**Disaster Resilience in Fukushima, Japan**

Floods, earthquakes, hurricanes and typhoons are some of the worst natural disasters. The Yangtze floods in 1931 in Eastern and Central China killed around 3.7 million people. The Kashmir earthquake in 2005 in Pakistan, caused landslides killing around 79,000 people. The Haitian Earthquake in 2010 caused death of around 250,000 people and left hundreds of thousands displaced. The 1923 Tokyo Yokohoma earthquake caused subsequent wildfires that led to 140,000 deaths of people and most houses burnt down. (Lake)

Typhoon Nina – Banqiao Dam Failure in 1923, causing the death of 26,000 people. Contamination and famine, due to the floods caused the death of around 145,000 people. In the 1900, a great Hurricane occurred in Galveston, Texas, leading to the death of 8,000 people and 10,000 people misplaced. (Lake)

Natural disaster occur in different parts of the world causing damage of property and loss of lives. Japan is prone to natural disasters compared to other countries due to its topography, geography and climate. Earthquakes, tsunamis, typhoons, landslides and volcanic eruptions are some of the natural disasters frequently occurring in Japan. The archipelago is located along the ring of fire, where tectonic plates meet making the area prone to natural disasters (Klein, January 6 2023).

In March, 2011, Fukushima Japan experienced the Great East Japan Earthquake. The earthquake was accompanied by a severe tsunami, with a height of two story building, causing the death of around 20,000 people and 500,000 people evacuated from the area (Reid, May 9 2019). The tsunami flooded the reactors of Fukushima Daiichi nuclear plant causing leakage of radiation from the plant. For the plant to be decommissioned it will take many more years. Human settlement in the area still discouraged, due to the contamination of the environment in the area with radiation. (BBC, 2021)

The impact of the 2011 earthquake and other natural disasters that have been occurring in Japan has led to the government and communities developing measures to build resilience towards natural disasters. Case studies, risk management and disaster management framework have been developed to help build resilience of the community to natural disasters.

**Risk Management**

Risk management involves careful planning to ensure that the community and affected persons are able to continue their normal operations as much as possible, in the event of occurrence of a natural disaster. Disaster Risk Reduction mechanisms are incorporated, reducing physical and economic loss due to natural disasters. Japan has used technology to reduce the risk and impact of natural disasters in Fukushima.

Installation of early warning systems in gadgets

Japan has installed early warning systems in smartphones, able to detect tremors that occur before an earthquake, allowing people to evacuate into safe spaces.

Drones and Robots

Technology development in Japan has led to development of drones and robots to address the possible impact of natural disasters. The drone is uses thermal infrared imaging to detect people and ascertain their location as well as condition, aiding the rescue team in identifying the vulnerable people in the situation. The drones are very helpful to fire and police departments. (Disaster Prevention Technology Japan)

Robots are function as well as humans would. To manage natural disaster risks, robots access and investigate hazardous sites, helping identify extent of damage as well as identify any casualties or people who need help. The robots helps guarantee the safety of the rescue team. (Disaster Prevention Technology Japan)

Use of technology to predict the occurrence of rainstorms and the impact of tsunamis.

Japan has developed an app that can measure rain clouds and also determine the size of storms using radar technology. One is able to accurately measure rainfall due to its high speed and three-dimensional properties. The app allows the users to detect heavy rainfall before it occurs. (New App ( tenki.jp Tokyo Raincloud Radar) Released, 2020)

Technology developed by Tohoku University used to assess the impact of natural disasters. The technology is able to determine the height, scale, range and number of people within range of an incoming Tsunami, after an earthquake. The information is distributed within 30 minutes, allowing prevention of fatalities upon occurrence.

**Case Studies of Natural Disasters in Japan**

Case studies have been used to examine and analyze the impact of natural disasters in Japan. Japan has experienced several natural disasters over the years including tsunamis, typhoons, earthquake, landslides and volcanic eruptions.

In July 2018, residents of Soja, Japan experienced heavy rainfalls that led to the explosion of an aluminum recycling factory. The explosion was caused by flood water reaching the Molten Aluminum chamber within the factory. Another factory and neighboring houses were destroyed due to the explosion. The incident caused 273 casualties, 432 injured and 8 missing people. (Mieko Kumasaki, 2020)

By use of various cases studies, Japan is able to minimize impact of natural disasters. Measures are put in place to ensure safeguarding of human life and minimal impact on property based on past experiences. For example, Japan has been able to establish the cause of the explosion in Soja. Ensuring isolation of safe storage of hazardous materials in factories is one of the measures that could be implemented to ensure prevention of explosion of factories, in case of flooding.

**Framework for Disaster Management.**

Japan has a Disaster Management Plan, developed by The Central Disaster Management council for tsunamis and earthquakes. The management plan is localized to address specific area needs, in this case Fukushima. The Management plan involves investing resources in research and innovation of monitoring systems, creating awareness on evacuation, safety drills and hazard maps and incorporating disaster management in urban use and development. (Ikeda)

The Fukushima earthquake was not only a natural disaster but also and industrial disaster. The Daiichi nuclear plant that was destroyed by the tsunami was eventually closed but remained an environmental hazard due to emission of radiation from the plant to the environment. The incident creates the need to have structural measures in place to control and manage natural disasters.

**Structural Measures**

The government of Fukushima has put in place structural measures to ensure both industrial and natural impact due to natural disasters are controlled.

**Improvement of rivers**

Fukushima has been part of the Abukuma River Integrated Flood Management Project. The projects has been developed to reduce and control floods in the area on occurrence of natural disasters. Equipping rivers with flood alert systems while designating other rivers as flood alert rivers will help control the impact of the floods. People can be evacuated in a timely manner preventing casualties due to flooding. (Abakuma River Intergrated Flood Management Project, January 2020)

**Development of Flood-risk urban design.**

Urban designs in Fukushima have been improved by designating disaster risk areas. In order to reduce chances of damage, the houses are built as earthquake-proof and with raised floors. The measures will prevent human death and loss of property on occurrence of an earthquake or tsunami. (Abakuma River Intergrated Flood Management Project, January 2020)

**Development of water drainage systems**

Proper drainage in Fukushima will help reduce flooding in Fukushima. Japan has developed a drainage system that has helped reduced floods in the area by 90%. Japan constructed the World’s largest diversion facility, with a depth of 50 meters underground. When water levels in rivers rise, due to heavy rainfall, excess water flows into the facility therefore floods are prevented. (Japan: Smart Water Drainage Facility Reduces cost of Damage Caused By Floods by 90%, April 2023)

Non-structural measures have been put in place to help the Fukushima community mitigate and control the impact of natural disaster. Partnership of the local people, with the government and the private sector has led to successful implementation of the measures.

**Disaster Risk Reduction Education**

Japan has incorporated Disaster Risk Reduction Education in schools. The capacity of the student to respond to disaster prevention initiatives within their community is enhanced. Frequent natural disaster drills are part of the curricula in school, ensuring that students have practical skills necessary to manage and control national disasters.

**Disaster Management Drills**

The Japan Health and Safety Act has incorporated risk awareness programs as part of disaster management. This includes emergency planning, safety response and evacuation drills. Highest safety levels are also ensured through improved designs and regularly testing and updating evacuation drills.

**Indigenous Knowledge**

The local people have also accumulated knowledge on disaster management specific to Fukushima area. The frequent occurrence of earthquakes and typhoons of different magnitude has led the community to develop preventive measures to control the impact of natural disaster. The preventive measure have been passed down from generation to generation building resilience over the impact of natural disaster in Fukushima overtime.

Land-use related measures

Ten years since the 2011, Earthquake in Fukushima, the community has not relocated back to the area near the nuclear plant. Not only is the area a flood-risk but could also be hazardous since the nuclear plant has not been decommissioned. Building a resilient community in Fukushima has been successful since the residents were relocated to a higher ground. The relocation and design has been structured to reduce damage should a tsunami occur. The location will hopefully sustain the community’s livelihoods. (Ishiwatiri)