

The impact of governance weaknesses on disaster management: focusing on the Osong underpass tragedy

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Abstract

This study aims to understand how governance vulnerabilities in Miho River management, nearby facility management, and disaster management affected the Osong Underpass tragedy. The Osong Underpass tragedy, which took 14 lives in July 2023, is known as a case where a natural disaster turned into a disaster due to the lack of response from the relevant administrative authorities. As there were numerous reports and warnings, it is an incident that causes great regret and anger in that such a disaster could have been prevented if only responses such as strengthening temporary embankments, installing barriers to underground passages, and controlling traffic were taken. However, in the era of climate crisis, the risk of flood damage is increasing, so if there is no system change, disasters like the Osong tragedy are likely to recur. This study seeks to reexamine the management and governance system for the entire river basin underlying the Osong tragedy.

Key words: Osong, disaster, complexity, governance, crisonomy, disastronomy

I. Introduction

In the July 2023 Osong underpass disaster that claimed 14 lives, there were warnings, reports, but no control. Floods are repeated every year, but there is no discussion of an integrated management system.

The accident was summarized as the collapse of a temporary embankment of the Miho River on the morning of July 15, which caused a sudden influx of river water into the Gungpyeong 2 underpass in Osong-eup, Cheongju-si, flooding 17 vehicles, including city buses, passing through the underpass and killing 14 people. The media and various disaster experts did not view the accident as a natural disaster caused by heavy rain or river flooding, but rather as a man-made disaster caused by a lack of response in the disaster management process (The Joong Ang, 2023b).

The Office for Government Policy Coordination (OPC), which conducted an internal audit, and prosecutors pointed to the lack of response by the relevant administrative offices as a major cause of the ferry disaster (OPC, 2023). Expanding on this, analyzing the causes of the Osong disaster based on the crisis management process model reveals problems throughout the prevention, preparedness, response, and recovery process. For a long time, there were conflicts between stakeholders or administrative agencies over water management, and governance based on common interests in disaster management was not established. Although the inadequate response of the five agencies - Chungcheongbuk-do, Cheongju-do, the Administrative Center Complex City Construction Agency, the Chungbuk Police Agency, and the Chungbuk Fire and Rescue Headquarters - was directly blamed for the disaster, it was not the only cause. The lack of prevention processes, such as establishing policies and securing budgets for facility management, as well as preparedness activities, such as building a flood-related information system and establishing an emergency communication system, also contributed to the inadequate response. The Osong underpass tragedy also revealed problems in the post-incident

cleanup process. Rather than reorganizing the disaster management system and establishing a cooperative system based on the lessons learned from the horrific disaster, the relevant agencies were in a hurry to deflect blame. The government also focused on covering up scandals, leaving the judicial system to its own judgment, while failing to overhaul disaster management as a whole (News1, 2023).

The Osong disaster requires a two-pronged governance diagnosis. Along with the disaster response system, the governance of the infrastructure and water management of the Miho River near the Osong Underpass over a long period of time should be studied. As the Osong underpass disaster was a combination of natural and social disasters, it is necessary to examine the policies and stakeholders' activities that contributed to the disaster, both large and small. The climate crisis has made flooding one of the biggest risks in South Korea. Along with response measures to reduce the damage caused by floods, such as evacuation and traffic control, water management governance, such as flood defense facilities and raising water bowls in rivers, should also be analyzed.

Therefore, this study compares and analyzes the activities that should be carried out in the process of crisis management and the various activities that led to the Osong Underground disaster. First, we analyze the current status and problems of river and regional infrastructure management by identifying the events that occurred during the Osong underground disaster as revealed through documents and media reports. It also examines the systems and policies at each stage of the crisis management process, from prevention to preparedness to response to recovery, and identifies the requirements for smooth functioning. With reference to previous studies on crisis management activities and governance, we will also discuss the desirable role of local governments in disaster management. At a time when the risk of flood damage is high, it is hoped that the analysis of risk factors will prevent such a tragedy from happening again under similar conditions.

II. Overview of the Osong Underpass tragedy

Before the theoretical discussion on disaster management, the facts of the Osong underpass disaster were compiled from the State Security Office's investigation and the trial process.

After the incident, the Office of the State Coordinator conducted a ten-day inspection to independently determine the cause of the incident. The following records were compiled by the Office of the Chief Cabinet Secretary.

It started raining on July 13 in Cheongju, Chungcheongbuk-do, and by 08:00 on July 15, 40 minutes before the accident, the area had received about 372 mm of precipitation in two and a half days. At 06:40 on July 15, the water level of Miho Cheon Bridge reached the planned flood level of 29 meters 2 centimeters, and at 07:50, the water began to overflow the temporary embankment near Miho Cheon Bridge. The temporary levee then collapsed at 08:09. The OPC (2023) estimated that the river water started to enter the Gungpyeong 2 underpass, about 550 meters away, at around 08:27, about 18 minutes after the temporary embankment collapsed. According to CCTV footage at the time, by 08:35 on July 15, the underpass was already flooded to the point that it was impossible to drive through, and by 08:40, the Gungpyeong 2 underpass was completely flooded.

The OPC (2023) summarized the causes of the accident in two main ways. The OPC concluded that the accident was caused by the construction company's unauthorized demolition of the existing embankment under Mihochon Bridge and the construction of an inadequate temporary embankment, as well as the failure of the public administration to properly

monitor and supervise the construction, which were the precursors to the accident.

The trial and media coverage also revealed how the administration responded. There were several opportunities to prevent the tragedy before the accident, including warnings of flooding and reports of overflow, but they were not taken advantage of. In the days leading up to the disaster, there were 23 reports to the five agencies of Chungcheongbuk-do, Cheongju City, the Administrative Center Complex City Construction Agency, the Chungbuk Police Agency, and the Chungbuk Fire Department (Hankyoreh21, 2023).

At 06:34, two hours before the accident, the Geumgang Flood Control Center called the construction department of Heungdeok-gu Office by phone to inform them of the need to control traffic and evacuate residents (Yeonhapnews, 2023). Heungdeok-gu Office reported to the higher authority, the Cheongju City Government, but Cheongju City did not take any action, and Heungdeok-gu Office did not even contact Chungcheongbuk-do, the governing body of the road (Yeonhapnews, 2023). When contacted, Cheongju City defended that Gungpyeong 2 Subway Station is a national road, not a local road, and therefore under the jurisdiction of Chungcheongbuk-do, not Cheongju City (Hankyoreh21, 2023). Furthermore, the Cheongju City Public Transportation Department was unaware of the fact that the area was already flooded and off-limits at around 8:49 a.m. and instructed city bus companies to run detour routes and use Gungpyeong 2 Subway. This was in response to the flooding of other areas (Sedaily, 2023). The local government, Chungcheongbuk-do, did not respond. Chungcheongbuk-do did not control the Gungpyeong 2 subway station even though it was directly informed of the risk of flooding three times by the National Agency for the Construction of Administrative Centers and Complex Cities two hours before the accident (Nocutnews, 2023). The government excused itself by saying that it had received a flood warning and was watching it on CCTV, and that the temporary embankment was weak and collapsed (YTN, 2023).

Police and fire response was also poor. The Chungbuk Fire and Rescue Headquarters was the only agency to respond to the flooding site in response to a 911 call, and did not act on the report of an officer who visually confirmed that the embankment had collapsed. The 119 General Situation Room should have quickly deployed available manpower and equipment, but did not take the necessary measures (OPC, 2023; YTN, 2023). In addition, a report of a temporary embankment at the Miho Cheon Bridge construction site was received at 17:21 on July 14, a day before the accident, but was not disseminated to related agencies (OPC, 2023). The police also took inadequate measures. The Chungbuk National Police Agency received two 112 calls on the day of the accident about the flooding of Mihocheon Bridge and the need to control traffic. However, officers at the Osong police station mistakenly responded to the Gungpyeong 1 underpass instead of the Gungpyeong 2 underpass, where the accident occurred, and consequently failed to respond after the accident. The Chungbuk National Police Agency was accused of creating a false official document to cover up the lack of response and was taken to trial (Chungbukilbo, 2024).

The OPC's own post-incident audit noted that "there were numerous opportunities, but the lack of response from various agencies ultimately led to tragic damage" (Visigyu, 2023). Administrative agencies were criticized for failing to take advantage of even one of the many opportunities, and were accused of bureaucratic disasters that exceeded their human resources (Kyunghyangsinmun, 2023).

III. Theoretical discussion

1. Analyzing the Osong disaster based on the crisis management process model

The Osong underpass disaster highlights the poor crisis management situation of local governments, governance problems at the time of disasters, and the lack of resources available. In particular, the problem of poor governance at the time of a disaster is a problem that is pointed out every time a large-scale disaster occurs (Kyunghyangsinmun, 2023). The same problem was pointed out in the Itaewon tragedy, which occurred only eight months before the Osong tragedy. In the Itaewon tragedy, the police responded insufficiently even though they received a report four hours before the tragedy, and local governments, including Yongsan-gu and Seoul, did not recognize it as their responsibility (Hankyoreh21, 2023). In the Osong underpass disaster, numerous organizations, including police, fire, Heungdeok-gu, Cheongju-si, and Chungbuk-do, were responding to the disaster, but not a single one of them worked properly and did not take any action (Hankyoreh, 2023). In recent years, as disasters have become larger and more complex, governance has become even more important. The climate crisis is causing unpredictable natural disasters around the world, and there are many cases where the effects of natural disasters are spreading into large-scale complex disasters that cause social disasters due to the advancement of technology and the complexity of urban environments (Park, 2018). As disasters become more complex, the number of related organizations responsible for management also increases. This is why governance based on close cooperation among related organizations becomes more important in disaster response. The recent disasters in South Korea have shown how disastrous a lack of coordinated response can be. Even if the temporary embankment could not have been prevented from bursting, the loss of life could have been avoided by simply organizing traffic to block the underpass.

The lack of a disaster control tower is a similar issue that has been pointed out after every major disaster since the Sewol ferry disaster. In the case of the Sewol ferry disaster, the government reorganized as one of the follow-up measures immediately after the accident. This was to strengthen the actual operation and coordination of the control tower in the event of natural and social disasters that require a national response (Lee, 2018: 329). The government launched the National Safety Office in November 2014, but it was ineffective as it only changed the organizational structure while leaving the disaster classification method unchanged. Lee (2018) points out that during the Sewol ferry disaster, the Ministry of Safety and Public Administration's Disaster Safety Task Force, which was composed of general administrative officials with no experience in managing maritime disasters, failed to respond properly and caused confusion. She criticized the disaster classification, which combined human disasters and disasters that paralyzed national infrastructure systems into one social disaster.

After the Osong disaster, Heo Jun-haeng (2023) proposed an alternative to the absence of a disaster control tower: a pan-ministerial flood prevention group. He believes that it is a way to solve the situation where people are only arguing about their responsibilities in the face of flooding. Establishing an overarching organization may be an option, but fundamentally, we need to analyze disaster management as a whole and see if there is a need for a control tower organization.

The crisis management process consists of prevention and preparedness before a crisis occurs, and response and

recovery after a crisis occurs. The analysis of crisis management policies is also based on the CEM model (Petak, 1985; Lee, 2018:239).

As part of crisis management, prevention is an activity that assesses and seeks to reduce the risk posed by actual or potential disasters. In the case of the Osong underpass disaster, a natural disaster caused by record-breaking flooding was the basic element of the crisis.

In a survey of climate change and safety and maintenance professionals conducted by Kim et al. (2021), heavy rainfall was identified as the most important climate change factor to consider in the future. In Korea, 87.7% of all damages are caused by floods, so managing flood damage is a priority for disaster management in Korea in the era of climate change.

At the national level, prevention activities can include fundamental and long-term activities that can reduce natural disasters themselves, such as carbon neutralization activities. As natural disasters are already being intensified by the climate crisis, preventive actions are also needed to minimize the damage caused by floods by rebuilding infrastructure. Policies and standards for disaster-resilient infrastructure need to be revised. Planning flood levels should be raised and new risk analyses should be conducted. The installation of bridges and other facilities should also be accompanied by an analysis of their disaster safety and impact (Park et al., 2016).

For example, the OPC-Court (2023) cited the collapse of an inadequate temporary embankment as a direct cause of the Osong disaster. The court ruled that the contractor and supervisor of the 'Osong to Cheongju (Section 2) Road Expansion Project' demolished the existing embankment without permission and then built a temporary embankment poorly or neglected to manage and supervise the construction site, causing loss of life. How many centimeters below the planned flood level was disputed. Even if it was a few centimeters higher than the planned flood level, it is not enough to prevent disasters caused by the intensifying climate crisis. Apart from the problem of poor construction of the temporary dike, the standard of the Miho River dike itself should be raised to prevent future disasters.

Flood defense facilities, such as levees, are designed for a 200-year frequency for the Big Four rivers. The 200-year frequency means that the facilities are designed to protect against flooding in response to a rainfall event that occurs once every 200 years. Small rivers other than the four major rivers have defenses with a frequency of 50 to 100 years. The government is also aware of the problem of revising the standards. The Ministry of Public Administration and Security (2024) revised the 'Design Standards for Small Rivers (Ministry of Public Administration and Security Notification)' from 50-100 year frequency to 50-200 year frequency to prevent disasters, and implemented it on March 8, 2024. Small rivers are rivers that are not subject to the River Act and have an average width of more than 2 meters and a length of more than 500 meters. As of the end of 2023, there were 22,073 locations nationwide (total length of 34,454 kilometers). It will be applied to small river maintenance projects after the amendment is implemented. There are limitations that do not apply to existing facilities.

While defense facilities are an issue, silt deposition reduces the water capacity of the river. The Miho River has not been dredged for 60 years due to opposition from civil society organizations over environmental concerns (Chosunbiz, 2023).

It is also worth mentioning that the concentration of facilities near Miho Bridge has created a bottleneck in the waterway. The area near Miho Bridge is the narrowest point in the middle reaches of the Miho River. This makes it

economically advantageous to build the bridge. This is why railroads and roads are densely built. The basic river plan for the Geumgang River system, released by the Daejeon Regional Land Management Agency of the Ministry of Land, Infrastructure, and Transport in 2011, includes a plan to widen the river to solve this bottleneck. However, this was not implemented due to opposition from residents and civic organizations (Ohmynews, 2011). The issue of river maintenance was raised again in 2017 when record heavy rains caused the Seoknamcheon and Gagyongcheon, local rivers tributary to the Miho River, to overflow and flood the Cheongju city center. The Chungbuk province even suggested early completion due to concerns about flood damage. This time, the construction was suspended due to the bridge construction project (Jbnews, 2023).

The simplest facility to prevent flooding is one that blocks access when there is a risk of flooding. Accidents caused by flooding of underpasses have been frequent in recent years. In 2020, after an accident in Busan that killed three people, the facilities at the automobile complex were expanded, but the Gungpyeong 2 underground underpass, where the tragedy occurred, was excluded (The Joong Ang, 2023a). The Chungbuk Provincial Government assessed that there was no risk of flooding, explaining that "the flooding of the Gungpyeong 2 underpass was an exceptional situation where river water entered due to a natural disaster" (The Joong Ang, 2023a). Since then, the Ministry of the Interior and Safety has expanded the number of underpasses to 431 from 16, of which 285 are scheduled to be installed within 2024.

Preparedness activities are those that develop actual operational capabilities to respond to a crisis situation (Hy&Waugh, 1990:19; Lee, 2018:240). It includes activities such as developing warning capabilities to indicate the impending impact of a disaster or securing the resources needed to respond to a crisis in advance. Proactively seeking the cooperation and coordinating the functions of response organizations within and outside the region, and training rescue workers are also preparedness activities.

In the Osong Underground tragedy, the lack of coordination and collaboration in advance led to a terrible outcome where agencies received reports but failed to contact or respond to the agencies that should have been responding.

As the flooding was predictable due to the warnings and alerts issued by the Geumgang Flood Control Center, the city should have checked the communication network in advance and checked what actions to take so that the cooperation system could be activated immediately when the flooding caused damage. There was also a lack of training for on-site personnel to respond to the disaster. In Cheongju, a city with a history of frequent flooding, it is easy to recognize that traffic control may be necessary when flooding occurs. The Gungpyeong 1 underpass, where the police reportedly responded to the call, is practically flat, which means that the risk of flooding is low. The police had to head to Gungpyeong 2 underpass when they received a call about the risk of flooding, but this seems to be the result of a lack of prior training or awareness.

The situation at the Chungbuk Fire Headquarters was similar. Recognizing the possibility of the temporary dike collapsing, field personnel checked on the workers who were reinforcing the dike to prevent it from being washed away, and after the dike collapsed, they notified the headquarters 119 EOC. The EOC notified the city of Cheongju of the flooding without notifying the governing body. This was because they did not know in advance which roads were most at risk and who to contact depending on the management entity. If the information system had been in place, the response could have been faster.

2. Conflict management and governance

The Osong tragedy was also underpinned by a pattern of conflict over water management and a lack of governance. It is difficult for governance to succeed when roles are unclear or there are large policy gaps regarding responsibilities (Kim, 2018). Under the Moon Jae-in administration, the central government has integrated water quantity and quality, while devolving the management of tributaries and streams to local governments. While the organizational framework was in place, there was no consensus on disaster management, which is key to water management. After the Osong disaster, there are some arguments that we should revert to the pre-integration of water quality and quantity and focus on water management. There are also analyses that the Ministry of the Environment, which is in charge of integrated water quality and water quantity management, has no experience in dimensional measures centered on water management. It has also been pointed out that the budget for tributary and local stream management was transferred from MOLIT to local governments, and there were no separate measures for them. However, re-segregation is not the answer either. It could lead to duplication and waste due to excessive competition.

It's not just the overall governance structure that is controversial, but also individual issues such as dredging. In response to criticism that the lack of dredging after the Osong disaster exacerbated the damage, the Ministry of Environment has taken a proactive stance, including dredging. In October 2023, the Minister of Environment said, "In 2024, we are considering dredging seven tributary national river districts and building 10 dams to create a 'water bowl' to prevent flooding" (MOE, 2023).

Local governments have also taken an active role in dredging. This is because the sediment that had been deposited without dredging for a long time was blamed as one of the causes. Environmental organizations, which have opposed dredging, disagreed, saying that the Osong disaster was caused by the lack of dredging, which distorts the truth. They point out that even if dredging is done, the sediment will build up again in one to two years, and argue that comprehensive management of the entire watershed should be carried out by dismantling the beams and dikes (Hankyoreh, 2023). As environmental organizations point out, there have been attempts by the government to manage the watershed by expanding the width of the river. In 2015, the government planned to expand the width of the Miho River to 610 meters in the Miho River Outer District River Maintenance Project, but the project was not completed due to road and rail improvement projects (Jbnews, 2023).

As the Ministry of Environment and local governments are actively engaged in dredging, while environmental organizations are still opposed to dredging, there are some areas where there are conflicts over opposition to dredging. Daejeon City came into conflict with environmental organizations in 2024 when it spent 4.2 billion won to dredge 17 bridges in Daejeoncheon, Yudengcheon, and Gapcheon. The sale of aggregates was also tendered, delaying the completion of the dredging. In the vicinity of Sejongbo, environmental groups staged a two-month tent protest over the reactivation of the bridge (SBS, 2023).

As conflicts escalate, it is difficult for responders to succeed even if they are coordinated. The basis of cooperation and coordination, or governance, is common interests or interdependence. In general, governance refers to a cooperative

system with formal and informal linkages in which the interdependence of the actors involved is based on exchange and mutual cooperation, common interests, shared beliefs and expertise (Rhodes, 1996: 658-659; Kim, Jun-Ki and Lee, Min-Ho, 2006: 92-95).

This does not mean that actors need to establish a hierarchical command-and-control relationship based on a single organization or unify their organizations in order to work together. Rather, they should have horizontal cooperation. It is important to form a loose network of connections without compromising uniqueness and autonomy (Kim, 2018).

Jung Jung-gil (2000) focused on the public service linkage network and proposed a new governance in which the government takes responsibility and manages the activities of the service linkage network to ensure that they are carried out in a desirable manner. It emphasized the provision of public services through the participation of various governmental and non-governmental organizations and the provision of services through a network of participants with autonomy. Above all, it was reiterated that trust is an important basis and condition for cooperation in the interdependent exchange relationship of participants. However, the governance structure presupposes and organizes a hierarchical hierarchy.

The process of unifying the Ministry of Environment from a dual structure with the Ministry of Land, Infrastructure, and Transport managing water quantity and the Ministry of Environment managing water quality has not been successful in terms of organizational integration. The results of the integration were not good because the governance, beliefs, and interests of each were not fully integrated and the focus was only on organizational integration. For example, after the consolidation, the Ministry of Environment did not take any flood and drought measures (Chosun Ilbo, 2023). At the same time, the budget for tributary and local river management was transferred from MOLIT to local governments, and tributary and local river management was not carried out (Chosun Ilbo, 2023).

Water governance in the Netherlands is instructive. Kim (2018) notes that the Netherlands has developed a broad partnership between government departments and other actors to promote its water industry. The Netherlands has an unfavorable geography, with 55% of the country below sea level and vulnerable to flooding. The country has long focused on water management at the national level and has accumulated considerable know-how. It stands out for its transparency and self-governance based on citizen participation.

According to Section 12 of the Regional Water Authorities Act, local residents comprise more than 70% of the Regional Water Authorities Board members. However, representatives of undeveloped landowners, entrepreneurs, and natural green space owners are all involved in important decision-making, so the information gap is considered small. According to a representative of the regional water management agency interviewed in April 2018, the majority of the board members are local residents who are elected in elections held every four years (Havekes, 2018).

Some argue that it is difficult to increase the role of local governments in facilities such as water and sewerage while reducing the role of the central government in the short term. In most countries, except for the United Kingdom, where water and sewerage are privatized, local governments often play a role in water management, but local governments in Korea have poor financial conditions. The current method of implementing public subsidized sewerage projects, where the central government manages the project selection and follow-up, will inevitably change to increase local discretion and autonomy. The central government should pay more attention to setting strategies and targets, improving the quality

of sewerage services, and evaluating the performance of state investment. It is necessary to establish criteria for local governments to prioritize projects in urgent areas such as disaster management, rather than prioritizing popular projects (Kim et al., 2018). It is also necessary to consider reintroducing a financing system to prepare for the demand for reinvestment of old facilities, which is likely to occur in special and metropolitan areas in the future. According to the Korean Peninsula Climate Change Assessment Report, the frequency and intensity of heavy rainfall has been steadily increasing since the late 1990s, and most of Korea's infrastructure is rapidly aging, so the damage to facilities due to climate change is likely to be exacerbated. In particular, the aging rate of river facilities that directly capture precipitation and river flows is expected to increase sharply from 20.35% in 2021 to 43.93% in 2031 (Kim et al., 2021).

The desirable role of local governments in disaster management governance can be summarized as involving local residents and establishing field-based mobile response organizations. Lee (2018) emphasizes the importance of the first response of local organizations centered on affected residents when disasters occur, and suggests that local governments should strengthen local participation and private support systems. In order for local governments to respond to disasters efficiently, they need to establish a field-centered mobile response organization, but most of them do not have such an organization, which makes it difficult to respond immediately. Even when they do respond, they are often handled by general government employees who are not trained or practiced in disaster management. Lee (2018) suggests that there is a need to increase the professionalism and scale of on-site response personnel, establishing various crisis management systems, and properly collaborating with human resources such as higher levels of government and volunteer groups (332~333).

IV. Conclusions

The Osong Underpass tragedy revealed a systemic problem that continues to be identified throughout the prevention, preparedness, response, and recovery process.

The process of installing facilities such as bridges on the Miho River prioritized economics over disaster risk, and the intertwining of multiple construction projects meant that proper precautions were not taken (Hankyoreh, 2023).

Rapid response to disasters requires close cooperation and coordination among relevant organizations, but the Osong disaster revealed situations where people did not find the right person and reported or contacted the wrong place (Hankyoreh21, 2023). This is due to poor disaster preparedness.

The lack of response was evidenced by the fact that traffic was not closed in the face of rapidly rising floodwaters, but rather diverted traffic from other routes to the most dangerous underpasses.

The process of recovery was also characterized by trials that revealed allegations that police and others had falsified logbooks and reports rather than rebuilding the disaster management system (MBCchungbuk, 2024). Nearly a year later, in June 2024, the trials of officials were still ongoing, and it was not clear which officials in which agencies had committed crimes or misconduct that led to the tragedy. Inspections by the Office of State Coordination, prosecutors' investigations, and media coverage have revealed some generalized disaster management problems. However, this has only focused on the poor response of administrative agencies after the disaster and the construction of temporary dikes that contributed to the flooding.

In order to avoid another Osong tragedy in the era of climate change, it is necessary to redefine the governance of river infrastructure management (water management) and disaster management. The Osong disaster has prompted a renewed discussion on the division of roles between the central and local governments, along with a system of cooperation based on trust and autonomy. The central government must ensure that disaster management is central to the overall governance of water management through the water management budgets and institutions it allocates to local governments. While no single organization can do it all, establishing a disaster control tower, such as an inter-ministerial disaster prevention plan, or an integrated management system linked by information systems is an alternative.

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