Chapter 1
Overview and Historical Review

Abstract This book investigates and scrutinizes the lessons learned in the Republic of Korea during a five-decade swath of disasters – from 1948 to 2015 – and results in the disaster response policy change model in the wake of major disasters for resilience building. This book is structured of power-law relation between disaster loss and frequency in Korea from 1948 to 2015, focusing events in the power-law distribution, Disaster-Triggered Policy Change Model, and suggestions for resilient future. To start with the historical review, how to understand disaster throughout the ages was investigated: from an Act of God to Mother Nature’s will to societies’ inherent risk. As we journey through disaster’s history, we start to see the categorization of disasters by cause, principle, and risk – drawing to an understanding of risk through hazard and vulnerability.

Keywords Large-scale disaster • Typical disaster characteristics • Complexity theory • Power law • Disaster-Triggered Policy Change MODEL • Disaster Risk Reduction (DRR) • Sustainable Development Goals (SDGs) • Climate change • Act of God • Hazard • Vulnerability

1.1 Introduction and Overview

Everyone hopes to enjoy a safe life: a life free from turmoil and disaster. In addition, governments and political leaders are no different; they too pursue this illustrious goal through laws, policies, and organizations. Look at most political elections – some of the main reasons the electorate vote for a certain candidate is their belief that the candidate will be able to make an economy free of turmoil or a nation safe from large-scale disasters domestically and internationally. However, whereas most people try to be proactive in preventing disaster from touching their lives, governments have been historically reactionary when it comes to disaster management response. Jeong, Yak-yong, a renowned Korean scholar and government official in the late Joseon Dynasty, said, “Always prepare for disaster because an ounce of prevention is worth a pound of cure.” This notion is wise and poignant; however, it seems difficult to follow as society is becoming more complex, interconnected, and ripe for new types of disasters with intricate and devastating ripple effect. We can see this in five disaster events that have taken place recently:
the 2003 Daegu Subway fire in the Republic of Korea, the 2011 Tohoku earthquake and tsunami, and the subsequent Fukushima Daiichi Nuclear Power Plant accident in Japan, the 2015 Tianjin explosions in China, the Ebola virus, and the Middle East respiratory syndrome coronavirus (MERS-CoV) that has infected people around the globe. Each of these events exposed their respective governments to their ill-preparedness to catastrophic events.

So, what do governments need to do is to enhance national preparedness to disaster in light of increasingly interconnected societies, the growing complexities and magnitudes of disasters, and intensifying disaster damage. More specifically, an increased level of scrutiny and research needs to be conducted on effective Disaster Risk Management (DRM) and response based on a comprehensive understanding of disaster characteristics and disaster response policies.

The five disasters described above exhibit the typical disaster characteristics in line with complexity, interconnectivity, uncertainty, and intensifying magnitude, and policy implications for effective disaster response in modern society. The 2003 Daegu Subway fire in the Republic of Korea was a human-triggered disaster caused by one person’s angst against society in combination with poor staff education and training dealing with subway accidents and a poor safety culture that left passengers too powerless and untrained to use emergency exits. The 2011 Tohoku earthquake and tsunami, and the following Fukushima Nuclear Power Plant accident in Japan, was a “supercomplexed” disaster in combination with a natural disaster that triggered a technological disaster.

Authorities failed to increase the predictability measure of uncertainty, relying on past data or disaster precedents to build disaster countermeasures (the protection levee system was designed to handle a base 8 earthquake on the Richter scale; however, the earthquake that struck Tohoku and Fukushima was base 9 on the Richter scale). The 2015 Tianjin explosions in China were an increasing disaster risk combined with industrialization and a concentration of high-risk facilities, which falls within Normal Accident Theory. And, the Ebola virus and the MERS-CoV are newly emerging disasters triggered by interconnectivity of the world, making local infections easily transmittable to other countries and insufficient information sharing among countries, such as a lack of sharing of medical status of symptoms. From 1976 to 2013, the Ebola virus that struck sub-Saharan Africa occurred mainly in isolated villages and killed all inflicted people so it was rarely transmitted to the outside world. However, after a significant increase of activity between the United States (USA), Europe, and Africa, the Ebola virus that stuck West Africa in 2014 was easily transmitted from its origin source to Europe and the USA. MERS-CoV, in 2012, was also easily transmitted outside of its origin source in Saudi Arabia to the rest of the world through greater interconnectivity.

Historically, scholars and leaders have tried to understand and tame disasters. In ancient times, people mainly understood major disasters as God’s punishment and placated them through rituals and prayers. After the 1790 Lisbon earthquake, scholars tried to understand what constituted disaster, called hazard, such as an earthquake, a hurricane, and a volcanic activity. Leaders used this knowledge to start developing policies and laws to reduce risk due to hazard. In modern times, we
have tried to understand vulnerability that is interrelated with social structure, such as population density, patterns of urbanization and industrialization, and social inequality. Through planning, understanding risk, developing disaster mitigation plans, education and training programs, and so forth, modern scholars and leaders strive to push hazard and vulnerability as far away from society as possible.

Currently, Complexity Theory is coming to the forefront of explaining the characteristics of disasters. Complexity Theory, which began from research on complex natural phenomena such as meteorology, has been recently applied to the characteristics of disaster as recent disasters have been triggered by various and complex causes. Pelling (2003) argued that Complexity Theory possesses a very important lesson to understanding ways to respond to disasters. For example, one of the characteristics of Complexity Theory is emergence, and it shows a trait of disasters that take place with unexpected causes at an unexpected place. In addition, studies by various scholars, such as Barton et al. (1994), Becerra et al. (2006), Janczura and Weron (2012), and Jo and Ko (2014), indicate that the relation between event frequency and its magnitude regarding earthquakes, hurricanes, and floods follows the power law, which is one of the characteristics of a complex system. However, most previous studies on disaster and complexity have been limited by focusing on specific types of disaster. To understand the characteristics of disaster in a country, additional and comprehensive analysis about the characteristics of all types of disasters that have occurred in that nation needs to be scrutinized using comprehensive data sets of natural and social disasters. The power law has a significant implication for enhancing disaster risk management in that long-tailed distributed events in the power law function will have a severe impact on social systems due to damage beyond acceptable and comprehensible levels even though the events are infrequent. Birkland (1997) noted that these events, labeled as “focusing event,” could provide a window of opportunity for policy change by concentrating the attention of various organizations, government officials, and media. However, there has been little research done on the dynamics of policy change after a focusing event irrespective of its benefit and advantage, which is one of the reasons we decided to focus our attention on this monumentally missed opportunity, an opportunity to help people and society become safer and happier.

This book investigates and scrutinizes the lessons learned in the Republic of Korea during a five-decade swath of disasters – from 1948 to 2015. The reason we have focused on Korea is because it is considered to be one of the quickest modernized economies (rapidly developing from a “super” poor nation to a leading Organization for Economic Cooperation and Development (OECD) nation within 50 years), and, in the same period, it experienced the typical disaster trajectory types, emerging and complex disaster types, and a rapid increase in disaster magnitude and complexity. With a strong political will and effective public policy, Korea successfully improved the way it responded and strengthened its resilience to disasters.

The Korean people have suffered many casualties, uncountable physical damages, and severe economic loss caused by various disasters; of course, none more so than from colonization and war in the twentieth century. In the twenty-first century,
disaster risk in Korea is increasing due to the emergence of new types of sudden disasters, such as MERS-CoV, the increase of complex disasters, and the heightened probability of a slow onset severe drought interwoven with climate change. However, research on disasters in Korea has been limited by focusing on the effect of a single disaster, finding the cause of a disaster, or making policy recommendations based on a study of other nations’ disaster management systems. To remedy this, it is essential, for the future development of an effective disaster response policy, to understand the characteristic of power-law distributed disasters and to analyze the dynamics of various elements, such as political will and media, on policy change in the wake of focusing events. Therefore, research needs to be conducted and focused on the dynamics of disaster response policy change and power-law distribution in Korea.

We hope that change and research begin with our book. In our book, the key question that we believe that needs to be addressed is “What model can best explain DRM in the Republic of Korea?” To find the answers to the key question, this book will dig into the following four sub-questions:

Q1. What are the relations between event frequency and disaster damage in Korea?
Q2. What are triggering events that influence organization and law change for disaster response in the power-law distribution?
Q3. How does the triggering event affect organization and law change for an effective disaster response in Korea?
Q4. What is the most important factor to bring about organization and law change in the wake of major disasters in Korea?

By answering these questions, we hope to improve disaster response organizations, policies, and laws that will give people and the society at large a happy life free of turmoil and disaster, on a basis of a better understanding of how disasters had occurred or will occur and what are key factors for resilience and sustainability. To this end, we have organized this book into five progressively leading parts that will conclude with a potential future path for disaster management, an effective disaster response based on the Disaster-Triggered Policy Change Model, and research in developing nations in Asia and Africa and, hopefully, other continents around the world. Overall, we focused our attention on global trends in responding to disasters, the characteristics of power-law distributed disasters, and the dynamics of policy change in the wake of focusing events.

We begin our book by laying out the basic theoretical background needed to conceptualize and categorize disaster (Chap. 2) in order to design a disaster data collection method and to categorize the analysis. We also go through the ways society has looked at, explained, and mitigated various disasters from ancient to modern times. Finally, we introduce disaster theories and progresses of disaster management in modern times.

Our first look into specific natural and social disasters in Korea (Chap. 3) helps to define and analyze the characteristics of disasters. From there, we can start to identify the disaster loss-frequency relation in Korea from 1948 to 2015 by using
three types of variables: natural disaster death frequencies, natural disaster economic loss frequencies, and social disaster death frequencies.

After making a firm foundation, we start to look at the focusing events in the power-law distribution (Chap. 4). From here, we can start to see some potential focusing events by using a statistical model and real focusing events by linking major disasters with disaster response policy change.

Before moving forward, we need to find disaster response policy changes (Chap. 5) that are in line with focusing events that brought about change in disaster response organizations and laws. With those found, we can now analyze how various dynamic streams after focusing events had affected the corresponding disaster response policy change. We begin to use the Disaster-Triggered Policy Change Model as an analytical tool as well as build the role of each stream for the change in disaster response organizations and laws.

Chapter 6 introduces the current disaster response institutions in Korea and draws a conclusion with a direction for a resilient future, in line with global trends, such as Sendai Framework for Disaster Risk Reduction (SFDRR), Sustainable Development Goals (SDGs), and climate change negotiations.

This is the first book to outline the whole spectrum of disasters and policy change for a nation – using Complexity Theory and policy change models based on the characteristics of disasters. Korea has a unique experience achieving resilience building and institutional reforms together with rapid economic growth while coping with various natural, technological, and social disasters and new types of disasters, consecutively or even simultaneously, within 50 years. Additionally, it has well documented its major disasters and the corresponding policy changes and institutional reforms. In the near future, developing Asian and African countries may experience this disaster trajectory at the cost of rapid economic growth, and it is one of the intents of this book to lay out the future disaster path, theoretical policy making guide, and desirable institutional and organizational transformation for Asia and Africa; it could also be applied to South America and the Middle East in time.

1.2 Historical Review

1.2.1 Understanding Disaster as God’s Act

1.2.1.1 Global Perspective (Ancient Period to Middle Age)

In ancient and medieval times, disaster was considered the divine realm of God. Ancient human societies considered praying to God the only way to ward off disaster, and when a force majeure did occur, it was seen as God’s punishment for sinful or disrespectful behavior. During such historical catastrophic epics like Noah’s Great Flood, the Great Fire of Rome in AD 64, and the Black Death in medieval Europe, tens of thousands of people perished; however, neither
the government nor the people contemplated the root causes of the disaster. There was no reason to ponder the root causes, as prayer was the only prescription to overcome disaster because catastrophe was a way of God punishing sinners.

It is noteworthy, however, that there were efforts during the ancient and medieval times to prepare countermeasures against God’s method of punishment and preparations to overcome the result of God’s disasters. The initial awareness of disaster management began in AD 6, when the Roman emperor Augustus organized a professional fire brigade as well as vigilantes to monitor different areas of Rome. The 1000 strong vigilantes were responsible for seven quadrants of the city, being placed in seven groups to handle the 14 administrative districts of Rome. These seven groups were responsible for preventing, monitoring, and extinguishing threatening fires within their designated area of responsibility. In AD 64, a massive conflagration broke out – known later as The Great Fire of Rome. In the wake of the disaster, the ruling emperor, Nero, instituted a series of building codes to prevent the recurrence of disastrous fires, which included the use of geometric architectural forms and open spaces to prevent the rapid spread of a fire, if one broke out again. Additionally, he further introduced several systematic disaster management measures to handle a fire as well as the masses trying to flee it. Some of these measures were water nodes, built around the city to secure supplies of water for the fire brigades; dedicated people, appointed to manage water supplies; and fire shelters, created as a safe haven for the masses to escape an inferno.

The most infamous disaster to have occurred during the European Medieval Ages is the fourteenth-century pandemic known as the Black Death, decimating one third of the population. At the time of the outbreak of the plague, the authorities, citizens, and even medical doctors were ignorant of the cause of the disease and thus implemented inappropriate response methods, which resulted in the spread and mutation of the pathogen. However, it is notable that the authorities made some efforts to reduce the impact of the disease: with the Black Death as an impetus, a policy to isolate people, who were possibly carrying the virus, for 40 days from entering cities, was introduced, which is interpreted as the starting point of public health policies (Kim et al. 2014).

1.2.1.2 Korean Development (Three Kingdoms, Unified Silla, and Goryeo)

Records of Disaster

There is no written record of a disaster occurring during the Gojoseon era; therefore, we will address disasters that took place during the Three Kingdoms period from which disaster records are available. The most significant historical records for this period are the Chronicles of the Three Kingdoms (the Korean word “Samguk Sagi”) and the Heritage of the Three Kingdoms (the Korean word “Samguk Yusa”). Although, the main objective of these two chronicles was to record the political history of the Three Kingdoms, and thus these sources are
limited in describing disaster occurrence and countermeasures in depth; albeit, they are still a reliable source of disaster history, which can be used to illustrate Korea’s historical disaster trajectory and responding policies. According to Jung (1986), there are 937 records of calamity and disaster in the Chronicles of the Three Kingdoms, and that is where we will start our look into the history of disaster in Korea.

**Goguryeo (BC 1C ~ AD 668)**
The total number of records of calamity and disaster during the Goguryeo era was 162. One hundred and nineteen records are of abnormal astronomical phenomena (e.g., solar eclipses and meteorites), climatological disasters (e.g., droughts and frigid temperatures), geophysical disasters (e.g., earthquakes), and social disasters (e.g., fires and smallpox). Sixty-three records are of upheaval during wars, rebellions, or riots. Among them, earthquakes with 19 records were the most frequent disaster, and most articles about them lack specific impact information, simply describing when an earthquake occurred. One example of recording states is “there was an earthquake during the winter in October in the second year of King Moonjamyung” (Samguk Sagi Vol 19). The second highest recorded disaster was damage due to cold weather such as frost or hail damaging grain crops. Goguryeo, the northernmost of the Three Kingdoms, frequently experienced frost and hail in April and from August to October. The cold-weather damage in fall and winter and droughts in spring and summer (12 records) caused the area to suffer from starvation frequently. Some records state thieves appeared from across the border during certain droughts, pushing the people of Goguryeo into the kingdom of Silla (a neighboring realm). In addition, there are records of thunder and lightning, heavy snowfall, disease, and insects.

**Baekje (BC 18 ~ AD 660)**
The total records of calamity and disaster during the Baekje era are 140, which does not include calamities such as war, rebellion, and riot. Among them, drought was the most frequent disaster (32 records), which caused disproportionately more calamities as Baekje encompassed the largest plain area among the Three Kingdoms. One example of record states that the fields turned red because of no precipitation for an extended period (Samguk Sagi Vol. 28). It can be inferred that since Baekje’s major industry was agriculture, it put great effort on watching the weather by observing movements of heavenly bodies. Therefore, Baekje records contain more statements about such things as solar eclipses (25 records) and comets (10 records) than Goguryeo or Silla. Other disaster records include earthquakes (16 records), floods, typhoons, fires, and smallpox outbreaks.

**Silla (BC 57 ~ AD 676)**
The record shows that drought was the most frequent disaster, recorded 39 times in the Silla era. Next were earthquakes that marked 26 records. Like the disaster records that centered in the capital city or along the royal road in the Samguk Sagi, the Goryeosa disaster records predominantly show those that occurred in the capital city. The five major earthquakes in the 21st year of Pasa of Silla (AD 100),
the 7th year of Girim of Silla (AD 304), the 42nd year of Nulji of Silla (AD 458), and the 4th year of King Munmu caused many casualties, along with severe damage to private houses. Moreover, there is a record that the south gate of the Golden Palace was collapsed by the earthquake that occurred in February in the 42nd year of Nulji of Silla (AD 458). According to the Samguk Sagi Vol. 34, a royal palace was established in the 21st year of Hyeokkeose and was named Golden Palace. Thus, it can be inferred that the south gate of Golden Palace, which was a palace in the early Silla period, was collapsed because of an earthquake. The third and fourth most recorded disasters were cold-weather damage due to frost and hail, with 24 records, and flood with 23 records. Severe floods took place mostly in April and July by the lunar calendar, and there were two major floods in April and July in the 5th year of Soji of Silla (AD 482). In July (autumn) of AD 589, according to the record of the 11th year of King Jinpyeong, a deadly flood swept through the western part of the realm; 30,300 buildings and 60 private homes were destroyed, and 200 people perished (Samguk Sagi Vol. 4). Earthquakes, landslide, heavy snowfall, fire and smallpox are disasters further recorded in the era. Also, there was damage from a gale-force wind (the Korean word “daepoong”).

The Unified Silla (AD 676 ~ 935)
Droughts were the most common disasters during the Unified Silla era with 39 records, and some of them were accompanied by locust damage in autumn. Earthquakes were the second most common with 36 records (Shin 1984) followed by frost and hail damage with 24 records and floods with 23. There were also records of disasters such as heavy snowfall, landslide, fire, and smallpox.

The Goryeo Dynasty (AD 918 ~ 1392)
Goryeo was founded by the 1st King Wanggun in 918 and lasted for 475 years with the 34th King Gongyang as the last emperor. Like the disaster records that centered in the capital city or along the royal road in the Samguk Sagi, the Goryeosa disaster records predominantly show those that occurred in the capital city.

The most reliable disaster record source for the Goryeo Dynasty is the 1451 Historical Book of the Goryeo Dynasty (the Korean word “Goryeosa”). Compared
to the records of the Three Kingdoms and Unified Silla, the Goryeosa contains more records of disaster, which may suggest that there were more disasters in the Goryeo Dynasty than previous eras or that the Goryeo Dynasty took more interest in disaster damage. Drought was the most frequent disaster with 380 records, and like Baekje, agriculture was an integral part of the Goryeo Dynasty. Therefore, droughts, which normally begot social disasters such as starvation, thievery, and spread of disease, were closely monitored and recorded. The second most frequent disasters were fires and casualties caused by lightning strikes with 345 records; lightning rods were not invented until the 1750s. In Goryeosa, one record states, “as lightning caused a fire to Sinheungchang, the crop warehouse blew away and a blaze covered the sky” (Goryeosa Vol. 53a). Damage from lightning can be identified with such records.

Hail, frost, earthquake, gale-force wind, and heavy rainfall were logged as disasters with 238, 56, 152, 161, and 139 records, respectively. Also, fire-related records were 174. Abnormally low temperatures took place in the latter Goryeo Dynasty, too. Climatologically speaking, this phenomenon was due to a sudden beginning of a cold climate in the latter Goryeo Dynasty. According to Goryeosa, there were people with outerwear due to a wind blowing and cold weather in June the 13th year of King Gojong (Goryeosa Vol. 53b) and in May the 3rd year of King Chungryeol (Goryeosa Vol. 53c), and some deaths occurred because of hail and snow in April in the 11th year of King Chungsook.

Disaster Response Ways

The ways to respond to disasters written in Samguk Sagi can be summarized with three points. First, disaster response policy was not developed yet on the basis of the comprehensive understanding of the root cause of each disaster type, rather it was based on the unity of government and religion and the ritual associated with the disaster type. For example, there were records of a ritual for rain after an extended period of drought – the king would hold a memorial service as a priest – as an effort to minimize damage when droughts continued. Samguk Sagi recorded seven rituals for rain in Silla, four in Baekje, and one in Goguryeo. An interesting fact is that the king performed the ritual for rain fewer times than the real frequency of severe drought, implying that the king and the religious leaders waited until the last moment to perform the ritual to placate the people more than call upon the Gods for rain.

Second, though there was not a systematic disaster relief aid like today, there were efforts by the government to help people’s lives, which were burdened from disaster. For example, when drought- or locust-related disaster took place, ambassadors were deployed to seek out ways to help people or to help starving people by opening up a storage depot. Also, the king personally gave pardons after looking at conditions of sinners. In addition, the king announced not to execute large-scale engineering works so that it would not bother the farming period, but also relieve the burdens of tax and tribute worth a year to a village facing disaster.
Third, in order to minimize disaster, facilities were established. One of the pivotal national projects in the ancient time was to minimize damage of the crops from flood and drought since agriculture was the key industry during the period. Efforts by the government to create small and large reservoirs for irrigation and to minimize damage from disaster in each town were partly registered in Samguk Sagi. At this time, one of the representative reservoirs was the Byeokgolje Reservoir Site in the Baekje period, and its embankment remains from Pogyo-li to Walsong-li in Buryang-myun, Kimje-si, Jeollabuk-do. The Byeokgolje Reservoir Site is the largest reservoir among ancient reservoirs that remain until now and was created in the 27th year of King Biryu (AD 330) who was the 11th king of Baekje. Also by seeing that they secured water by artificial walls rather than just relying on rainwater, it can be inferred that ancestors found wise ways to live a safe life from disaster.

The Goryeo Dynasty was based on the agricultural industry and the governing during the period was not completely separated from religious practices, linking disaster with heaven’s will; thus, drought was not considered just as a natural phenomenon, but also as a spiritual disharmony between heaven and people. As a result, when droughts continued, the central government initially held a ritual to heaven as a response. The most frequent way to abate disaster was to hold a royal religious ceremony, followed by reducing tax, granting clemency to prisoners, and laying the dead to rest.

Lightning, like drought, was considered as a reprimand of the sky. So rather than establishing countermeasures to prepare for lightning, it was interpreted from a political viewpoint. In the third year of King Seongjong (AD 984), when there was a lightning strike, royal secret inspectors, Sirang, Nangjung, and lobbyists, were all removed from office (Goryeosa Vol. 3). Also according to the record of the second year of King Heejong (AD 1206), it can be inferred that lightning was considered as a punishment of the sky as one record is written as “imperator Park Jungmo was struck by lightning since he was greedy and untruthful” (Goryeosa Vol. 21).

Other natural disasters, such as hail, frost, flood and earthquake, were also understood as punishment caused by the imbalanced link between human beings and heaven.

In case of fire, response ways were more realistic compared to natural disasters such as drought. When a fire broke out in a central administrative institution, managers of nearby institutions were mobilized to seize the fire. Also the record of the 20th year of King Moonjong (1066) tells that a manager watched over fire in every storage and warehouse, and an Eosadae (fire inspector) from time to time was sent to inspect (Goryeosa Vol. 8).

In the Goryeo Dynasty, a tendency to consider disaster as a hardship from heaven was quite strong. Though measures to deal with each disaster were not institutionalized, several ways to respond to disaster, which are seen in the
contemporary world, appeared in earnest such as the revision in fire protection systems, flood and drought plans such as building reservoirs, and an increase of government’s interest on disasters.

1.2.2 Understanding Risk: Hazard and Vulnerability

1.2.2.1 Global Evolution (From 17C to the Beginning of 20C)

In the 1600s, the first insurance company in the history of disaster management was found. Evidence suggests that an insurance company started to offer fire insurance in the wake of the 1666 Great Fire of London (Kim et al. 2014).

It took another century for disaster management groups to adopt more scientific methods. In Lisbon, Portugal, on November 1, 1755 (Fig. 1.1), a society-changing earthquake, called the Great Lisbon Earthquake, rocked the just waking-up city with a magnitude of 8.5 ~ 9.0 on the moment magnitude scale. It resulted in huge death tolls, ranging from 10,000 to 100,000, and is considered as one of the deadliest earthquakes in history. After the earthquake, society, administrators, and disaster management companies (e.g., insurance companies) started to look at disasters from a wider perspective. Research into earthquakes using scientific methods began in earnest, and preparations for future disasters began to be codified and implemented into construction, public works, and city planning. Hereby, people began to move away from the traditional God-centered disaster management theory. Furthermore, through the Great Lisbon Earthquake, academic studies such as “Disaster Relief,” “Seismology,” and “Earthquake Engineering” became available for study (Shrady 2009).

The 1800s saw disaster-related laws enacted in the USA. In 1802, a great conflagration broke out in Portsmouth, New Hampshire. In 1803, the US Congress passed an act for the federal government to support disaster recovery and relief for the New Hampshire, and this act is regarded as the first legal support by the US federal government (Haddow et al. 2014). However, after this enactment, it took one century for the US federal government to provide comprehensive disaster relief to state governments damaged by a catastrophic natural disaster. After massive disasters during the century, such as the earthquake in New Madrid, Missouri, in 1811 (Fig. 1.2), the fire in Chicago in 1873, and the Johnstown Dam collapse in Pennsylvania in 1889, only ad hoc relief activities were taken by state and local governments, and there were no national policies to deal with natural or social disasters (Anna et al. 2006).

The 1900s was the era of ideological confrontation, the Cold War, where democracy and communism were in conflict. At that time, disaster management was conducted using the “quasi-war model,” which is a way of using war research methodologies to practice disaster study (Gilbert 1995).

In the early 1900s, the USA suffered the impact of various natural disasters such as a hurricane in Galveston in 1900. As in the 1800s, local groups provided ad hoc
disaster response. Noticing the severe limitations of these local groups handling disaster relief, the US federal government, specifically the US Congress, assigned the American National Red Cross as the official organization for the federal
government for disaster relief in 1905. Since then, the Red Cross has served as the primary organization for disaster relief in the USA, just in time to provide relief for catastrophic events, such as the 1906 earthquake and fire in San Francisco, the 1926 hurricane in Miami, and the 1927 flood of the Mississippi River downstream (Claire 2012).

At the same time in Europe, scholars began to conduct research on the vulnerability embedded in their society after the December 28, 1908, devastating earthquake (magnitude 7.5) and tsunami, which occurred along the Straits of Messina between the island of Sicily and mainland Italy (RMS 2008). Those events, which almost completely destroyed Messina, are recorded as one of the biggest natural catastrophes that had occurred in Europe until that time. The disaster made headlines worldwide, and international relief efforts were launched. For the reconstruction of the city, the USA, together with several European countries including Russian Federation (Russia), United Kingdom of Great Britain and Northern Ireland (UK), and France, assisted in the recovery efforts after the great disaster. The 1908 earthquake spurred the adoption of the first seismic design regulations in Italy in 1909, which were issued by Royal Decree. However, until the Second World War, not much effort was spent on risk management, specifically natural disasters. In fact, it was not until the British 1948 Civil Defense Act that a basis for DRM came to fruition in Europe.

1.2.2.2 Korean Evolution (Joseon, Japanese Colonial Era, and US Military Period)

Records of Disaster

Joseon Dynasty (AD 1392 ~ 1910)
The Joseon Dynasty lasted for 518 years from 1392 to 1910 and is divided into the early and late dynasties by the Japanese Invasion of Korea in 1592, because there were many changes in political, economic, and the social system after the Japanese invasion. Similarly, ways to respond to disaster dramatically changed after the Japanese invasion in 1592; therefore, this book investigates Joseon Dynasty’s disaster response ways during its former and latter period. Most of the data for the investigation came from the records of disaster in the Annals of the Joseon Dynasty, in which most major disasters in Joseon Dynasty, such as drought, flood damage, fire, and infectious disease, were described.

Major disasters during the Joseon Dynasty were lightning with 1375 records, hail with 1083 records, earthquake with 1030 records, severe storm with 354 records, frost with 301 records, and drought with 272 records (Lee 1997). From 1392 to 1600, about 1.3 droughts occurred annually on average, indicating

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4Joseon Dynasty is sometimes divided into two periods: Joseon Dynasty (1392 ~ 1897) and The Greater Korean Empire (1897 ~ 1910).
that there was a drought almost every year. Also regarding flood damage, there were 178 records in total, indicating that flood damage occurred 0.8 times annually on average. Therefore, it can be inferred that the former part of Joseon Dynasty suffered from drought and flood damage every year. The fact that such disasters took place every year in the Joseon society, where agriculture was the basis of the state, shows that those disasters affected not only the daily lives of the people but also the political stability of the Dynasty. Droughts were concentrated in the regions such as Youngseo in Gangwon province, the northwest of Hwanghae province, the southwest coast of Pyungahn province, and eastern Kyungsang province. This can be seen as an effect of geological traits. If drought happened especially in time of sowing rice seeds or rice ripening in those regions, where rice farming was concentrated, the damage was felt on a national level.

Also in case of flood damage, damage occurred frequently in the downstream of the Amnok River and the Tumen River and mid- and downstream of the Han River and the Nakdong River. For flood, farmland around the river was flooded, private houses were washed away, and people and livestock were swept away (Oh 1991).

In the late Joseon Dynasty, continuing natural disasters since the sixteenth century and large-scale wars, such as the Japanese Invasion of Korea in 1592, the Japanese Invasion in 1597, the Manchu Invasion of Korea in 1627, and the Manchu Invasion in 1636, led the society in a state of confusion. Also, an infectious disease spread all over the country including Jeju Island from the 1660s to the early 1670s, and according to the Chronicles of the fifth year of King Hyunjong, infectious disease was severe in Gaesong-bu, and a cow epidemic occurred as well (The Annals of the Joseon Dynasty, King Hyunjong Vol. 9). These records indicate that the late Joseon Dynasty suffered immensely from several severe social disasters.

Among natural disasters in the late Joseon Dynasty, thunder and lightning were identified 995 times. Other frequent disasters were hail (849 records), flood damage (570 records), earthquake (470 records), drought (344 records), frost (291 records), heavy storm (279 records), and unexpected snow and rain (242 records) (NEMA 2005).

The comparison of disaster frequency records between the early and the late Joseon Dynasty is as follows:

• The records of earthquake largely decreased in the late Joseon Dynasty compared to 1000 earthquakes that occurred in the early Joseon Dynasty; the reason of the decrease is still being investigated.
• The records of drought in the late Joseon Dynasty, with a total of 344 droughts from 1601 to 1863, are similar to that of the early Joseon Dynasty.
• There were 570 records of flood damage in the late Joseon Dynasty: the flood occurrence increased from 0.8 (the early) to 2.1 (the late) per year on average.

The increase of flood damage in the late Joseon Dynasty might have been triggered by two causes: the increase of natural hazards, such as heavy rain and typhoon, and the increase of social vulnerability due to the development of urban areas followed by increase in population and the expansion of agricultural areas. If flood damage or droughts occurred where people did not live or did not grow crop,
such disasters were not likely to be recorded in the Chronicles. As the population
increased and the city and farming technology developed, the extent of damage
from disaster probably increased and vulnerable regions that needed to be managed
also expanded too. This logic has something in common with what is seen today in
Asia and Africa that are experiencing fast industrialization and urbanization and are
facing an increase in frequency and the scale of disasters.

Japanese Colonial Era (AD 1910 ~ 1945)
The Japanese Colonial Era lasted from 1910 to 1945; Korea was under colonization
due to Japanese imperialism. The records of disaster at that time are mainly about
natural disasters including flood damage and drought.

There were 46 records of flood damage including the torrential rain in Busan
City on July 12, 1912. Among them, the biggest damage took place in 1920, 1925,
and 1936. The heavy rain in Sancheong-gun, Gyeongsangnam-do, on July 19, 1920
poured 400 mm of rain, and the water level of Samnangjin-eup reached 8.09 m,
which was the highest water level ever recorded to that time. Accordingly,
37,829 ha flooded and 21,482 ha of land was lost or buried. In addition, 7170
private houses were lost and collapsed and about 1100 people died. Four consec-
secutive severe floods, called the Eulchuk severe flood, occurred in 1925.

About 300 ~ 500 mm of torrential rain came to the southern part of Hwanghae-
do from July 11 to 12, and the Han River, the Quem River, the Mankyoung River,
and the Nakdong River were in flood. The second flood caused the Han River and
the Imjin River to breach their banks due to the heavy rain from July 16 to 18 with a
maximum precipitation of 650 mm near the Han River and the Imjin River’s
watersheds. The water levels of the Han River on the 18th recorded the highest,
13.59 m at Ttuk-Seom (Island), 11.66 m at a footbridge, and 12.74 m at Yongsan-
gu. As the water of the Han River went across the embankment, about 30,000
jeongbo of land flooded. Places with the worst damage were Ichon 1-dong, Ttuk-
Seom, Songpa-dong, Jamsil-ri, Shincheon-ri, and Pungnap-ri. At this time, the first
floor of the official residence of the National Railroad of Yongsan was inundated by
water and trains at Yongsan station flooded. The third flood came due to lots of rain

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5 As of 2015, the Republic of Korea has 244 local governments: 17 upper-level local autonomies
and 227 lower-level local autonomies. 17 upper-level local autonomies are composed of 8 prov-
inces (the Korean word “do”), 1 special autonomous province (Jeju), 1 special city (Seoul),
6 metropolitan cities (Busan, Daegu, Incheon, Daejeon, Gwangju, Ulsan), and 1 autonomous
metropolitan city (Sejong), and 226 lower-level local autonomies are composed of 75 cities (the
Korean word “si”), 82 counties (the Korean word “gun”), and 69 districts (the Korean word “gu”).
Lower-level local autonomies are further subdivided into community-level administrative centers:
220 towns (the Korean word “eup”), 1193 townships (the Korean word “myeon”), and 2089
neighborhoods (the Korean word “dong”). In this book, city and do refer to the upper level; si, gun,
and gu refer to lower level; and eup, myeon, and dong refer to community level (Ministry of the
Interior, 2016).

6 The Korean words “Seom” and “Do” mean island.

7 30,000 jeongbo is equivalent to 30,000*3000*3.3 km².
in the Kwan-Seo area\textsuperscript{8} in August, which resulted in severe damage by the flood of the Daedong River, the Cheongcheon River, and the Amnok River. The last flood was formed as a tropical depression that created near the Mariana Islands in the end of August and went out to the East Sea through Mokpo-si and Daegu City in early September. Because of this, there was heavy rain in the northern part, and the Nakdong River, the Yeongsan River, and the Seomjin River flooded. Due to the severe floods from July to September in 1925, called the “Eulchuk year floods,” the number of dead reached 517 (NEMA \textsuperscript{2005}). In 1934 and 1936, several severe disasters triggered by heavy rain occurred consecutively.

Another great disaster that severely damaged Korea during the Japanese Colonial Era was drought. During the period, there were a total of 31 drought records. The fact that there were 31 droughts in 35 years indicates that there was famine and damage every year due to drought. Among them, some of the worst cases are as follows: a drought in Jeju Island continued from May 15, 1924 to July 11, 1924. Also, as a drought continued in the northern central area from July 28, 1924 to September 6, 1924, Japan even had to import 1.27 million bags of rice. The central region faced damage due to a drought from April 26, 1929 to May 25, and in the same year, Mokpo-si had a drought with no rain for 34 days starting May 12. The Yeongnam region\textsuperscript{9} too went through a severe drought from July 3 to August 14. In 1939, there was a spring drought focused on Daegu, and Gwangju City met with consecutive dry days from May 12 to June 15 and from July 1 to 23. The national production of rice in 1939 decreased by 40% of that of the average yearly yield due to the drought in Mokpo-si from May 12, 1939 to June 20, 1939 and a nationwide drought in July and August in the same year.

In 1942, there again was another year of drought called the “Imonyeon drought.” The great drought from May to August hit every corner of the Korean peninsula and crushed the military provision base of Japan. This drought was continued by another one in April and May in 1943 and another summer drought in 1944. As a result, a three-year poor harvest was unavoidable.

During the Japanese Colonial Era, the majority of the people in Korea could not avoid famine due to a lack of absolute quantity and therefore had to rely on roots of herbs and barks of trees to sustain their lives (NEMA \textsuperscript{2005}).

Disaster Response Ways

One of the ruling ideologies that the first king of the Joseon Dynasty had was physiocracy, the “agriculture-first” principle. Therefore, agriculture was the basis of the national industry, and farmers and rural areas were the backbone of a social structure. Thus, the Joseon Dynasty took practical and concrete measures against

\textsuperscript{8}The Kwan-Seo area means Pyeong-An South and North Provinces.

\textsuperscript{9}The Yeongnam region means Gyeongsangnam-do, Gyeongsangbuk-do, Busan City, Daegu City, and Ulsan City.
disasters, such as drought and flood that could hugely impact agriculture production, and put efforts to improve the disaster management system. First, the measures were concentrated on irrigation facilities because they were essential in solving the agriculture-related problems caused by the shortage or the excess of water. Irrigation facilities of the Joseon Dynasty include a bank that was to block valleys with dikes and irrigate water with a water gate. Blocking water is to build banks to block seawater, and irrigation facilities to draw water for irrigation water called a river port are the major irrigation facilities. Representative irrigation facilities of the Joseon Dynasty are threefold: the Korean word “Je” that was to block valleys with dikes and irrigate water with a water gate, the Korean word “Eon” that was to build bank to block seawater, and the Korean word “Bo” that was to draw water from a river for irrigation.

In the volume of King Taejo, in the Annals of the Joseon Dynasty, a passage reads, “One that matters to encourage agriculture is to build Je-Eon in order to prepare for a drought and the rainy season (The Annals of the Joseon Dynasty, King Taejo Vol. 8).” It can be inferred that there were efforts to respond to drought and flood damage from the earliest days of the state. Also in the ninth year of King Taejong, Woo Hee-yol, governor of Wojnu, handed in public appeals to build Je-Eon, and he argued that Je-Eon was very important for preparing for or preventing drought, and there was a need to establish a government agency for the tasks (The Annals of the Joseon Dynasty, King Taejong Vol. 17).

Accordingly, the Joseon Dynasty established a temporary government agency; called the “Je-Eon Dogam,” responsible for embankment construction and management projects. In time, it repaired the Byeokgolje Reservoir Site in Kimje, the Nulje reservoir in Gobu, and the Sutong reservoir in Bupyung and created the Gareungpodaesu reservoir in Ganghwa. Such irrigation facilities were mainly about repairing or creating reservoirs on a large scale in the early period, and to correspond to the needs of farmers for small reservoir sites was also secured. Also in 1679, the fifth year of King Sookjong, Hojo’s minister Oh Jung-wui suggested a department of embankment (The Annals of the Joseon Dynasty, King Sookjong Vol. 8). As a result, a regular department of embankment called the “Je-Eon Sa” was established to control and coordinate regional offices’ management of irrigation facilities. Secondly, within the expansion of irrigation facilities, the Joseon government practiced religious ceremonies such as rituals for rain, gicheongje, and worship at noted mountains and large rivers; at Jongmyo, a royal ancestral shrine; and at Sajik, an altar where ritual ceremonies were performed for the purpose of overcoming drought and flood damage altogether. Such method was transcended from the ancient times with an idea that disaster is the punishment by the heavens. Thirdly, in the Joseon Dynasty when Confucianism was accepted, the king himself responded to disaster as a way to become a virtuous man to win respect and take the lead service. That is, several policies were initiated such as asking for measures to overcome disaster to retainers; banning construction practices such as duty work, tribute, and donation; banning military training; avoiding power cuts which is to avoid activities in the midst of power outage; and reducing number of food and

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10The Korean word “Gicheongje” means ritual ceremony to God.
personnel affairs such as resignation according to a degree of damage from disaster. These indicate a will to overcome natural disasters with the royal regime instead of heavenly mandates such as ritual for rain that was mentioned in the second point (NEMA 2005). During the reign of Sejong the Great, the fourth king of the Joseon Dynasty, instruments for astronomical observations like a rain gauge were invented along with the development of astronomy; various astronomical books and charts were studied and published. In that period, knowledge for agriculture, such as an almanac, the 24 divisions of the year, and chronemics, was considered as the basic of Imperial politics. Therefore, kings in the early Joseon Dynasty invested in astronomical phenomena, namely, the world of the sun, the moon, and the stars. Also, they were considered one of national supreme studies as the movements of heavenly bodies were connected to the livings of human. The study of astronomy is vital not only for the dignity of King but also for the stability of agriculture-based economies and the enrichment of the people.

For example, Yi Sun-ji (1406 ~ 1465) of the Sejong era obeyed the royal command to publish a Korean book of “Cheonmunyoucho,” which includes the integrated astronomical theory from the earth and the sky, the five elements to meteorological phenomena, and this made a connection between national safety and disasters for the public. In other words, academic researches on hazard that occur due to external factors were used as a political tool for the king and as a tool for the lives of the public.

Ways to respond to social disaster such as arson also evolved systematically. From the early fifteenth century to the end of the sixteenth century, there was Byeolwaseo, which was a division that manufactured and sold roof tiles. This was set up to block fire outbreaks in private houses in the capital city following a request from a monk, Haesun, in 1406, the sixth year of Taejong. At that time, most homes were thatched, which made the nation vulnerable to conflagration. The establishment of Byeolwaseo is evidence of the government’s institutional effort to minimize the potential damage from fire.

Also in 1417, the 17th year of Taejong, the first regulation on firefighting activity called “Gumhwa Regulation” was announced. The Regulation set a punishment according to the scale of fire and defined responsibilities of officers to prevent fire in detail (The Annals of the Joseon Dynasty, King Taejong Vol. 34). Also from the records of the eighth year of Sejong the Great, fire prevention measures were set up such as building anti-fire provision in rooms on both sides of the main gate where servants lived and expanding roads inside the city (The Annals of the Joseon Dynasty, King Sejong Vol. 31). In 1467, the 13th year of Sejo, a detailed checklist, called “Samok,” describing goods and individual roles for soldiers for fire prevention, was developed and sent to responsible agencies, such as the Ministry of Labor and the Hansung11-boo (The Annals of the Joseon Dynasty, King Sejo Vol. 44). This is an early version of modern firefighting systems, and it can be seen that a systematic system for disaster response from fire had been prepared.

11Hansung is name of Seoul during the Joseon Dynasty.
In case of the infectious diseases that killed many during the Joseon Dynasty, retrospective measures rather than preventive measures were taken. The central government deployed medical doctors along with medicine to the affected regions and recorded all management processes for future mitigation measures (The Annals of the Joseon Dynasty, King Seongjong Vol. 15). The Joseon Dynasty’s response way laid the foundation for today’s disaster response measures. Though the level of response was not comprehensive and proactive enough to block risk factors in advance to disaster like today, it is notable that institutions and tools to minimize damage were prepared, and evolutions continued toward a more efficient system management.

1.2.3 Evolutionary Understanding of Disaster

Major disasters in Goguryeo, located in the northern area of the Korean peninsula, were earthquakes, cold-weather damages harming agriculture in the spring and the early fall season, and droughts in spring and summer. Major disasters in both Baekje, centered around the Han River basin, and Silla, located in the southern region of the Korean peninsula, were drought, earthquake, flood, fire, and smallpox. Drought was considered to be the most severe disaster in the period of the Three Kingdoms, Unified Silla, and the Goryeo Dynasty. As agriculture was the center of most economic activities during the period, severe drought caused crop failure that brought about a food shortage, hunger, looting, and the spread of diseases, which resulted in a big social disaster. In the ancient countries where the form of politics was theocracy, people held rituals for rain to resolve droughts because droughts were seen as a judgment of the sin of human from the heavens. The government also put some efforts to relieve the public by releasing government-stocked rice, exempting tax to lessen the burden of the public, and constructing reservoirs like Byeokgolje. However, a ritual for rain was giving more hope and comfort than the construction of reservoirs to the public suffering from disasters.

In the Joseon Dynasty, rituals for rain were still important ways to deal with drought. There were places for Jongmyo and Sajik in the center of each region as well as the nation to worship Gods of land and soil like their ancestors. However, the government’s disaster response ways evolved. Unlike the ancient era, where heat or cold and drought or floods were entirely considered as the face of Providence, people in the Joseon Dynasty tried to resolve natural disasters by considering topography and using agricultural technology. In other words, people grew rice mainly in Jeolla-do,12 Gyeongsang-do,13 and

12The Jeolla-do is composed of Jeollanam-do and Jeollabuk-do.
13The Gyeongsang-do is composed of Gyeongsangnam-do and Gyeongsangbuk-do.
Chungcheong-do\textsuperscript{14} rather than the Yeongseo region\textsuperscript{15} of Gangwon-do and the southern region of Gyeongsang-do where droughts occurred frequently and made efforts to expand and improve irrigation facilities. Also, the “Je-eon Sa” that is responsible for managing irrigation facilities was established for more systematic farming management.

The evolving pattern of worldwide disaster management is similar to that of Korean disaster management. In ancient/medieval eras, people prayed to Gods as severe disasters were mostly considered as a judgment of the heavens or God. Even though many people died from the Noachian deluge, the Great Fire of Rome AD 64, and the Black Death, which ran rampant in Europe, no comprehensive or systematic research on the cause of the disaster was conducted. This was because people thought that the disasters were punishment by Providence, which could be only overcome by prayers. However, it is worth noting that they had made an effort to make countermeasures even during ancient and medieval eras. After the Noachian deluge, Noah searched for a lean field to live a new life, and after the Great Fire of Rome, the government repaired the roads and waterways to respond promptly to fire. Also, in medieval times, when many people died from the Black Death, the government implemented policies on public health like isolating suspected cases. In other words, nations have taken actions to prepare countermeasures to protect the public from disasters.

Disaster response ways in Europe had significantly evolved in the wake of the 1755 Lisbon earthquake. People started to study the cause of disasters in earnest, and the importance of a national relief system and the safety of urban settlement were brought to the forethought of government officials and urban planners. This was also related to the social atmosphere of the Renaissance, where people were interested in “human.” In other words, disaster was perceived as a field requiring scientific research, not as God’s realm. Therefore, damage investigation was implemented to recover the destructed site, and disaster recovery based on urban planning was implemented under the leadership of Marquis Pombal. The modern concept of disaster management was formed in the wake of the 1755 Lisbon earthquake. Since the nineteenth century, many countries had started to develop national relief systems, which laid the foundation of the establishment of specialized organizations on disaster management and the development of disaster insurance systems. From the mid-twentieth century, comprehensive research started on the vulnerability of society as well as natural phenomena like typhoon and earthquake.

As reviewed above, the way humans have responded to disasters has evolved: starting from praying to Gods for countermeasures; to understanding hazard through research on natural phenomenon, such as earthquake and hurricane; and to reducing vulnerability, a disaster-causing factor embedded in society.

\textsuperscript{14}The Chungcheong-do is composed of Chungcheongnam-do and Chungcheongbuk-do.
\textsuperscript{15}Gangwon-do is divided into the Yeongdong (east of mountain range) and Yeongseo (west of mountain range) with the Taebaek mountain ranges.
through human endeavor. The development of science and technology and an increased interest in human society has made disaster shift from God’s domain to natural and social science areas. In addition, increased citizenry rights made governments become actively engaged in disaster management.

Figure 1.3 shows the evolving process of the overall perception of disaster. The row describes changes in viewpoint of responses to disasters historically, and the column indicates a percentage of overall disaster perception. The amount of activities of government and citizens to respond to disasters is expressed in the sum of the blocks inside the picture. The percentage is not an accurate numerical value but rather addresses that such change in viewpoint is enlarged or minimized.

What can be inferred from the figure is that the ways to respond to disasters show a tendency to gradually evolve due to a triggering point momentum. When disasters take place, a perspective to interpret disasters as Gods’ act was dominant in the ancient world, and this belief became weaker in modern society. Although some cases that still view disaster as a supernatural phenomenon from a religious point of view can be found even in contemporary societies, disaster response ways have evolved through more comprehensive and systematic understanding of hazard, vulnerability, and the characteristics of the contemporary society in the wake of triggering events, such as the 1755 Lisbon earthquake.

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