for preparing for and responding to a flood, and it is responsible for providing comprehensive emergency response guidelines to all flood rescue service providers including public and private volunteer organizations including the utilization of existing and future flood relief assets. Also, the Guidance for Accessing Specialist Flood Rescue Mutual Aid presents the role and responsibility for each agency regarding floods as well as the action procedure (SOP) to enable prompt response in case of a flood.

The local disaster response plan in the UK is carried out through the Strategic Emergency Plan (SEP). The purpose of the SEP is to present the direction of regional response activities and methods, through which the disaster response strategy and disaster response plan of each cooperation organization is prepared. The SEP is managed through the LRF organized in each area, and the LRF is responsible for developing a more detailed implementation plan on the basis of what was given by RRF.

Switzerland

In Switzerland, Cantons and Communes have the authority and responsibility for disaster response, and the federal government intervenes only in the event of a national crisis. Particularly, Switzerland has a disaster management system based on a close cooperation among the federal, state, and local governments, a proactive role of the military in disaster response, and a strong civil defense system.

The basic act of disaster management in Switzerland is the Federal Civil Protection and Civil Defence Act (BZG, Bundesgesetz über den Bevölkerungsschutz und den Zivilschutz).

At the federal level, the Federal Office for Civil Protection (BABS, Bundesamt für Bevölkerungsschutz) under the Federal Department for Defense, Civil Protection and Sport (VBS, Eidgenössisches Departement für Verteidigung, Bevölkerungsschutz und Sport) is responsible for disaster management.

Under BABS, National Alarm Center (NAZ, Nationale Alarmzentrale) operates 24 h all around the year in order to monitor situations, disseminate disaster information, and respond to disasters when necessary. Since its establishment in 2007, NAZ has designated radioactivity, chemical accidents, and the collapse of bridges due to a natural disaster as major disasters, making preparations for such disasters, and NAZ has also established the linkage system between major facilities and competent authorities to judge the situation in case of a disaster.

The Office for Civil Protection, Sport, and Military (BSM, Amt für Bevölkerungsschutz, Sport und Militär) takes charge of the normal-time disaster

management system at the local level. BSM is divided into four departments, and the department related to disaster management is included in the Citizen and Nation Protection Division. The manager of BSM changes according to the conditions of the state government.

The five local-level emergency services utilize an “integrated system” (Verbundsystem) which allows for an autonomous or a cooperative response, depending on the severity of the situation. In an extended or severe disaster situation, any of the police, fire brigades, health and ambulance services, technical agencies, or civil defense organizations can partner up to handle the crisis; this can be done at the communal or at the cantonal level. Additionally, based on federal government guidelines, which includes the basic principle of disaster management and civil defense, the physical plan for disaster response, and the technical and structural countermeasures, state and local governments develop and manage their own disaster response plan. For planning and preventative measures for natural hazards, the five civil-security agencies follow the National Platform for Natural Hazards (PLANAT) guidelines.

The Swiss civil-security agencies, basing their planning activities on “risk-based planning” and “integral risk management,” have developed common prioritization procedural guidelines (RIKO) and an online tool (EconoMe). The guideline and the online tool, based on “protection objectives” (Schutzziele), are also designed to keep natural hazard management projects cost-effective. When it comes to implementing a project, the BABS have developed a tool (KATAPLAN) to identify and classify various risks and the planning of response measures by cantonal agencies. The BABS have also developed a learning program (LernRisk) and assessment software (RiskPlan) (BABS 2013; BfU and BABS 2017).

Until now, we have described the disaster management system in six countries. Table 2.13 shows the national and local disaster management organizations during normal time and emergency situations.

2.2.4 Policy Implications

Social advancements in contemporary society beget new techniques and technologies. Thus, new risks due to the application of the new technologies are continually springing up, and difficulties predicting uncertainties increase in parallel with new risks. Furthermore, due to the development of information technology, the rise of interdependence increases propagation or chain properties to expand continuity in type, range, and scope (Oh 2013).

The contemporary society can be featured with a change in natural environment such as climate change, socioeconomic environmental change such as aging, urbanization, and polarization, international environmental change such as each country being networked, and an entrance of complexity which indicates characters such as emergence, self-organization, and adaptation. Due to these changes in environment, the contemporary society can be represented as increase of complex

Table 2.13 Disaster management system and laws of seven countries

CoCountry	Disaster response system				Disaster-related law
	Federal (or National)		Local		
	Normal times	Emergency	Normal times	Emergency	
Korea	MPSS	CDSCHQ	City/Do Disaster and Safety Management Bureau	City/Do and Si/Gun/Gu DSCHQ	Disaster-related law Framework Act on the Management of Disasters and Safety
	Disaster Management Supervision Agencies	CDMHQ	Si/Gun/Gu Disaster and Safety Division		
	Central Safety Management Committee		City/Do and Si/Gun/Gu safety management committee		
USA	DHS	JFO	Disaster management department	EOC	Stafford Disaster Relief and Emergency Assistance Act
	FEMA				
Japan	Central Disaster Management Council	Emergency Disaster Countermeasure Headquarters	General Affairs and Planning Department	Local Disaster Countermeasure Headquarters	Basic Act on Disaster Control Measures
	Cabinet Office	Urgent Disaster Countermeasure Headquarters	Disaster prevention sections in the General Affairs Division		
	Leading Government Departments		Local Disaster Management Council		
UK	CCS	COBR/CCC	RRF	RCCC	CCA
			LRF	SCG	
Australia	EMA	CCC	DMG	DCC	No federal disaster law or procedure for national emergency situation
Germany	BBK	Crisis Task Force (Krisenstab)	Disaster Management Bureau of Ministry of the Interior in State government	Gefahrenabwehr	ZSKG
	GMLZ				
Switzerland	VBS	NAZ	BSM	Not found	BZG
	BABS				
	NAZ				

disasters meaning that natural and man-made disasters take place in combination, of normal accidents which can lead to massive disasters with a tiny technological defect, and of new types of disaster that are mostly considered as new epidemics such as Ebola and MERS-CoV.

Most developed countries have put stress on developing an effective disaster response system to cope with emerging risk interwoven with complexity and climate change. The policy implications through the comparative analysis can be summarized as follows:

First, many countries aim for an integrated organization that considers both natural disasters and social disasters. The USA has endeavored to build an integrated disaster management system through the establishment of FEMA, and since the 9/11 Terror Attack, the DHS has been integrated to take charge of disaster management and terrorism. The DHS set the National Preparedness Goal to reflect the insights and lessons learned from Hurricane Katrina and to build a comprehensive organizational capacity for the entire nation that includes federal, state, and local governments and the private sector.

Japan and the UK have an organization that control and coordinate disaster and emergency response directly under the Prime Minister. The CCA of UK and the Cabinet Office of Japan are both small in size, but they are characterized by a very high level of authority for the overall coordination of disaster policies. According to the types in the reorganization of disaster management proposed by the Organization for Economic Cooperation and Development (OECD), the case of the USA corresponds to the first case, “super-ministry,” and Japan and the UK correspond to the second type, “a relatively small and highly influential body under direct authority of the head of government” (Wyman 2009). Disaster response plans are also being developed within national and local governments using an integrated disaster management style for all hazards approaches (Waugh 2000).

Second, all stakeholder engagement for disaster response is highly recommended. The USA successfully established the disaster risk management system by promoting the engagement and commitment of all levels of governments, citizens, and NGOs. Australia and Japan also developed standard operating procedures indicating citizenry roles and activities in case of emergencies. In addition, Australia developed checklists to enhance citizenry participation for disaster preparedness. Japan has enhanced citizenry participation and preparedness by strengthening citizenry education and training. Korea should improve the participation of local governments, NGOs, and citizens to DRM by providing guidelines and incentives and enhancing the governance-based approach.

Finally, many countries have stressed the clear accountability of each government and interlink between the national government and local governments. Most countries, such as Australia, Germany, Japan, and the USA, empowered local governments for disaster response and engaged in the national crisis situation. In addition, the interlink between national and local disaster response planning was also emphasized. The USA improved interlink between NRF and NIMS at the federal level and EOP at the state and local levels. In Australia, the Attorney

General set up the strategic objective for national safety, crisis management, and disaster relief and established the comprehensive DRM system.

In summary, most developed countries are in the process of shifting from a top-down, fragmented, and hazard-oriented disaster risk management approach into a comprehensive, integrated, and human-centered approach. While this is happening, special attention is being paid to “low probability and high impact” focusing events that are located in the long tail of the power-law distribution.

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