Integration of Disaster Risk Reduction into Urban Planning and Infrastructure Development

Research Report

Asian Disaster Reduction Center Visiting Researcher Program
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1. About Research

India's fast urbanization has made metropolitan areas more susceptible to disasters. Tragically, catastrophe risks have frequently been neglected in infrastructure development and urban planning. The necessity of incorporating disaster risk reduction (DRR) into these procedures to improve urban resilience is becoming increasingly apparent.

Early stages exposure, vulnerabilities, and hazards are all part of incorporating disaster risk reduction into urban development. Resilient infrastructure design, building codes, social systems, and land use planning must be developed. Notwithstanding initiatives and legislative attempts to mainstream disaster risk reduction, there are still issues to be resolved, such as low awareness, a lack of technical expertise, fragmented governance, and conflicting agendas.

So, it is important to carry out study on how Japan include DRR into urban planning and development. It seeks to pinpoint best practices and offer advice to practitioners and policymakers.

Significance of the research

The research topic is significant due to the following reasons:

1. Enhancing urban resilience by incorporating DRR principles and strategies into planning and development processes.
2. Shifting from reactive disaster response to proactive risk management in urban areas.
3. Ensuring the design and construction of sustainable and resilient infrastructure that can withstand and recover from disasters.
4. Promoting multi-sector collaboration and stakeholder engagement for effective implementation of DRR measures.
5. Long-term cost savings by avoiding or minimizing post-disaster recovery and reconstruction expenses.
6. Policy implications for the development of guidelines, regulations, and incentives that support the integration of DRR into urban planning.

Specific Aims

1. Identify opportunities and potential areas for improvement, in integrating DRR into urban planning and infrastructure development processes in India.
2. Explore and document best practices and successful case studies that demonstrate effective integration of DRR measures in Japan.
3. Develop actionable recommendations for policymakers, practitioners, and stakeholders to enhance the integration of DRR principles and strategies into urban planning and infrastructure development practices.

Expected Results

1. A comparative analysis of the best practices and lessons learned from Japan’s experience in integrating DRR into urban planning and infrastructure development, highlighting the key factors for success and the challenges faced.
2. A set of practical and feasible recommendations for enhancing DRR integration into urban planning and infrastructure development in India,
3. A dissemination strategy for sharing research findings and recommendations with the relevant stakeholders, policymakers, practitioners, and communities, using appropriate channels and formats.

2. Disasters in Japan

Disaster Risk Profile of Japan

Japan is an archipelagic country stretched over 3,000 km (1,900 mi) along the Pacific coast of East Asia. It is surrounded by the Pacific Ocean, the Sea of Okhotsk, the Sea of Japan, and the East China Sea. The territory of Japan comprises four large islands of Hokkaido, Honshu, Shikoku, and Kyushu, and other smaller islands with a total land area of about 378,000 square kilometers. It is a mountainous country, with two-thirds of its territory covered with forests. Most areas have a temperate climate with four distinct seasons, although Okinawa in the south is subtropical, and Hokkaido in the north is subarctic. Therefore, it has great diversity of plant and animal life.

Japan is highly prone to various natural disasters. The most frequent natural hazards are earthquakes, tsunamis, typhoons, volcanic eruptions, floods and landslides. Occasional torrential rains and heavy snows are another challenge for the country.

Japan is geologically active region known as the Pacific Ring of Fire, which is characterized by frequent earthquakes, volcanic activity, and tsunamis. This is because the country sits at the intersection of four tectonic plates - the Eurasian Plate, North American Plate, Pacific Plate, and Philippine Sea Plate. These plates are constantly moving and interacting with each other, causing seismic activity in the region.

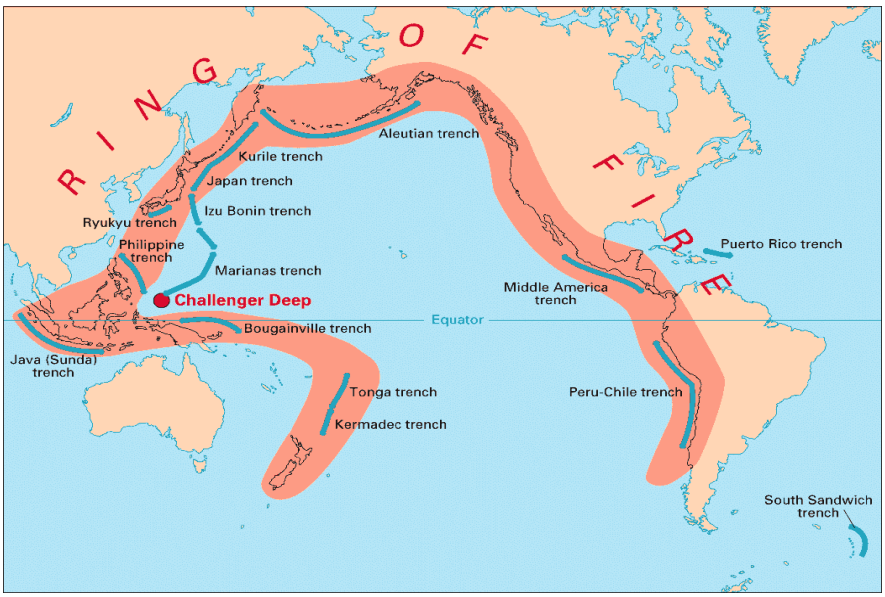
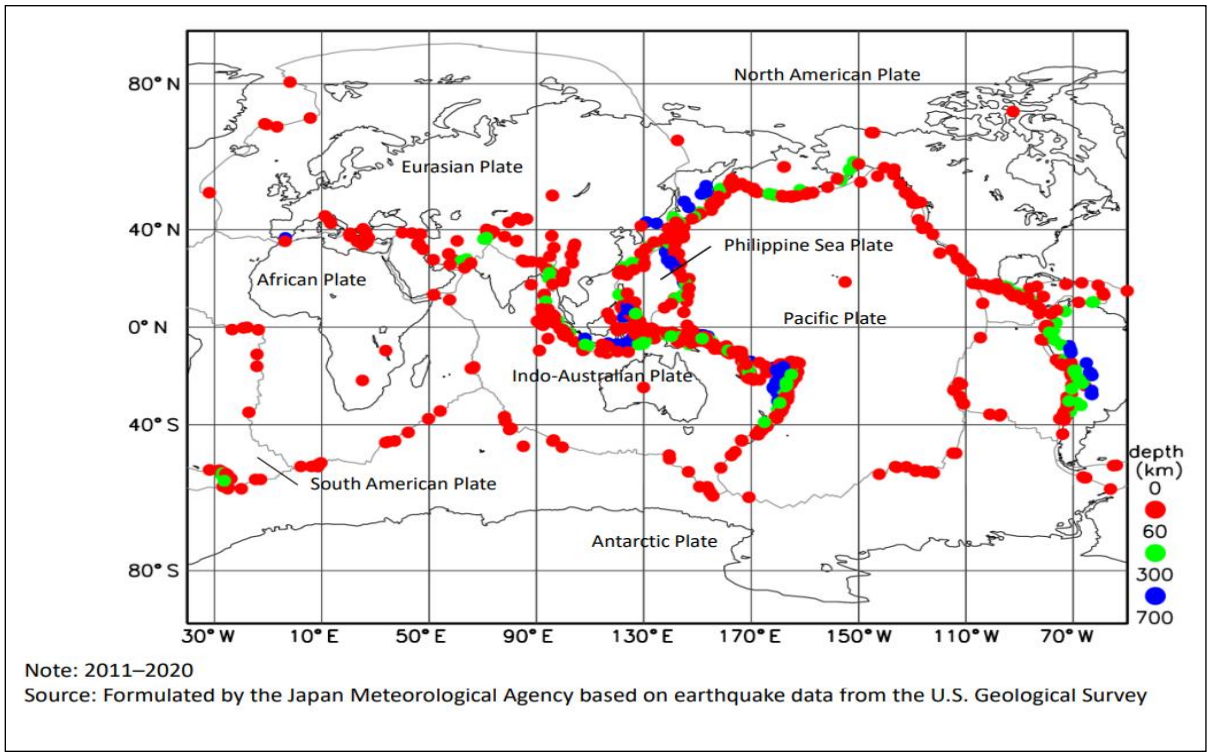


Figure 1-Ring of Fire

The movement of these plates also causes volcanic eruptions, as magma from deep within the Earth is pushed up to the surface. With around 110 active volcanoes, it is one of the most volcanically active countries in the world. In addition to earthquakes and volcanoes, Japan is also prone to tsunamis. These can be triggered by undersea earthquakes, as well as landslides or other disturbances in the ocean.

Figure 2- World distribution of Tectonic plates and Earthquake hypocenters



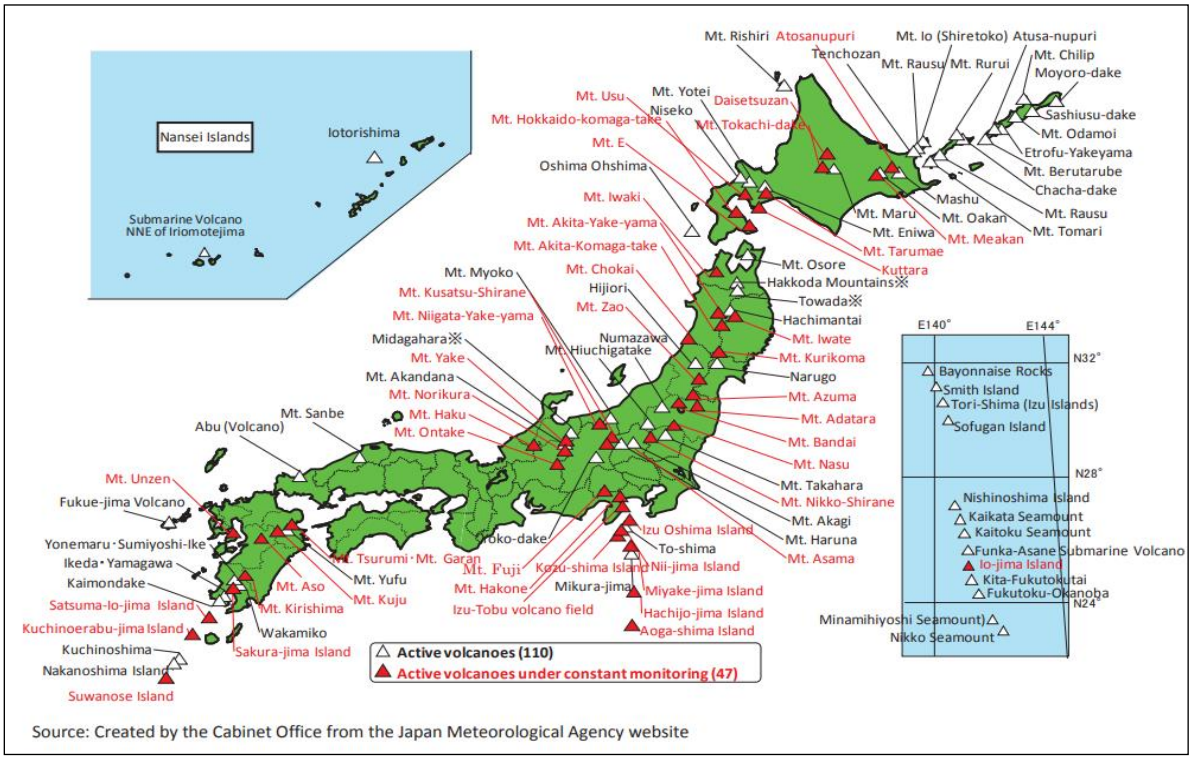


Figure 3- Distribution of Active Volcanoes in Japan

Japan is also subject to extreme weather conditions, including seasonal rain fronts, typhoons, and heavy snowfall. The rainy season, or "tsuyu," typically occurs from late May to mid-July, bringing heavy rainfall and sometimes causing floods and landslides. Typhoons, or tropical cyclones that form over the warm waters of the Pacific Ocean

are also a common occurrence in Japan, particularly between May and October. These storms can bring strong winds, heavy rainfall, and storm surges, which can lead to flooding and sediment disasters such as debris flows, landslides, and slope failures. August and September are typically the peak months for typhoon activity. Heavy snowfall is common on the Sea of Japan side of the country during the winter months, particularly in areas such as Niigata and Hokkaido. This can lead to transportation disruptions, power outages, and other problems.

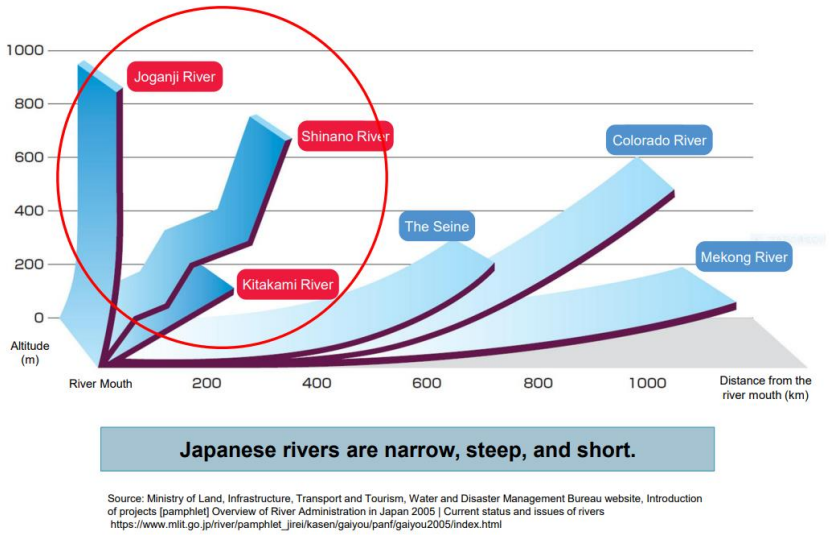


Figure 4- River gradient in Japan and the World

The average precipitation in Japan is 1,718 mm/year, higher than the world average (880 mm/year). Local heavy rain and torrential shower have been occurring frequently. Comparing to the rivers in the continents, the rivers in Japan are short and steep, so rain fallen in the watershed flows out rapidly causing flooding in the plains and the bottom lands.

Fire risk in Japan is also high and there are several factors that contribute to this risk. The proximity of buildings in densely populated areas is a factor that increases the risk of fire in Japan. Fires can easily spread from one building to another, especially in areas with narrow streets and alleys. Tsunamis and earthquakes can also lead to large-scale fires in Japan. When buildings and infrastructure are damaged by these disasters, gas lines and electrical wires can be severed, leading to gas leaks and electrical sparks that can ignite fires. Japan's highly developed chemical and high-technology industries also pose a significant fire risk. These industries often use hazardous materials and produce large amounts of heat and sparks, which can lead to fires and explosions.

Japan has a large forested area that cover around 70% of its total land area. Forest fires can be caused by lightning strikes, but they are often caused by human activities such as campfires, cigarette butts, and agricultural burning. These fires can spread quickly, especially during the dry season in summer. When compared to the World, Japan was the site of 9% (5 of 56) of the meteorological disasters from typhoons, flooding, and other causes, and 16% (9 of 55) of the earthquakes and tsunamis since 1900 AD.

Major Natural Disasters in Japan

Every year there is a great loss of people's lives and properties in Japan due to natural disasters. Largescale typhoons, earthquakes and Tsunamis have caused extensive damage and thousands of casualties.

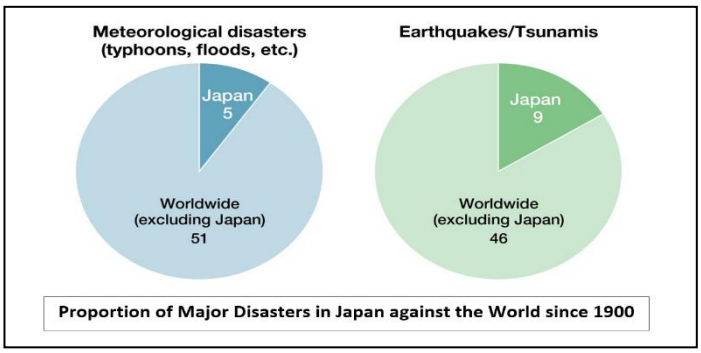


Figure 5- Disaster Comparison with the World

Date	Disaster	Main Disaster Areas	Number of Dead and Missing
January 13, 1945	Mikawa Earthquake (M6.8)	Southern Aichi	2,306
September 17-18, 1945	Typhoon Makurazaki	Western Japan (Especially in Hiroshima)	3,756
December 21, 1946	Nankai Earthquake (M8.0)	Various Places in West of Chubu	1,443
August 14, 1947	Mt. Asama Eruption	Around Mt. Asama	11
September 14-15, 1947	Typhoon Catherine	North of Tohoku	1,930
June 28, 1948	Fukui Earthquake (M7.1)	Around the Fukui Plains	3,769
September 15-17, 1948	Typhoon Ion	From Shikoku into Tohoku (Especially in Iwate)	838
September 2-4, 1950	Typhoon Jane	North of Shikoku (Especially in Osaka)	539
October 13-15, 1951	Typhoon Ruth	Nationwide (Especially in Yamaguchi)	943
March 4, 1952	Tokachi-oki Earthquake (M8.2)	Southern Hokkaido, Northern Tohoku	33
June 25-29, 1953	Torrential Rains	Kyushu, Shikoku, Chugoku (Especially Kitakyushu)	1,013
July 16-24, 1953	Torrential Rains	West of Tohoku (Especially in Wakayama)	1,124
May 8-12, 1954	Storm Disaster	Northern Japan, Kinki	670
September 25-27, 1954	Typhoon Toyamaru	Nationwide (Especially in Hokkaido and Shikoku)	1,761
July 25-28, 1957	Torrential Rains	Kyushu (Especially around Isahaya)	722
June 24, 1958	Mt. Aso Eruption	Around Mt. Aso	12
September 26-28, 1958	Typhoon Kanogawa	East of Kinki (Especially in Shizuoka)	1,269
September 26-27, 1959	Typhoon Ise-wan	Nationwide (Except for Kyushu, especially in Aichi)	5,098
May 23, 1960	Chile Earthquake Tsunami	Southern Coast of Hokkaido, Sanriku Coast, Shima Coast	142
January 1963	Snow Disasters	Hokuriku, Sanin, Yamagata, Shiga, Gifu	231
June 16, 1964	Niigata Earthquake (M7.5)	Niigata, Akita, Yamagata	26
September 10-18, 1965	Typhoons 23, 24, 25	Nationwide (Especially in Tokushima, Hyogo, Fukui)	181
September 23-25, 1966	Typhoons 24, 26	Chubu, Kanto, Tohoku (Especially in Shizuoka, Yamanashi)	317
July to August 1967	Torrential Rains	West of Chubu, Northern Tohoku	256
May 16, 1968	Tokachi-oki Earthquake (M7.9)	Southern Hokkaido and Tohoku Area centering around Aomori	52
July 3-15, 1972	Typhoons 6, 7, 9 and Torrential Rains	Nationwide (Especially in Kitakyushu, Shimane, Hiroshima)	447
May 9, 1974	Izu-hanto-oki Earthquake (M6.9)	Southern Tip of Izu-hanto	30
September 8-14, 1976	Typhoon 17 and Torrential Rains	Nationwide (Especially in Kagawa, Okayama)	171
January 1977	Snow Disaster	Tohoku, Northern Kinki, Hokuriku	101
August 7, 1977- October 1978	Mt. Usu Eruption	Hokkaido	3
January 14, 1978	Izu-Oshima-kinkai Earthquake (M7.0)	Izu-hanto	25
June 12, 1978	Miyagi-ken-oki Earthquake (M7.4)	Miyagi	28
October 17-20, 1979	Typhoon 20	Nationwide (Especially Tokai, Kanto, Tohoku)	115
December 1980 - March 1981	Snow Disasters	Tohoku, Hokuriku	152
July to August 1982	Torrential Rains and Typhoon 10	Nationwide (Especially in Nagasaki, Kumamoto, Mie)	439
May 26, 1983	Nihon-kai-chubu Earthquake (M7.7)	Akita, Aomori	104
July 20-29, 1983	Torrential Rains	East of Sanin (Especially in Shimane)	117
October 3, 1983	Miyake Is. Eruption	Around Miyake-jima Island	—
December 1983 - March 1984	Snow Disasters	Tohoku, Hokuriku (Especially in Niigata, Toyama)	131
September 14, 1984	Nagano-ken-seibu Earthquake (M6.8)	Western Nagano	29
November 15 - December 18, 1986	Izu-Oshima Eruption	Izu Oshima Island	—
November 17, 1990	Mr. Unzen Eruption	Nagasaki	44
July 12, 1993	Hokkaido-nansei-oki Earthquake (M7.8)	Hokkaido	230
July 31 - August7, 1993	Torrential Rains	Nationwide	79
January 17, 1995	Great Hanshin-Awaji Earthquake (M7.3)	Hyogo	6,437
March 31, 2000 - June 28, 2001	Mt. Usu Eruption	Hokkaido	—
June 25, 2001 - March 31, 2005	Miyake Is. Eruption and Niijima and Kozushima Is. Earthquake	Tokyo	1
October 20-21, 2004	Typhoon 23	Nationwide	98
October 23, 2004	Niigata-ken-Chuetsu Earthquake (M6.8)	Niigata	68
December 2005 - March 2006	Heavy Snowfalls	Japan Sea Coast centering around Hokuriku Area	152
July 16, 2007	Niigata Earthquake (M6.8)	Niigata	15
June 14, 2008	Iwate-Miyagi Inland Earthquake (M7.2)	Tohoku (Especially in Miyagi, Iwate)	23
December 2010 - March 2011	Snow Disasters	From Northern Japan through into Kanto-Koshinetsu Area (Especially in Yamanashi)	131
March 11, 2011	Great East Japan Earthquake (Mw9.0)	Eastern Japan (Especially in Miyagi, Iwate, Fukushima)	21,839
August 29 - September 7, 2011	Typhoon 12	Kinki, Shikoku	94
November 2011 - March 2012	Deep Snowfall from November 2011 onwards	From Northern Japan through into West Japan on the Japan Sea Coast	132
December 2012 - March 2013	Deep Snowfall from December 2012 onwards	From Northern Japan through into West Japan on the Japan Sea Coast	101
November 2013 - May 2014	Deep Snowfall from November 2013 onwards	From Northern Japan through into Kanto-Koshinetsu Area (Especially in Yamanashi)	93
August 20, 2014	Torrential Rains of August 2014	Hiroshima	74
September 27, 2014	2014 Eruption of Mt. Ontake	Nagano, Gifu	63

*Mw: Moment magnitude
Notes:
1. The disasters listed resulted in fatalities and missing persons as follows: 500 or more for storm and flood disasters, 100 or more for snow disasters, and 10 or more for earthquakes, tsunamis, and volcanic eruptions. It also includes disasters for which governmental Major Disaster Management Headquarters were established based on the Disaster Countermeasures Basic Act.
2. The number of fatalities and missing persons for the Great Hanshin-Awaji Earthquake is the current figure as of December 22, 2005. The number of deaths directly caused by structural collapse, fire, and other factors caused by seismic shaking on the day of the earthquake, excluding so-called "related deaths," is 5,521.
3. The numbers of fatalities from the Miyake Is. Eruption and Niijima and Kozushima Is. Earthquake are from the earthquake of July 1, 2000.
4. The numbers of fatalities and missing persons since 2014 are from flash bulletins based on Cabinet Office summaries.
5. The number of fatalities (including earthquake-related fatalities) and missing persons resulting from the Great East Japan Earthquake is the current figure as of March 1, 2015.
Source: Created by the Cabinet Office based on the meteorological almanac of Japan, Chronological Scientific Tables, National Police Agency materials, Fire and Disaster Management Agency materials, Extreme Disaster Management Headquarters materials, and Hyogo Prefecture materials

Figure 6- Major Natural Disasters in Japan since 1945

Typhoon Ise-wan was an exceptionally intense and one of the most destructive typhoons in Japanese history. It struck the Ise Bay region on the southern coast of Honshu Island, on Sept. 26, 1959, and wreaked havoc in the city of Nagoya. The storm killed more than 5,000 people, left an estimated 1.5 million people homeless, and injured almost 39,000 people.

The Great Hanshin Awaji Earthquake of a 7.3 magnitude hit Awaji Island of Hyogo Prefecture in Western Japan on 17 January 1995. It killed 6,434 people, injured 43,792 people, destroyed 104,906 houses, half destroyed 144,274 houses, and partially destroyed 390,506 houses. The area of 835,858 square meters was burnt down by the fires that broke out along with the earthquake.

A magnitude 9.0 Great East Japan earthquake hit northeastern Japan on 11 March 2011, recording the largest earthquake hit in Japan. Its epicenter was in the coast of Sanriku and its epicentral area stretched from the coasts of Iwate Prefecture to Ibaraki Prefecture. Massive shakes were observed particularly in eastern Japan, including a Japanese intensity scale of 7 registered in the north of Miyagi Prefecture. Furthermore, this trench-type earthquake occurred near the boundary of the Pacific Plate and the plate beneath the Tohoku area, triggered seafloor movements and generated a massive tsunami. It killed 15,870 people, 2,814 people went missing and 6,114 people were injured and 129,472 buildings totally collapsed, 255,977 half collapsed and 702,928 partially collapsed.

With the progress of society's capabilities to respond to disasters and mitigate vulnerabilities to disasters by developing disaster management systems, promoting national land conservation, improving weather forecasting technologies, and upgrading disaster information communications systems, disaster damage has shown a declining tendency. As such, natural disasters remain a menacing threat to the safety and security of the country.

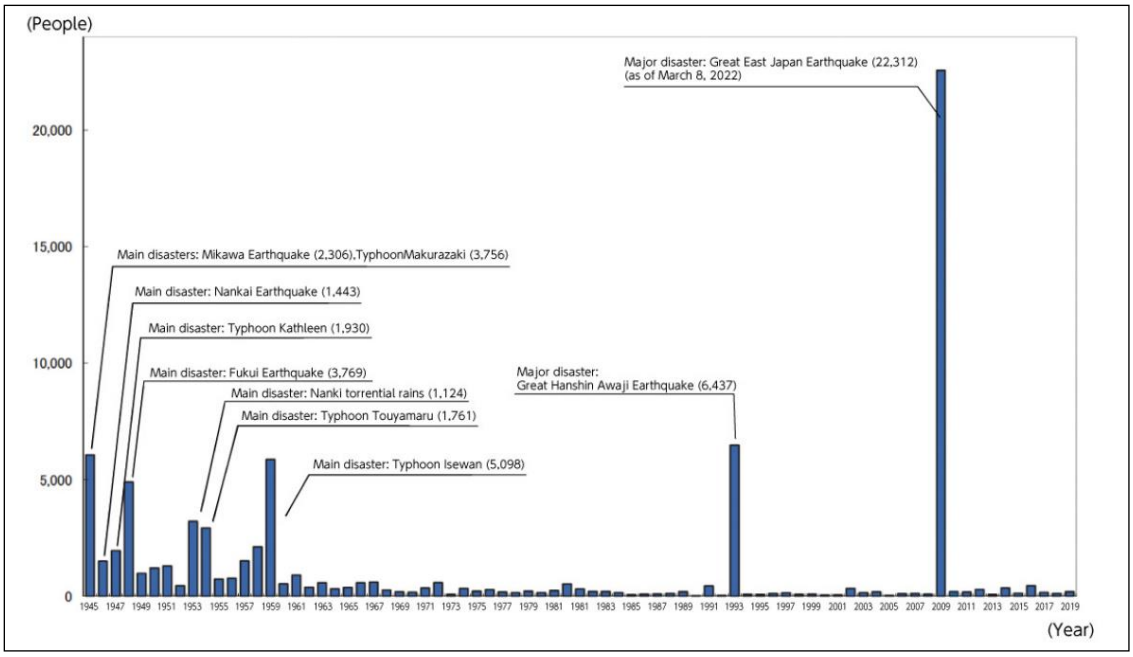


Figure 7- Number of Fatalities and Missing Persons Due to Natural Disasters

3. Disaster Management System in Japan

Disaster Management Laws

Japan has established a comprehensive legal framework for disaster management, including laws covering all phases of disaster management. These laws include seven basic acts, eighteen disaster prevention and preparedness acts, three disaster emergency response acts and twenty-three disaster recovery and financial measures acts. The acts and other legislations address all the phases of disaster with clearly defined roles and responsibilities among the national and local governments.

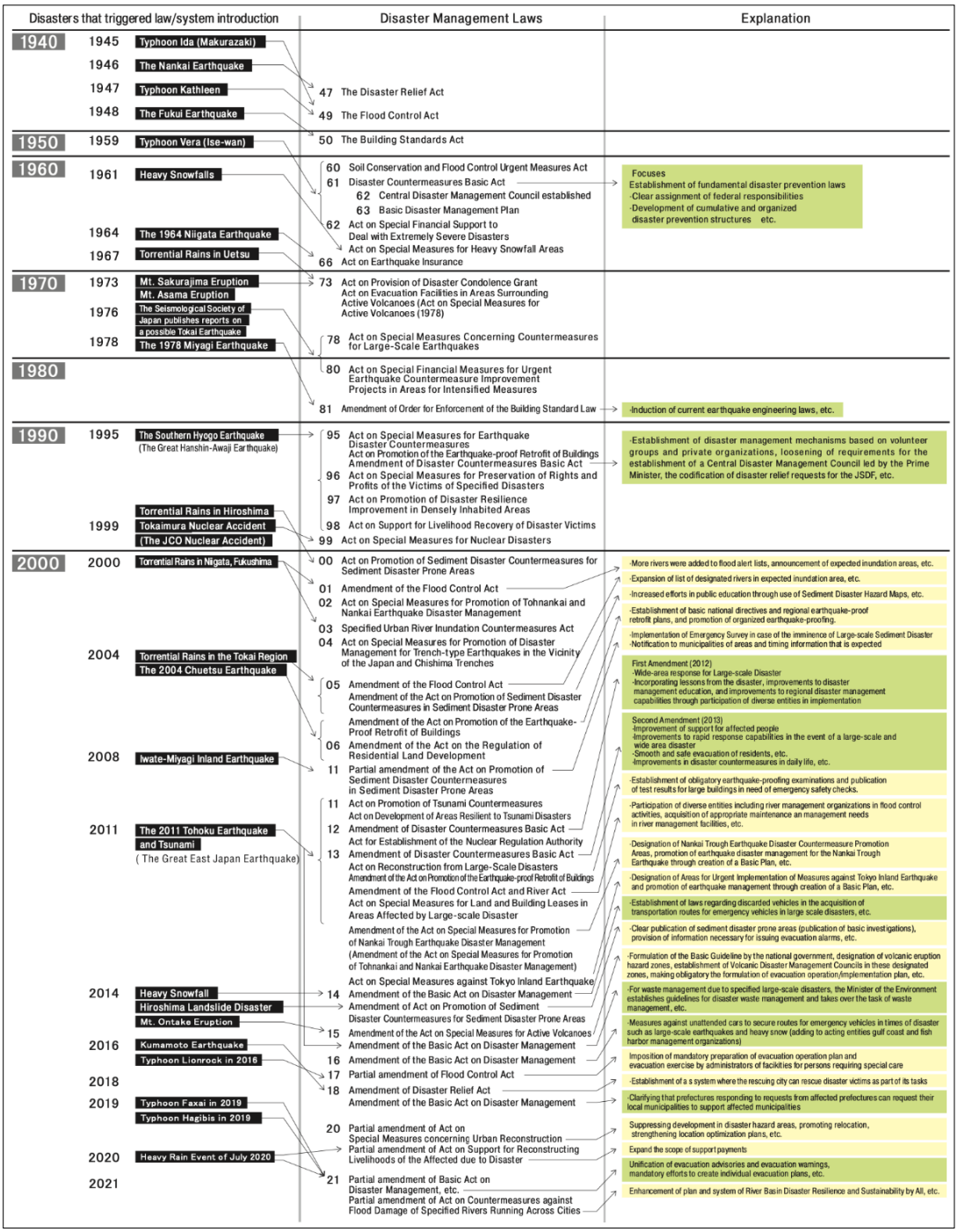


Figure 8- Disaster management laws in Japan

Disaster Countermeasures Basic Act 1961

The immense damage caused by Typhoon Ise-wan in 1959 led to the enactment of the Disaster Countermeasures Basic Act in 1961, which formulates a comprehensive and strategic disaster management system. It is considered a national priority to protect national land as well as citizens 'lives, livelihoods, and property from natural disasters.

There have been constant revisions and amendments in the Basic Act on Disaster Management since its first enactment, and with lessons learned from the Great East Japan Earthquake, provisions were added for enhancement of the measures concerning support activities mutually done by local governments in 2012 and the measures for ensuring smooth and safe evacuation of residents and improving protection of affected people in 2013. Measures against unattended cars in order to promptly clear them from the roads for emergency vehicles were added in 2014. In 2021, in order to ensure smooth and rapid evacuation in the event of a disaster and strengthen the implementation system for disaster measures, evacuation information was reviewed, individual evacuation plans were legalized, and measures in the regulations concerning acceptance of residents for region-wide evacuation were stipulated. The government has also taken measures such as making it possible to establish the National Disaster Management Headquarter at the stage of threatening disaster.

Figure 9- Outline of the Basic Act on Disaster Management

Acts on Response to Disasters

Out of the different acts related to Disaster management, The Disaster Relief Act (1947), Fire Services Act (1948) and Flood Control Act (1949) are the ones focusing on response to disasters.

The Disaster Relief Act, 1947 provides a legal framework for the Japanese government to provide emergency relief in the event of a disaster, and it outlines the roles and responsibilities of various government agencies, local governments, and non-governmental organizations in the disaster response effort. It also emphasizes the

importance of cooperation between the government, local communities, and the public in disaster preparedness and response, and it provides guidelines for the protection and support of disaster victims.

The Fire Services Act, 1948 regulates fire service and fire defense in Japan. It sets out the roles and responsibilities of the fire service and the legal framework for fire prevention, firefighting, and disaster response in Japan. It also establishes the Fire and Disaster Management Agency (FDMA), which is responsible for coordinating fire and disaster management across the country.

The Flood Control Act, 1949 is a law that was enacted to prevent and control floods in the country. The Act outlines the roles and responsibilities of various government agencies, local governments, and other organizations in flood control efforts, and it establishes a legal framework for flood control measures such as the construction of levees, dams, and other structures. It also emphasizes the importance of disaster preparedness and response, and it encourages the development of comprehensive flood control plans that involve local communities and other stakeholders.

4. Institutional Setup

Japan has a well-established disaster management system that is implemented through a 3-layered approach, consisting of the national, prefectural, and municipal levels.

At the national level, the Cabinet Office plays a leading role in disaster management by establishing policies, coordinating with other ministries and agencies, and providing financial support to the prefectural and municipal governments. The Prime Minister also serves as the head of the Central Disaster Management Council, which is responsible for overseeing national disaster management policies and operations.

At the prefectures and local municipalities, the Prefectural and Municipal Disaster Management Councils led by the respective Governors and Mayors are established with the members of representatives of local government organizations including police and fire management department and designated local public corporations. Implementation of disaster risk management measures is based on the Local Disaster Management Plans drafted by the Councils. They are also responsible for coordinating disaster response and recovery efforts within their jurisdiction.

The Cabinet Office

The Cabinet Office of Japan is "the place of wisdom" that provides strategic advice and support to the Cabinet and the Prime Minister. It was established in 2001 with the aim of enhancing the coordination and integration of government policies and initiatives. It plays a critical role in disaster management and emergency response.

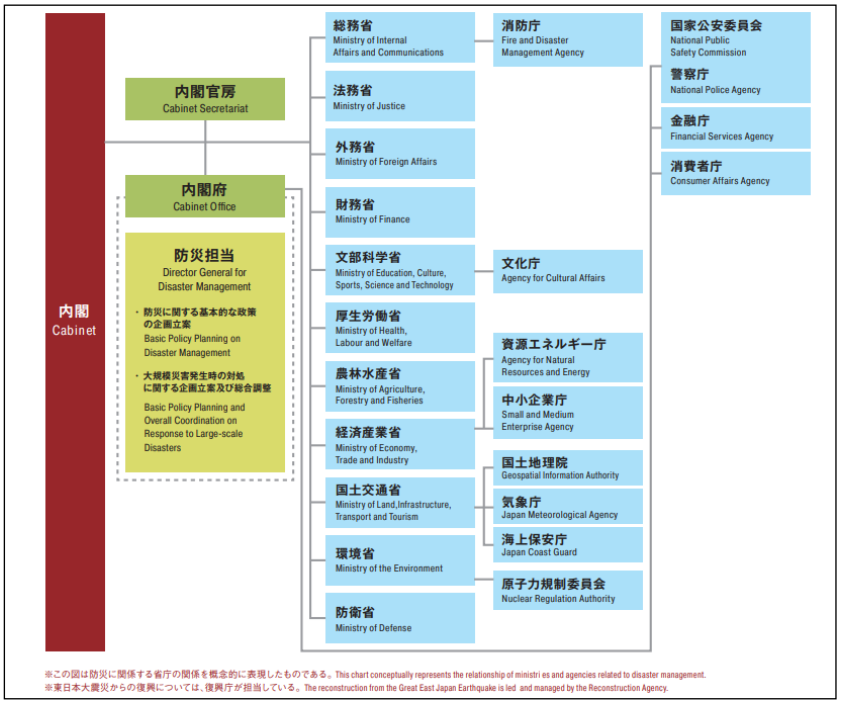


Figure 10- Cabinet Office and related Ministries

Central Disaster Management Council

The Central Disaster Management Council is an advisory body established in 1961 under the Disaster Countermeasures Basic Act to ensure the comprehensiveness of disaster risk management and to discuss matters of importance about disaster management. The council consists of the Prime Minister, who is the chairperson, Minister of State for Disaster Management, all ministers, heads of major public institutions and experts.

The Cabinet Office is the secretariat for this Council and the Minister of State for Disaster Management has been assigned as the Minister State for Special Missions and is assisted by the Director-General for Disaster Management his mandate being to handle planning and central coordination regarding matters relating to basic policy on disaster risk reduction, and matters concerning disaster countermeasures in the event of a large-scale disaster.

The Council decides the national government's disaster management policies which are carried out by respective ministries and agencies, accordingly. In the event of a large-scale disaster, the Cabinet Office is engaged in collection and dissemination of accurate information, reporting to the Prime Minister, establishment of the emergency activities system including the Government's Disaster Management Headquarters, and overall wide area coordination concerning disaster response measures.

Figure 11- Central Disaster Management Council

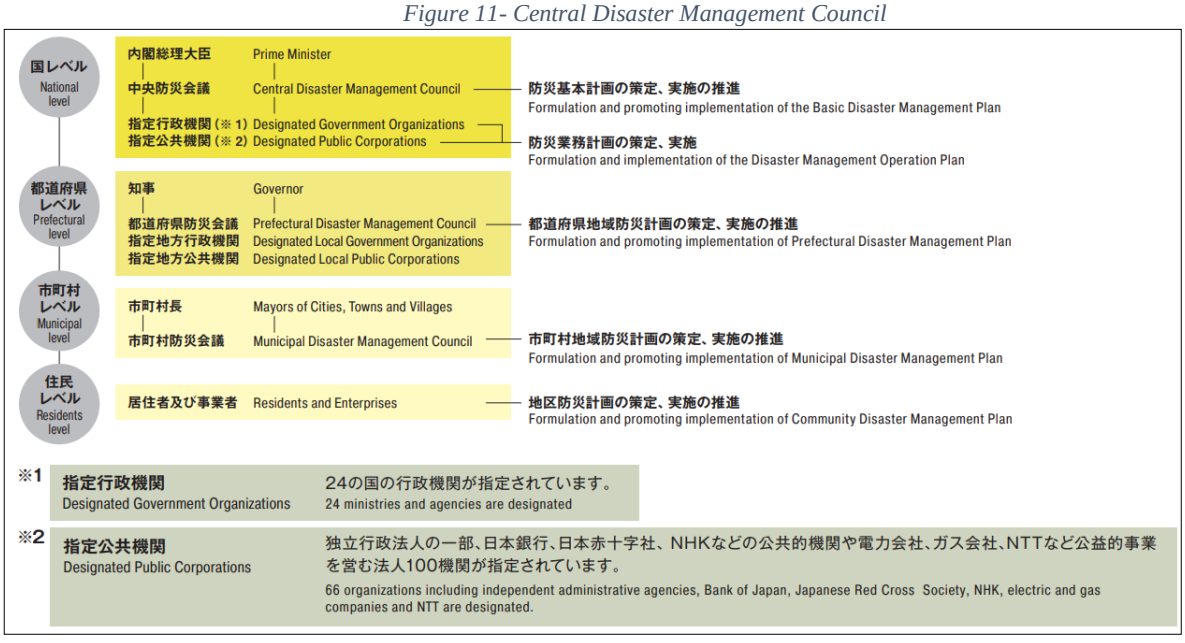


Figure 12- Outline of the Disaster Management System

5. Disaster Management Planning System

1. Basic Disaster Management Plan: This plan is the highest-level plan and constitutes the basis for disaster management activities prepared by the National Disaster Management Council based on the Disaster Countermeasures Basic Act. It is prepared by the Central Disaster Management Council and is the plan for disaster management activities in the country.

2. Disaster Management Operation Plan: This is a plan prepared by each designated government organization and designated public corporation based on the Basic Disaster Management Plan and should provide measures to be undertaken for disaster prevention pertaining to the business of a designated administrative organ.

3. Local Disaster Management Plan: This is a plan prepared by each Prefectural and Municipal Disaster Management Council, subject to local circumstances and based on the Basic Disaster Management Plan.

4. Community Disaster Management Plan: This is disaster management activities plan at the community level which is established by residents and businesses jointly on a voluntary basis.

The Basic Disaster Management Plan

It is a comprehensive and long-term disaster management plan forming a foundation for the Disaster Management Operations Plan and Local Disaster Management Plan. It stipulates provisions for the establishment of the disaster management system, promotion of disaster management measures, acceleration of post disaster recovery and reconstruction measures, and promotion of scientific and technological research on disaster management. Since its establishment in 1963, this plan has been reviewed every year based on the Basic Act on Disaster Management and revised when deemed necessary. Therefore, the plan was revised entirely in 1995 based on the experiences of the Great Hanshin-Awaji Earthquake.

It defines responsibilities of each entity such as the national and local governments, public corporations and other entities. It consists of various plans for each type of disaster, where specific countermeasures to be taken by each entity are described according to the disaster management phases of prevention and preparedness, emergency response, as well as recovery and reconstruction. Further, based on the lessons learned from the Great East Japan Earthquake, a new chapter was created in December 2011, for Tsunami Disaster Countermeasures. In recent years, lessons from disaster responses and developments in measures as well as responses to the COVID-19 have been considered for the revisions.

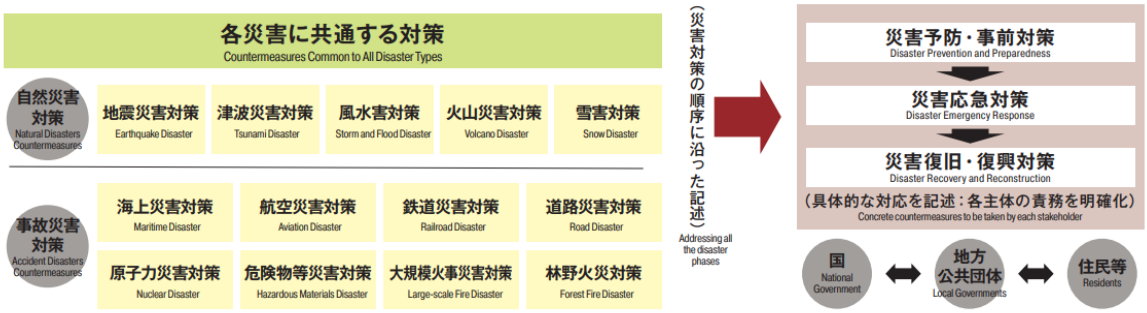


Figure 13- Basic Plan for Disaster Risk Reduction

Community Disaster Management Plan

In order to encourage and promote proactive disaster management activities among residents (including both individual and corporate residents) in a given area based on the spirit of self-help and mutual help, and to enhance the disaster management capabilities of the area in a bottoms-up manner, it is stipulated that a community disaster management plan, featuring the community level disaster management activities, may be prescribed in the municipal disaster management plan. In developing a community disaster management plan, more active and proactive participation of the area residents is necessary at an early stage of such development. As such, it is

stipulated that the area residents may jointly make a proposal (proposed plan) to the municipal disaster management council that a community disaster management plan be stipulated in the municipal disaster management plan. Thus far, the plans reflected in the community disaster management plans are that of 30 prefectures, 73 municipalities and 901 communities (as of April 1, 2020).

The Business Continuity Plan of Central Government

"The Business Continuity Plan of Central Government (Measures against Tokyo Inland Earthquake) stipulates the executive systems and work environment essential to continue the governmental services smoothly in the event of the Tokyo Inland Earthquake occurring and in case the political, administrative and economic core functions may be seriously affected by the Earthquake. Regarding the executive system, the Plan stipulates that, upon the Tokyo Inland Earthquake occurring, government staff including those in charge of the administrative management gather at the central government buildings and stay there for a week to continue the emergency priority operations in rotation, so that such emergency priority operations will be smoothly carried out. With regard to the work environment, it stipulates that the government buildings be constructed to be earthquake resistant with a work environment to continue the emergency priority services and administrative work in case of emergency.

Based on this Plan, central government ministries and agencies shall revise the business continuity plans of each ministry and agency, identify services that need to be continued under their responsibility in case of emergency as the emergency priority operations, and they work out a system and environment necessary to carry those out.

Figure 14- Business Continuity Plan of Central Government

It is planned that those business continuity plans developed by respective ministries and agencies be reviewed and evaluated by experts, and that these plans as well as the Plan itself be revised based on the result of such evaluation. In the same manner, the systems for business continuity of local governments in the event of a large-scale disaster are being developed and the Government is to give support to them by way of formulating guidelines.

White Paper on Disaster Management

The White Paper on Disaster Management in Japan is an annual report published by the Japanese government that provides a comprehensive overview of the country's disaster management policies, strategies, and activities. The White Paper on Disaster Management has its origins in the Disaster Countermeasures Basic Act, 1961. The act established the basic framework for disaster management in Japan and called for the creation of a national disaster management plan and the publication of an annual report on disaster management.

The first White Paper on Disaster Management in Japan was published in 1962, and since then, it has been published annually by the Cabinet Office of Japan. The purpose of the white paper is to provide a comprehensive overview of the country's disaster management policies, strategies, and activities, and to promote public awareness and understanding of disaster management issues. The white paper is an important tool for monitoring and

evaluating Japan's disaster management efforts, and for identifying areas where improvements can be made. It also serves as a valuable reference for other countries and organizations that are interested in learning from Japan's experience and expertise in disaster management.

In recent years, the relevance of the White Paper on Disaster Management in Japan has been heightened by several high-profile disasters, including the Great East Japan Earthquake and Tsunami in 2011, which highlighted the importance of effective disaster management and the need for ongoing efforts to improve disaster resilience.

The white paper is also relevant in the context of the growing global concern about the impact of climate change on the frequency and intensity of natural disasters. As a country that is highly vulnerable to natural disasters, Japan's experience and expertise in disaster management can provide valuable insights and lessons for other countries that are facing similar challenges. It is a valuable resource that provides insight into Japan's disaster management efforts offers important lessons for other countries and organizations that are working to improve disaster resilience and reduce the impact of disasters on communities and societies.

6. Early warning systems

Observation, Forecasting and Warning of Disaster Risks

Observation systems that can accurately detect disaster risks in real-time have been progressively improved for establishing early warning systems, supporting early evacuation and response activities, and thereby reducing disaster damage. Organizations involved in disaster reduction, especially the Japan Meteorological Agency (JMA), use 24-hour systems to carefully monitor various natural phenomena and weather conditions. In addition to observed information, the JMA issues a wide range of forecasts, warnings and advisories. Furthermore, in August 2013, it started to issue "Emergency Warnings" in case of a severe disaster far exceeding the past level of issuing warnings such as heavy rain emergency warning and heavy snow emergency warning.

Five Alert Levels

When a disaster occurs, the government issues various disaster information. Among these, proper understanding of the evacuation information issued by the municipality is particularly important. The Five Alert Levels, which has been implemented since the 2019 flood season, is informed by lessons from the 2018 Japan floods and provides evacuation information as an intuitive guidance for actions residents should take.

- Eg. With Alert Level 3: "evacuation of the elderly, the elderly evacuate from risk areas.
- Alert Level 4: "evacuation instruction," all persons evacuate from risk areas.
- Alert Level 5: "emergency safety securement," the disaster has already occurred, and going outside to designated emergency evacuation sites may be dangerous.

Therefore, actions such as moving to the safer upper floors or to a room that is furthest away from the mountain to protect one's life, would be necessary.

Alert level	Situation	Required action	Evacuation information
5	Disaster occurrence or urgency	Danger of life Secure safety immediately!	Emergency Safety Measures*1
	<Be sure to evacuate by alert level 4!>		
4	High risk of disaster	Everyone evacuates from hazardous places	Evacuation Instruction (note)
3	Risk of disaster	The elderly, etc. evacuate from hazardous places*2	Evacuation of the Elderly, etc.
2	Weather worsening	Check how to evacuate	Heavy rain, Flood, of Storm Surge Advisories (JMA)
1	Risk of weather worsening	Be prepare for disasters	Probability of Warnings (JMA)

*1 Alert level 5 is not always issued, as municipalities may not be able to certainly understand the situation of disasters.
*2 Alert level 3 is the timing for people other than elderly to suspend normal activities and begin evacuating voluntary when feel danger, as needed.
(note) Evacuation warning s are issued at the timing of current evacuation advisory.

Figure 15- Five alert levels

National Early Warning System (J-Alert)

J-Alert is a system which can send emergency information such as warnings of ballistic missile attacks, earthquakes, tsunami and any other bad weather through an artificial satellite and the terrestrial line to prefectures, cities and towns. It automatically activates municipal disaster management radio communication systems and sends information to residents immediately without manpower. It is usually used by the Meteorological Agency to transmit weather information for risk reduction such as weather warnings, information about an earthquake, a tsunami, a volcano eruption, and any other natural disaster. The Cabinet Secretariat sends information about ballistic missiles, air raids, guerrilla attacks, terrorism, and anything else the general population would need warning of. It is done through the transmission facilities of the Fire Agency to prefectures, cities and towns of the country. Nowadays there is another transmission route apart from the one through municipalities, which sends J-alert information to individual cell-phone users by email (i.e. in the form of area mails or emergency alarm mails) from the government through cell-phone service providers. Smartphones sold in Japan come with "Area email"

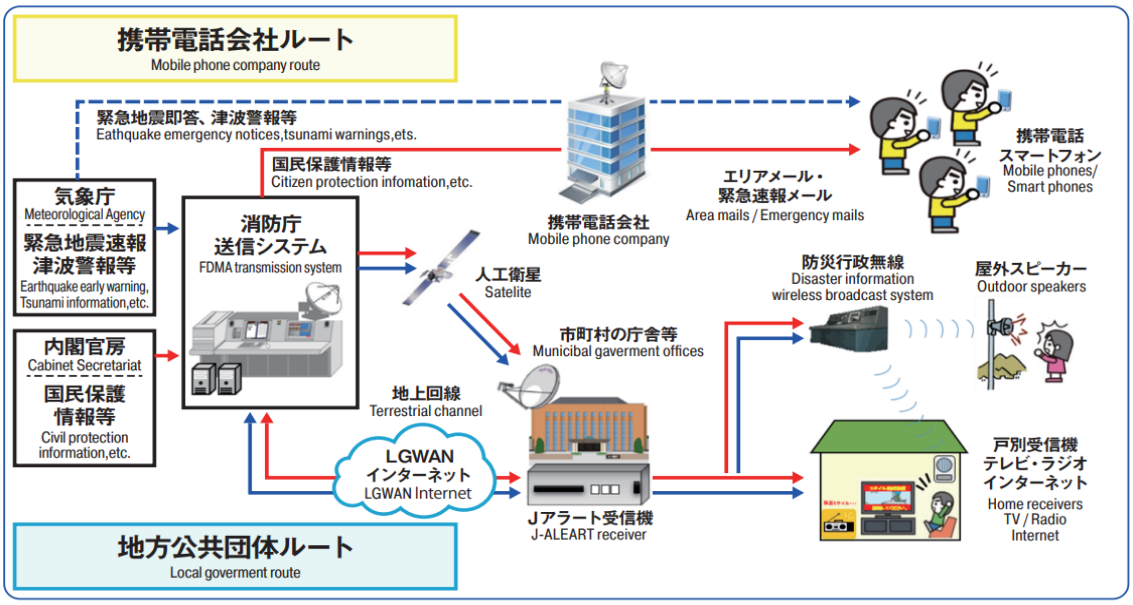


Figure 16- Outline of J-alert system Emergency alert email" installed in and are capable of receiving a J-ALERT.

Disaster Information Sharing System (L-Alert)

L-Alert is a common platform by which local municipalities send necessary information to local residents through various media such as broadcasting societies, television, radio, mobile phones, portal sites and application companies immediately and effectively when a disaster occurs. It was launched in June 2011, and since then it has been used by a lot of information senders. All of the prefectures and metropolis have started operating L-Alert by April 2018, and it plays a certain role as an information infrastructure such as sending reports of the status of the evacuation instruction issuance immediately thus contributing to the smooth provision of information to local residents in times of disaster.

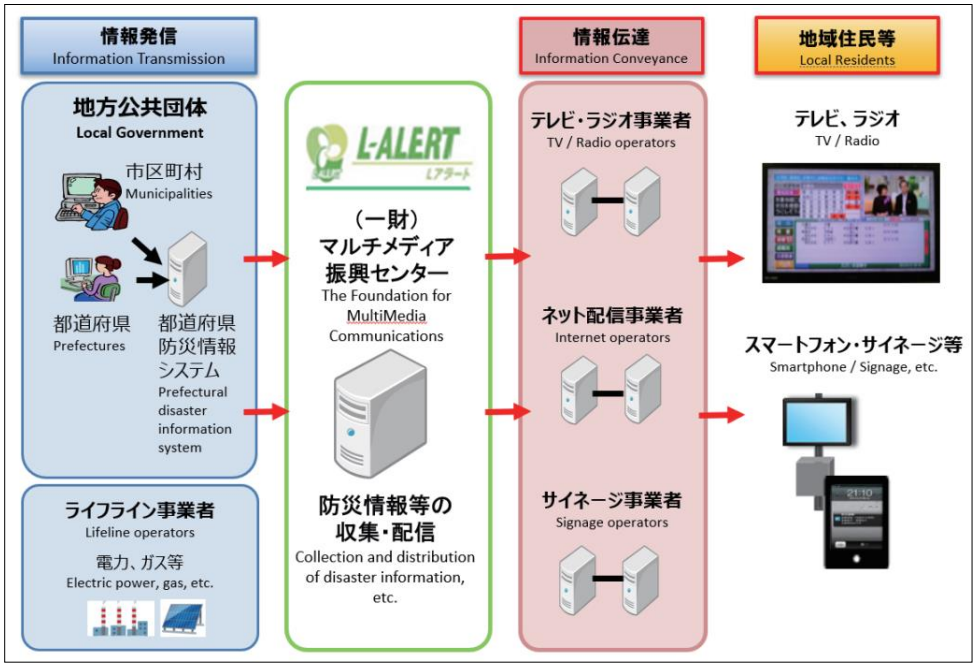


Figure 17- Figure 17: Outline of L-alert system

Information and Communications Systems

Central Disaster Management Radio Communication Network

The central disaster management radio network ensures mutual communication among disaster prevention related organizations nationwide in the event of a large-scale disaster such as an earthquake. In central Tokyo, the Prime Minister's Office, Central ministries, designated public institutions, and the Tokyo metropolitan government are connected by terrestrial micro wireless lines. In addition, these organizations are also equipped with portable satellite communication equipment in case of the Tokyo Inland Earthquake. On the other hand, designated public institutions located in areas other than central Tokyo are connected by satellite communication lines. In the event of a disaster, this system will be used for collecting and sharing information between central ministries, prefectures and designated public institutions, and for video conferencing between the affected prefectures and the prime minister's office. In normal times this system is used for exchanging information such as coordinating disaster-related work and for training in preparation for a disaster.

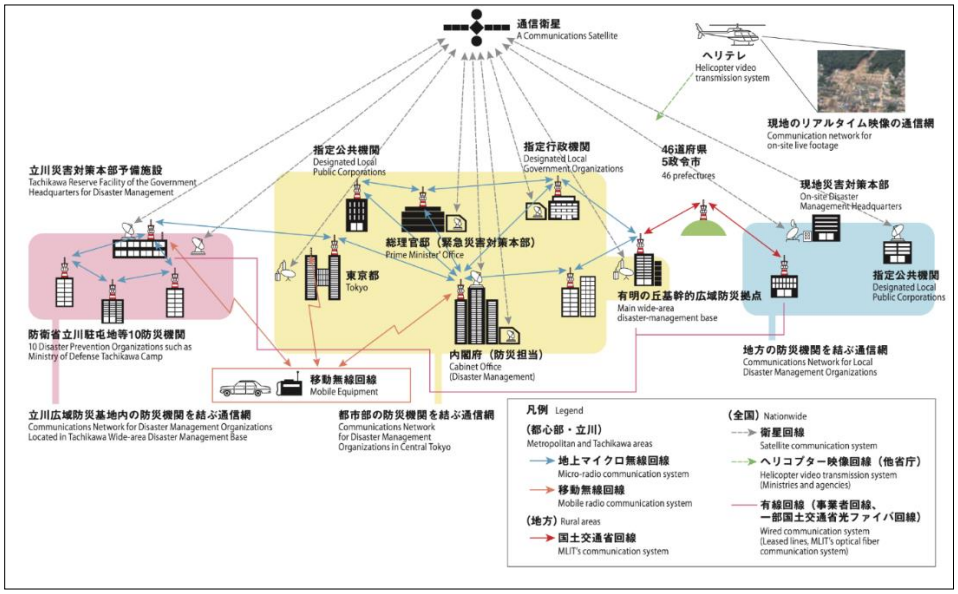


Figure 18- Outline of Central Disaster Management Radio Communication Network

Integrated Disaster Management Information System

Based on the experiences of the Great Hanshin-Awaji Earthquake, the Cabinet Office has an integrated disaster management information system to ensure the quick assessment of damage as well as rapid and appropriate decision-making. The information system consists mainly of the damage estimation function (Disaster Information System, or DIS) and information sharing function (Platform, or PF). After the occurrence of an earthquake, the damage estimation function (DIS) immediately estimates the human/building damage due to the earthquake and tsunami. This is instrumental in understanding the scale of damage during the initial response phase and informs the government's decision-making for dispatch of personnel to affected areas. The information sharing function (PF) visualizes and shares various disaster information collected from disaster management related organizations such as related ministries and agencies as well as infrastructure companies (including data on weather, community lifelines, evacuation, traffic and trains as well as satellite images) on a map. It thereby facilitates the assessment of damage and drafting of countermeasures at the government's Disaster Management Headquarters and meetings of relevant ministries and agencies.

Information Support Team (ISUT)

During times of emergency, it is necessary to quickly collaborate with relevant organizations to take various response measures. To do so, information held by each organization about "what is happening where," must be amassed so that a shared understanding of the situation is possible. Then the strategies about "who does what" can be implemented through placement of personnel and equipment. For apt decision-making by the disaster response personnel, it is essential to visualize this information on maps to systematically understand the situation.

The Cabinet Office and the National Research Institute for Earth Science and Disaster Resilience (NIED) launched as a prototype a dispatch team called ISUT (Information Support Team) in 2018.

- Since 2019 the team has been in full operation. At times of large-scale disasters, the team aggregates damage information and evacuation sites and plots this data on a map to support disaster response by administrative organizations and designated public organizations.
- The team provides an information aggregation website (ISUT Site) as well as creates and shares maps for disaster response personnel on a need-basis. In addition, for information collected by the ISUT that can be made available to the public, they are published on the NIED Crisis Response Site (NIED-CRS) operated by the NIED.
- During the 2020 Kyushu floods, staff were dispatched to the Kumamoto Prefectural Government. The staff helped various organizations assess the damage by supporting data collection and sharing the map produced with the prefectural disaster management headquarters, front-line actors such as police, firefighters and self-defense forces, designated public organizations, and support staff from other local governments.

7. Emergency Response to Disasters

In the event of a disaster, the national and local governments quickly collect and share disaster and damage information, and secure communications to carry out effective emergency activities such as emergency rescue and medical operations. Based on such information, local governments set up disaster management headquarters and related organizations establish their own operation mechanisms.

- The national government collects disaster information at the Cabinet Information Collection Center 24 hours a day. When a large-scale disaster strikes, an emergency team composed of the directors-general of the respective ministries and agencies gathers immediately at the Crisis Management Center in the Prime Minister's Official Residence to grasp and analyze the disaster situation, and report the results to the Prime Minister.
- Disaster Management meetings at the ministerial or high-ranking senior official level are held, as necessary. According to the level of damage, the government may establish the Headquarters for Major Disaster Management (headed by the Minister of State for Disaster Management) or the Extreme Disaster Management Headquarters (headed by the Prime Minister), to establish the policies for the disaster countermeasures, and to coordinate various emergency measures to be taken by various

Figure 19- Government Disaster Response Mechanism

organizations. Further, in order to grasp the situation in the disaster area, a government investigation team headed by the Minister of State for Disaster Management may be dispatched, or if quick and swift actions are needed to be taken with

Wide Area Support Mechanism

- In case of large-scale disasters that exceed the response capacities of the affected local government, various wide-area support mechanisms are mobilized by the Government which includes the Disaster Response Units of the National Police Agency (NPA), Emergency Fire Response Teams of the Fire and Disaster Management Agency (FDMA), Japan Coast Guard.
- The Self-Defense Forces are also dispatched for emergency response activities upon request from the governor of the affected prefecture. Also, personnel such as Disaster Medical Assistance Team (DMAT) provide medical services to the affected people.
- These teams transport severely injured persons via Self-Defense Forces vehicles and aircrafts to hospitals outside the disaster-stricken zone. In addition, the government provides relief goods without awaiting specific requests from affected municipalities. These basic necessities for the affected citizens' lives and living environment are procured by the government and delivered via emergency transportation to the affected areas in a "push-mode" support system.

Coordination between National government and local public entities

In the event of a disaster occurring, municipalities will primarily be engaged in emergency countermeasures as they are the closest to residents. Prefectural administration will get involved when comprehensive wider-area measures are necessary. In the event of a large-scale disaster beyond the capability of local public entities struck by the disaster, the National government will step in to support the local entity and coordinate mutual support among the local entities. At the national level, the Extreme Disaster Management Headquarters or the Major Disaster Management Headquarters is set up to promptly collect the disaster information from relevant ministries and local public entities struck by the disaster, and overall coordination is provided for rescue, first aid, medical and emergency supplies as necessary and appropriate. Also, an on-site disaster management headquarters may be set up to promptly coordinate among the affected local entities and collect information and requests from relevant prefectures and to properly conduct the emergency response activities in consideration to the needs for the affected people.

Disaster Response Agencies

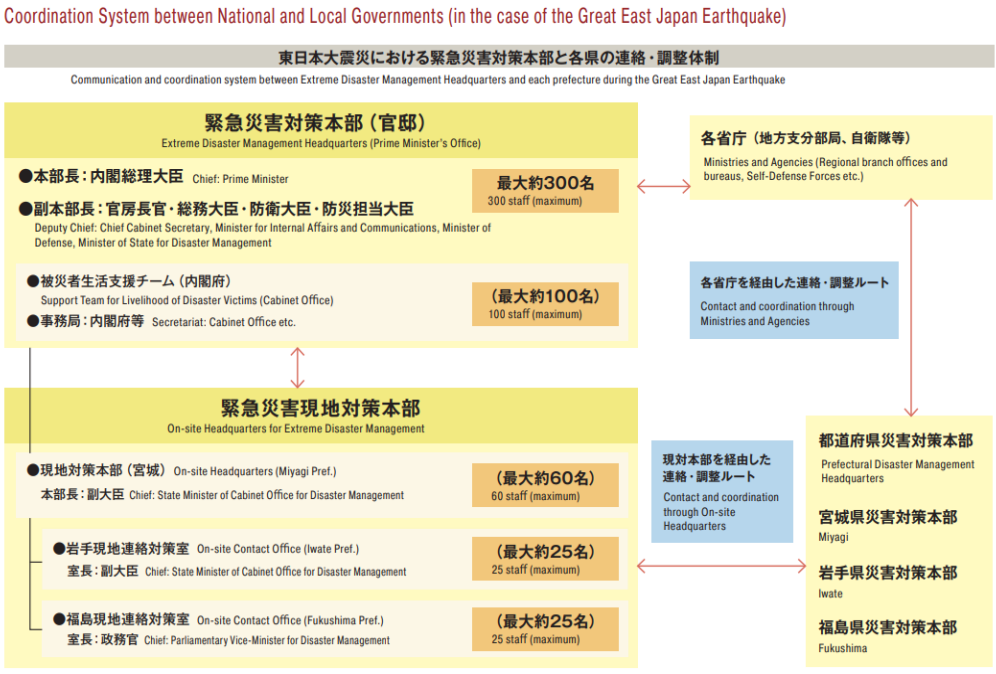


Figure 20- Example of Coordination between National and Local Governments

Various agencies at different levels carry out disaster response operations depending upon the size of the disaster. The following are some important agencies involved in the response activities.

Fire Service Organizations

Fire Service Organizations (FSOs) in Japan are crucial for disaster response, including firefighting, rescue, and medical services. FSOs operate at both national and local levels:
Municipal Level:

- Regular firefighting units: Full-time, professional firefighters employed by municipal governments, trained in firefighting, medical service, and rescue activities.
- Volunteer firefighters: Local residents trained and equipped to support regular firefighting units during emergencies, typically working regular jobs but expected to respond quickly to local disasters.

National Level:

- Emergency Fire Response Teams (EFRTs): Operated by the Fire and Disaster Management Agency (FDMA), comprising highly trained professionals.
- EFRTs respond to large-scale disasters surpassing local FSO capacities, supporting and coordinating with local FSOs, and providing additional resources and expertise.
- FSOs are frontline responders, crucial for protecting lives and property during emergencies in Japan.

National Police Agency

Police play a crucial role in disaster response, ensuring public safety, maintaining law and order, and providing security. In large-scale disasters, police collaborate with fire stations and the Self-Defense Forces (SDF) to:

- Conduct evacuation guidance, rescue operations, and searches for missing persons.
- Perform forensic examinations, identity checks, traffic management, and crime prevention.
- The National Police Agency's (NPA) disaster response units coordinate police efforts and provide support during emergencies.
- Police disseminate vital information to the public through various channels like social media and public address systems.
- Rapid response units are deployed immediately after a disaster for about two weeks, conducting disaster control activities independently.
- General units are dispatched later, engaging in searches, vigilance, traffic control, investigations, and other activities based on disaster area requests.
- Effective coordination with other agencies is crucial for successful disaster response.

Japan Self Defense Forces

- The Japanese Self-Defense Forces (JSDF) are the unified military forces of Japan, established in 1954.
- The JSDF includes the Japan Ground Self-Defense Force, the Japan Maritime Self-Defense Force, and the Japan Air Self-Defense Force.
- They are controlled by the Ministry of Defense with the Prime Minister as commander-in-chief.
- The JSDF's disaster relief role is defined in Article 83 of the Self-Defense Forces Law of 1954.
- The JSDF conducts a variety of disaster relief operations in collaboration with municipal governments when disasters occur.
- Over 100,000 SDF personnel were dispatched for relief operations for the Great East Japan Earthquake in March 2011.
- SDF are deployed only upon the request of the prefectural governor. Municipal Mayors can ask prefectural governors to request a disaster relief dispatch by the SDF.
- In urgent situations, the Minister of Defense or those designated by the Minister may authorize an exceptional dispatch (discretionary dispatch).
- The Minister of Defense is authorized to dispatch SDF once an earthquake or nuclear threat alarm is issued.

Japan Coast Guards

- The Japan Coast Guard (JCG) is a government agency under the Ministry of Land, Infrastructure, Transport

and Tourism (MLIT).

- It's responsible for disaster preparedness and marine search and rescue operations.
- The JCG conducts search and rescue operations in the event of a marine accident.
- It deploys mobile rescue personnel skilled in helicopter rescues, scuba diving, and providing emergency medical treatment.
- The JCG operates a 24/7 maritime accident reporting service through the Global Maritime Distress and Safety System (GMDSS).
- Incidents and accidents can be reported quickly by dialing 118 on a mobile or onboard phone.
- The JCG also responds to natural disasters, such as earthquakes and tsunamis.
- It operates a fleet of vessels and aircraft, including patrol boats, helicopters, and fixed-wing aircraft, to carry out its missions.
- These assets are strategically stationed throughout Japan to ensure rapid response to emergencies.

Disaster Medical Assistance Team (DMAT)

- DMATs are specialized medical aid teams formed after the 2005 Great Hanshin Awaji Earthquake.
- Guidelines for deployment by Ministry of Health Labour and Welfare (MHLW) ensure rapid response within 48 hours.
- Training conducted at National Hospital Organization's Disaster Medical Center for certification.
- Primary mission: emergency medical care, triaging, stabilizing, treating injuries/illnesses, and mental health support.
- Teams comprise 4-5 members: doctors, nurses, coordinators.
- 1,686 teams and 14,204 personnel nationwide (as of March 2019).
- Deployed in various disasters including earthquakes, heavy rains, and typhoons.
- Support hospitals during crises (e.g., water interruptions, power outages), evacuate patients.
- Integral part of Japan's disaster response, offering critical medical aid efficiently.

BOKOMI

- BOKOMI is a volunteer organization in Kobe City, formed after the 1995 Great Hanshin Awaji earthquake.
- Goal: Reduce disaster risks and ensure community preparedness.
- Unique aspect: Combines disaster response with local welfare activities.
- Made up of elementary school district-based voluntary groups collaborating with local government and fire department.
- First responders during emergencies, ensuring safety and control.
- Conducts various emergency drills: rescue, evacuation, information transmission, flood control.
- Local government provides equipment and materials; storehouses in parks for emergency supplies.
- Conducts welfare activities like lunch gatherings for elderly and community-building initiatives.
- Strengthens the city's disaster management system through combined efforts.

8. Learnings for India

a) **White Paper on Disaster Management**: The annual White Paper on Disaster Management providing an outline of the government's policies, measures, and initiatives for disaster management. India could benefit from a similar document, which would provide a roadmap for disaster management.

b) **DM plans at Community level:** Each community area develops a Disaster Management Plan based on the hazards and vulnerability in the area. These plans are periodically reviewed and updated to ensure that they remain relevant. Such an approach in India would ensure that every community is well-prepared to handle disasters.

c) **BOKOMI- Community Organization for Disaster and Welfare Management**: The Community Organizations like BOKOMI play a crucial role in times of disasters. These organization combines disaster response with local welfare activities during normal times. The organization is made up of various voluntary groups that collaborate closely with the local government and fire department. India could benefit by training similar organizations, which would help in building resilience at the community level.

d) **Business Continuity Plan**: The Business Continuity Plan stipulates that the executive systems continue to run the government services smoothly in the event of a disaster. It ensures effective response during the times of crisis. Implementation of a similar system in India will help in better response and quick resumption of normal activities.

e) **Communication Network**: The central disaster management radio network of Japan ensures communication among disaster prevention related organizations nationwide in the event of a large-scale disasters. This system uses communication satellites and other redundancies to keep up the communication and also for dissemination of alerts and warnings to the public. Similar system in India can improve the preparedness for disasters.

f) **Human Resource Development**: Japan places a strong emphasis on human resource development in disaster management. The country provides regular training to disaster management personnel, including government officials, first responders, and volunteers. India could benefit from a similar approach, as it would ensure that the country has a skilled workforce that can effectively respond to disasters.

g) **Evacuation sites and Emergency shelters**: In Japan, the network of evacuation sites and emergency shelters that can be quickly activated in the event of a disaster. The sites are equipped with basic facilities such as food, water, and medical supplies. India could benefit from the establishment of similar facilities, which would provide a safe haven for people affected by disasters.

h) **Community-Driven Approach**: Japan heavily emphasizes community involvement in DRR planning. Local residents have a voice in identifying risks and collaborating on mitigation measures tailored to their neighborhoods.

i) **Advanced Technology**: Japan invests significantly in technologies like early warning systems, hazard mapping tools, and resilient construction materials to improve disaster preparedness.

j) **Land-use Planning**: Strict zoning regulations limit building in high-risk hazard zones such as flood plains or landslide-prone areas. Critical infrastructure is often located in areas with less susceptibility to damage.

k) **Building Codes**: Some of the world's most stringent building codes are in place to ensure structures withstand earthquakes, typhoons, and other hazards. Retrofitting older buildings is also a continuous effort.

l) **Flood Management**: Japan utilizes a multi-layered approach using dams, levees, retention basins, and green infrastructure to control floodwaters. They've also created innovative underground discharge channels in cities like Tokyo.

m) **Infrastructure Protection**: Critical infrastructure like power grids, water systems, and transportation networks are designed with redundancy and protection. They're distributed geographically in case of disruption in one area.

n) **Early Warning Systems**: A nationwide network of sensors and communication systems provide real-time alerts on earthquakes, tsunamis, volcanic eruptions, and weather events. This helps authorities and the public take timely action.

o) **Education and Drills**: Regular drills and public education campaigns are a fundamental aspect of Japan's DRR strategy. Residents across all ages learn preparedness practices for various disasters.

Examples of Successful Implementation

1) Kamaishi City's Seawall: The seawall in Kamaishi City saved many lives during the 2011 Tohoku earthquake and tsunami. This is a prime example of effective hard infrastructure measures.
2) Tokyo's Underground Discharge Channels: Tokyo's massive underground floodwater diversion channels protect the city from frequent flooding, demonstrating innovative engineering for urban resilience.
3) Kansai Earthquake Memorial Museum: Museums like this serve as educational centers on past disasters, ensuring public memory and awareness remain high.
4) Continuous Improvement: - Japan recognizes DRR as an ongoing process. Their approach is constantly reviewed and improved considering new knowledge and evolving risks. Additionally, they share their expertise and work with other nations to enhance global disaster resilience.

5) Building Design and Retrofitting:

I. Hospitals: Many hospitals, particularly in earthquake-prone areas, are built with seismic isolation base systems, allowing them to move slightly during an earthquake, minimizing structural damage and ensuring continued functionality for emergency response.

II. Shinkansen (Bullet Train): The Shinkansen network incorporates numerous safety features like automated train control systems, earthquake detection and automatic shutoff mechanisms, and track resilience strategies to ensure passenger safety.

Here's what India can learn from Building Design and Retrofitting:

1. Seismic-Resistant Design Principles:
    a. Strict Building Codes: Implement stricter building codes that mandate earthquake-resistant features in new constructions, especially in high-risk zones. These codes should address factors like material selection, structural design, and foundation systems.
    b. Hospital Design: Prioritize seismic isolation base systems, especially for critical facilities like hospitals, to ensure their functionality during and after earthquakes.
2. Retrofitting Existing Structures:
    a. Vulnerability Assessment: Conduct vulnerability assessments of existing buildings, particularly critical infrastructure, and public spaces, to identify those most in need of retrofitting.
    b. Retrofitting Programs: Develop and implement government-funded or subsidized programs to encourage and financially support the retrofitting of vulnerable buildings.
3. Advanced Safety Technologies:
    a. Invest in Research: Invest in research and development of advanced earthquake safety technologies like automatic shutoff mechanisms and early warning systems.
    b. Infrastructure Resilience: Integrate strategies for track and infrastructure resilience into transportation networks like railways and metro systems.
4. Additional Considerations:
    a. Public Awareness: Educate the public about the importance of earthquake-resistant construction and the benefits of retrofitting existing buildings.
    b. Incentives for Compliance: Provide incentives for builders and homeowners to comply with stricter building codes and retrofitting programs. This could include tax breaks or low-interest loans.

c. Skilled Workforce: Develop a skilled workforce of engineers, architects, and construction workers trained in earthquake-resistant design and retrofitting techniques.

6) Nature-Based Solutions:

- Green Spaces and Urban Parks: Japan incorporates green spaces and urban parks into its urban planning to absorb rainwater, reduce flood risk, and mitigate urban heat island effects. These areas also serve as evacuation spaces during disasters.
- River Restoration and Floodplain Management: Japan has undertaken river restoration projects and implemented floodplain management measures to reduce the impact of flooding in urban areas. Natural riverbanks and widened channels help to control floodwaters and protect surrounding communities.
- Green Roofs and Vertical Gardens: Japanese cities promote the installation of green roofs and vertical gardens on buildings to enhance urban biodiversity, improve air quality, and reduce stormwater runoff. These features also provide insulation and help regulate temperatures within buildings.
- Sponge Cities: Japan has embraced the concept of "sponge cities," which involves designing urban areas to absorb, store, and reuse rainwater efficiently. Permeable pavements, rain gardens, and retention ponds are integrated into urban landscapes to manage stormwater runoff effectively.
- Tsunami Resilience: In coastal areas prone to tsunamis, Japan has implemented nature-based solutions such as mangrove forests and coastal vegetation buffers to reduce wave impact and erosion. These natural barriers help protect coastal communities and infrastructure from the devastating effects of tsunamis.
- Ecosystem-Based Disaster Risk Reduction: Japan recognizes the importance of ecosystem-based approaches for disaster risk reduction. This includes preserving natural habitats such as forests, wetlands, and coastal ecosystems, which provide valuable services such as landslide prevention, storm surge protection, and biodiversity conservation.

Here's what India can learn from Nature-Based Solutions undertaken by Japan:

- Green Spaces: Integrate urban parks to absorb rainwater, mitigate floods, and provide evacuation spaces during disasters.
- River Management: Undertake river restoration projects to control floodwaters and protect communities.
- Green Infrastructure: Encourage green roofs and vertical gardens to improve air quality, reduce runoff, and regulate temperatures.
- Sponge Cities: Design urban areas to absorb and reuse rainwater efficiently, reducing flood risks.
- Coastal Resilience: Implement coastal vegetation and mangrove forests to mitigate tsunami impacts and erosion.
- Ecosystem Preservation: Recognize the role of natural habitats in disaster risk reduction, such as forests and wetlands.

7) Community Engagement and Preparedness:

I. Community Disaster Management Plans: Many communities develop detailed plans outlining evacuation routes, designated shelters, and communication protocols in case of emergencies. These plans are often created collaboratively with residents, ensuring they cater to specific local needs and vulnerabilities.

II. Volunteer Networks: Japan has a strong tradition of volunteerism, particularly in disaster response. Local communities often have well-organized volunteer networks that can quickly mobilize to assist in rescue and recovery efforts after a major event.

Here's what India can learn from Community Engagement and Preparedness:

1. Collaborative Disaster Management Plans:
    - Develop Localized Plans: India can replicate Japan's model of creating community-specific disaster management plans. These plans should consider local topography, demographics, and potential hazards.
    - Resident Participation: Encourage resident participation in creating these plans. This fosters a sense of ownership and ensures the plans address the community's unique needs and vulnerabilities.
2. Strengthening Volunteer Networks:
    - Promote Volunteerism: India can cultivate a stronger culture of volunteerism, especially for disaster preparedness and response. This could involve campaigns, workshops, and incentives to encourage people to volunteer their time and skills.
    - Organize Local Networks: Facilitate the creation of well-organized volunteer networks within communities. These networks can be trained in basic disaster response skills and mobilized quickly during emergencies
3. Additional Considerations:
    - Communication Strategies: Learn from Japan's communication protocols for emergencies. Develop clear and accessible communication plans to ensure timely and accurate information reaches everyone in the community.
    - Multilingual Resources: Considering India's diverse population, ensure disaster preparedness information and materials are available in multiple languages.
    - Vulnerability Assessment: Identify and address the specific vulnerabilities of different communities. This might involve considering factors like poverty, access to resources, and infrastructure.

8) Resilient Urban Design.

I. Distributed Green Infrastructure Networks: Integrating green spaces, rain gardens, green roofs, and permeable surfaces throughout the urban fabric can reduce flood risk by absorbing run-off, while also improving air quality and lowering urban heat island effects.

II. Mixed-Use Zoning: Encouraging a mix of residential, commercial, and civic functions within neighborhoods creates less reliance on transportation networks during disasters, fosters strong community networks, and promotes faster post-disaster recovery.

III. Elevated and Flood-Proofed Buildings: Designing areas susceptible to flooding with buildings raised on stilts or with waterproofed and elevated lower floors can reduce damage and allow continued use during flood events.

Here's what India can learn from Resilient Urban Design:

1. Adapting to Local Needs:
    - Climate: While Japan focuses on earthquakes and floods, India has a wider range of concerns. Techniques like distributed green infrastructure can be applied for drought mitigation too.
    - Urban Fabric: Indian cities are often denser than Japanese ones. Mixed-use zoning can be implemented strategically to create more resilient pockets within existing neighborhoods.
2. Implementation Considerations:
    - Cost-Effectiveness: Green roofs might be expensive in some areas. Explore alternatives like native plant gardens or vegetative swales.
    - Social Equity: Elevated buildings might displace lower-income communities. Explore raising only critical infrastructure (hospitals, schools) and using flood-proofing techniques for homes.
3. Building on Strengths:
    - Informal Communities: India has a large informal sector. Look for ways to integrate them into resilient design plans, such as community gardens on rooftops.
    - Existing Initiatives: Many Indian cities have greening projects. Leverage these and create a city-wide

network.

Overall, Japan's approach highlights the importance of a multi-pronged strategy for urban resilience. By adapting these concepts to India's specific context and leveraging existing strengths, Indian cities can become more prepared for future challenges.

9) **Japan's investment in various disaster museums** serves as a testament to its commitment to disaster preparedness, education, and community resilience. These museums play a pivotal role in raising awareness, educating the public, and preserving the memory of past disasters. Here's how they benefit the Japanese community:

   Benefits of Japan's Disaster Museums:
   - Education: Raises awareness about disaster risks and responses.
   - Cultural Preservation: Preserves cultural heritage related to past disasters.
   - Community Engagement: Facilitates dialogue and collaboration among stakeholders.
   - Innovation Promotion: Showcases advancements in disaster risk reduction technologies.
   - Psychosocial Support: Provides spaces for reflection and healing for affected communities.

Here's what India can learn from Japan's investment in various disaster museums:

- Invest in public education and awareness.
- Preserve cultural heritage related to disasters.
- Promote community engagement and collaboration.
- Foster innovation in disaster risk reduction.
- Provide psychosocial support for affected communities.

10) **International collaborations & knowledge transfer:-** Japan actively participates in international collaborations on developing and sharing advanced technologies for disaster risk reduction. They are instrumental in promoting innovation and knowledge exchange to enhance global resilience to natural hazards. Major Initiatives are:

- Global Leader in DRR Conferences: Japan has hosted key UN World Conferences on Disaster Risk Reduction, like the one in Sendai in 2015 that led to the Sendai Framework for Disaster Risk Reduction (SFDRR) - a global roadmap for DRR.
- The Asian Disaster Reduction Center (ADRC): Headquartered in Kobe, Japan, the ADRC serves as a regional knowledge hub for disaster risk reduction in Asia. It facilitates collaboration, training, and information exchange among member countries.
- Science & Technology Cooperation: Japan actively participates in programs like the Integrated Research on Disaster Risk (IRDR) - an international initiative that brings together scientists to find solutions for disaster risk management.
- IRP:- internationally recognized as the principal platform for the sharing of experiences and learnings on approaches to build back better in recovery. It has goal to proactively contribute to the implementation of Priority Four of the Sendai Framework and lead discussions around the issue of building back better at international forums.

11) Sharing Advanced Technologies, :

- Japan International Cooperation Agency (JICA): JICA shares Japan's expertise in areas like early warning systems, earthquake-resistant building design, and flood control infrastructure with developing countries.
- Public-Private Partnerships: Japan fosters collaboration between its government, research institutions, and private companies to develop and share cutting-edge DRR technologies.
- "Sendai Cooperation Initiative": This initiative by Japan aims to assist developing countries in implementing the SFDRR by providing technological advancements and capacity building programs.

- Promoting Research & Development: Japan supports research into new DRR technologies like AI-powered disaster prediction systems and improved building materials for resilience.

12) Technology and Innovation:

I. Early Warning Systems: Japan's J-Alert system delivers real-time earthquake and tsunami warnings through various channels, including television, radio, and mobile phones. This allows for immediate evacuation and life-saving measures.

II. Hazard Mapping: Detailed hazard maps are readily available to the public, outlining areas susceptible to specific threats like floods, landslides, and liquefaction. This information helps individuals and communities make informed decisions about risk mitigation and preparedness.

III. Innovations in Technology and DRR in Japan: AI-Powered Disaster Management: Spectee,geobingan a Japanese company, developed AI-powered software that analyzes social media data, weather information, and traffic cameras to provide real-time insights into disaster situations. This allows authorities to respond more effectively and efficiently to unfolding emergencies.

IV. 3D Flood Simulation Tools: Advanced software programs can simulate potential flood scenarios in high detail, factoring in terrain, weather patterns, and infrastructure. This information helps engineers design flood protection measures and allows authorities to plan evacuation strategies for different flood scenarios.

V. Drones and Robots: These technologies play a crucial role in post-disaster situations. Drones can be used for search and rescue operations, damage assessment, and aerial photography, while robots can be deployed in dangerous environments to locate survivors or assist in debris removal.

VI. Supercomputer Applications: Japan's Fugaku, the world's fastest supercomputer, has been utilized for various DRR applications, including simulating, and predicting the behavior of typhoons and providing insights into potential earthquake risks.

VII. Smart Infrastructure: Sensors embedded in critical infrastructure can monitor its health and provide real-time data on potential vulnerabilities or damage during disasters. This allows for preventative maintenance and faster response to issues.

VIII. Predictive Analytics for Infrastructure Management in DRR-Predictive analytics plays a crucial role in DRR by leveraging data and machine learning algorithms to anticipate potential problems within infrastructure before they occur. This allows for proactive maintenance and mitigation strategies, ultimately enhancing urban resilience and minimizing disruption during disasters.

IX. Crowd-Sourced Damage Assessment in DRR: Utilizing the Power of the Public Crowd-sourced damage assessment (CSDA) is a relatively new and innovative approach in disaster risk reduction (DRR) that leverages the collective knowledge and presence of citizens to gather information about the impact of a disaster.

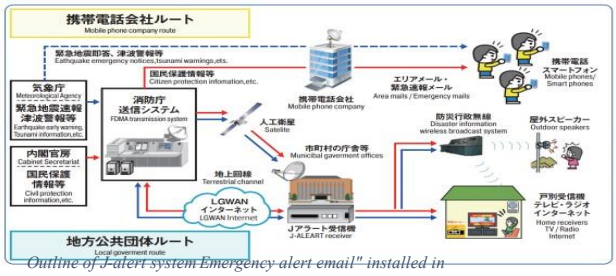
X. Virtual Reality Disaster Simulations: Creating VR simulations for residents and businesses to realistically experience different hazards. This can increase preparedness and improve decision-making during emergencies.

XI. Knowledge Sharing Platforms: Creating platforms to share detailed project methodologies, regulatory standards, and lessons learned with other disaster-prone nations, fostering global capacity building. Joint Innovation Programs Partnering with countries to co-develop new DRR technologies, leveraging diverse expertise, and sharing the costs of research and development.

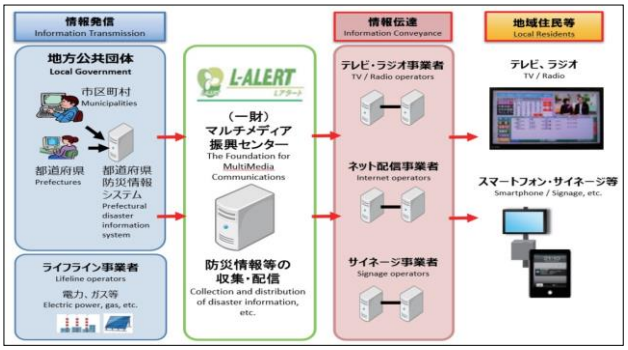
In conclusion, India by adopting some of the above-mentioned aspects can improve its disaster preparedness and response capabilities, and ultimately, save lives and mitigate the impact of disasters.

Best Examples

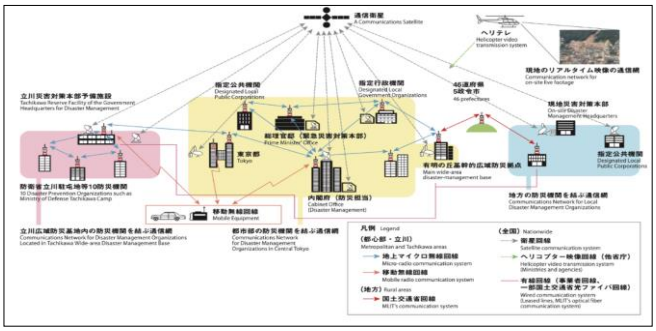
CommunicationInfrastructure



Outline of J-alert system Emergency alert email" installed in and are capable of receiving a J-ALERT.



Outline of L-alert system



Outline of Central Disaster Management Radio Communication Network

Japan's investment in various disaster museums and learning centres

CommunityEngagement and Preparedness

Sports Festival + DRR
(source: Himeji city home page)

Community Leader Training
(source: Hyogo Pref. EM &Training Center home page)

Storyteller

International collaborations & knowledge transfer

JICA

ASIAN DISASTER REDUCTION CENTER

SENDAI FRAMEWORK
FOR DISASTER RISK REDUCTION 2015-2030
SUSTAINABLE DEVELOPMENT GOALS
PARIS2015

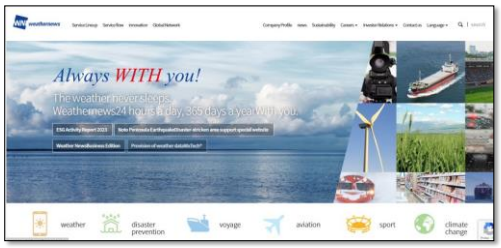
IRP INTERNATIONAL RECOVERY PLATFORM

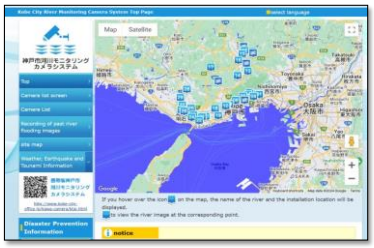
unesco
Centre Under the auspices of UNESCO

ICHARM
International Centre for Water Hazard and Risk Management under the auspices of UNESCO

SENTINEL ASIA

Innovation& Technology development





9. Conclusion

Japan's susceptibility to a myriad of natural disasters, including earthquakes, tsunamis, typhoons, floods, and landslides, underscores the necessity for a robust disaster management framework. Such a framework encompasses a continuum of measures spanning prevention, preparedness, response, and recovery.

Enshrined within Japan's legislative framework is the pivotal Disaster Countermeasures Basic Act of 1961, mandating proactive measures at both national and local levels. This legislation delineates governmental roles and fosters inter-agency collaboration, overseen by the Cabinet Office and the Central Disaster Management Council, chaired by the Prime Minister.

Dynamic updates to this framework are achieved through amendments to key acts and the dissemination of the White Paper on Disaster Management, elucidating government strategies and initiatives.

At the operational level, the bedrock of Japan's disaster preparedness lies in meticulously crafted plans: the Basic Disaster Management Plan, Community Disaster Management Plans, and Business Continuity Plans, designed to facilitate post-disaster functionality.

Japan's sophisticated early warning apparatus, comprising the J-alert and L-alert systems, coupled with robust communication networks like the Central Disaster Management Radio and Information Support Teams, are instrumental in disseminating critical information.

In the face of crisis, Japan's emergency response apparatus mobilizes a coalition of agencies, including fire services, law enforcement, self-defense forces, coast guards, medical assistance teams, and community volunteers, fostering seamless coordination and wide area support.

Human resource development initiatives, exemplified by disaster readiness drills and exercises, bolster community resilience and preparedness, ensuring effective evacuation and provision of emergency shelters.

Despite considerable investment in readiness, exemplified by mitigation efforts and early warning systems, monumental disasters like the Great East Japan Earthquake exposed vulnerabilities. However, Japan's adaptive approach to disaster management, informed by past experiences and leveraging predictive technologies, underscores its commitment to continual improvement.

In summary, Japan's evolving disaster management paradigm epitomizes its experiential wisdom, marked by a high degree of preparedness and adaptability in confronting natural calamities.

10. References

Early Warning Systems:

- **Earthquake Early Warning:** Seconds of warning before tremors hit, allowing crucial actions (reference: https://www.jma.go.jp/jma/en/Activities/eew.html).
- **Flood Forecasting and Warning:** Real-time data analysis predicts floods, enabling timely evacuations (reference: https://www.mlit.go.jp/en/).
- **Volcanic Activity Monitoring:** Sophisticated monitoring warns of eruptions, guiding evacuations (reference: https://www.kazan-pj.jp/en/emergency-observation).

Infrastructure Resilience:

- **Seismic Design Standards:** Stringent building codes ensure structures withstand earthquakes (reference: https://www.bcj.or.jp/upload/international/baseline/BSLIntroduction201307_e.pdf).
- **Multifunctional Infrastructure:** Infrastructure doubles as shelters, escape routes, and supply hubs (reference: https://www.mlit.go.jp/river/bousai/olympic/en/index.html).
- **Flood Protection Measures:** Robust levees, channels, and flood-resistant buildings minimize flood damage (reference: https://www.mlit.go.jp/river/bousai/olympic/en/index.html).

Community Preparedness & Risk Communication:

- **Regular Drills and Simulations:** Frequent drills prepare communities for emergencies (reference: https://en.wikipedia.org/wiki/Disaster_Prevention_Day).
- **Comprehensive Hazard Maps & Risk Assessments:** Publicly available maps raise awareness and inform preparedness plans (reference: https://www.gsi.go.jp/ENGLISH/page_e30071.html).
- **Multilingual Communication:** Information during disasters is disseminated in multiple languages for inclusivity (reference: https://www.metro.tokyo.lg.jp/english/guide/bosai/index.html).

Technology Sharing & Capacity Building:

- **Catalog of Technologies for DRR:** Online platform showcases Japan's DRR technologies (reference: https://www.mlit.go.jp/river/bousai/olympic/en/index.html).
- **Training Programs and Workshops:** Japan shares expertise and best practices through training (reference: https://www.bousai.go.jp/index-e.html).
- **International Partnerships:** Japan collaborates globally to build resilience (reference: https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030).
- https://www.data.jma.go.jp/vois/data/tokyo/STOCK/souran_eng/intro/volcano_list.pdf
- https://www.mofa.go.jp
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  https://pubs.usgs.gov/gip/dynamic/fire.html
- White Paper on Disaster Management in Japan (2012 to 2022)
- River Bureau Ministry of Land,Infrastructure,Transport and Tourism, JAPAN (mlit.go.jp)
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- Disaster Countermeasures Basic Act (No.223, November 15, 1961)

  https://www.jica.go.jp/english/news/field/2019/20200117_01.html
- JMAJ, January/February 2013—Vol.56, No.1 (https://www.med.or.jp/english/journal/pdf/2013_01/025_029.pdf)

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- Presentation/lecture materials during ADRC classes, visits, conferences and meetings.