

# The impacts of natural disasters on Asian economies: Case studies of earthquakes and tsunamis in Japan, and storms and floods in Vietnam

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Received 30 October 2011

**Abstract.** This paper examines the impacts of natural disasters on Asian economies through two cases of natural disasters in Japan and Vietnam. The paper uses published statistics and the opinions of experts together with personal analysis to examine these two cases, focusses on discussing the impacts of natural disaster on the economy of these two countries, and then expands conclusions to the scope of other Asian economies. The paper argues that natural disasters have considerable consequences on human life and economies, and lead to long term damage in Asia. The paper concludes by inferring some policy implications to help Asian countries minimize the impacts of natural disasters on their economies. It is emphasized that individual nations should understand the importance of nature and collaborate closely to protect nature and minimize the impact of disasters.

*Keyword:* Natural disaster, impacts, Japan, Vietnam, Asia.

## 1. Background

Millions of people are affected by harmful natural disasters annually. Such disasters could be explosions, earthquakes, floods, storms, or fires. In a disaster, people must face the risk of death, injury, or becoming lost and may lose their houses, properties, and relatives. Therefore, natural disasters can cause a wide range of physical and emotional damage which not only affect people when disasters occur, but also affects them for very long time in the remainder of their life.

Along with the global climate changes, natural disasters are increasingly becoming an imperative issue of humanity and have seriously affected countries around the world including those in Asia. How natural disasters affect a country's economy and how to overcome and minimize these effects are issues for consideration for the world.

This paper aims to provide an overview of natural calamity and the Asian economies, then examines the impacts of natural disasters on the economies of Asian countries through the cases of earthquakes and tsunamis in Japan, and storms and floods in Vietnam. Based on this analysis, the paper proposes several suggestions to minimize the effects of disasters on the Asian economies.

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## 2. Natural disasters

There are different ways to understand natural disaster. From a naturally-oriented perspective, natural disasters can be defined as occurrences, events or phenomenon that happen in nature. (Padli & Habibullah, 2009). Natural disasters can be of different types, such as earthquakes, floods, volcanic eruptions, landslides, hurricanes, tornadoes, tsunamis, thunderstorms and ice storms. According to Banuri (2005), three main types causing around 90% of the losses includes floods, earthquakes and cyclones.

According to Guha-Sapir (2008) and Guha-Sapir et al (2011), natural disasters can be classified into five categories including natural Biological<sup>(1)</sup>, Geophysical<sup>(2)</sup>, Climatological<sup>(3)</sup>, Hydrological<sup>(4)</sup>, and Meteorological<sup>(5)</sup>. Natural disasters result in a disruption in the balance of the environment and originate from different causes such as soil erosion, seismic activity, air pressure and ocean currents. More specifically, soil erosion can lead to floods throughout the world while seismic activity is a root cause of earth quakes, volcanoes erupting and typhoons. High or low air pressure determines

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*"In a socio-economic oriented perspective, natural disaster is understood as a "situation or event which overwhelms local capacity, necessitating a request to national or international level for external assistance; or an unforeseen and often sudden event that causes great damage, destruction and human suffering"."*

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thunderstorms, rain and hurricanes while ocean currents might lead to tsunami (Scott, 2008). Nowadays, it is widely accepted that human activities are also seriously responsible for natural disasters. For example, floods often occur in areas where mining and deforestation prevails whereas earthquakes can be triggered by drilling and bombing.

They have a profound impact on the quality of life through their destruction of food crops and livestock, and force dislocation of households and communities.

The economic impact of a disaster usually consists of damage to infrastructure, housing, loss of lives, loss of revenue and market destabilization on the local economy (UNESCAP, 2007). Such impacts finally affect the economy in subsequent years. Such impacts are those related to unemployment, inflation and the GDP (Gross Domestic Product). Natural disasters and its impacts are particularly concerning in developing countries such as those in Asia as they are much less equipped to handle disasters on a large scale and more vulnerable than the developed countries (Banuri, 2005).

## 3. The Asian countries' economies

Asia is the world's largest and most populous continent with around 4 billion people as of 2010. It is located in the eastern and northern hemispheres and covers 8.6% of the Earth's total surface area. Asia has the second largest nominal GDP of all continents after Europe, but the largest when measured in purchasing power parity. As of 2010, the nominal GDP of Asia was USD 18,515 trillion with the GDP growth rate of 9.0% and the GDP per capita of 8.2% (ADB, 2011; IMF, 2011).

Asia is known as a rich natural resources continent in the world. A huge variety of metals

<sup>(1)</sup> Examples of Biological Natural Disaster: Epidemic, Insect Infestation, and Animal Stampede.

<sup>(2)</sup> Examples of Geophysical Natural Disaster: Earthquake, Volcano, and Mass Movement (Dry).

<sup>(3)</sup> Examples of Climatological Natural Disaster : Extreme Temperature, Drought, and Wildfire.

<sup>(4)</sup> Examples of Hydrological Natural Disaster: Flood and Mass Movement (Wet).

<sup>(5)</sup> Examples of Meteorological Natural Disaster: Storm.

such as gold, iron, lead, titanium, uranium, and zinc have been endowed in Asia. Oil is also a profitable resource for many Asian countries such as Saudi Arabia, Iraq and Kuwait (Wikipedia, 2010). Furthermore, Asian countries possess low-cost labor resources which have been a source of comparative advantage for the production of many labor-intensive commodities such as textiles, clothes and footwear. Besides, many multinational companies in the world outsource parts of their production to Asian countries such as India, Vietnam and the Philippines, to take advantage of low labor cost and the pool of natural resources in this area.

Most of the Asian countries such as Cambodia, India and Vietnam are developing and agricultural-based. A big share of the agricultural products of the region such as rice, coffee, tea and sesame are exported to other continents - Europe, the Americas and Oceania. In addition, fishery products bring large profits to countries with long coastlines such as Japan, India and Vietnam. The manufacturing sector is also highly developing in many Asian countries, especially in Japan and the four tigers of the region - Korea, Taiwan, Hong Kong and Singapore - with a wide range of goods from those of cheap and low value to those of high-tech value. A range of LG, Samsung, Sony, Toshiba and Toyota's products are exported widely to Europe and the America besides being exported to the intra-region.

In 2010, the largest economies in Asia in order of GDP size were China, Japan, India, South Korea and Indonesia. China was the

second largest economy in the world, after the United States with a GDP of USD 5,878,257 million and the growth rate of 10.3%. Japan lost its position to China and was the third largest economy in the world with a GDP of USD 5,458,872 million. India was the third largest economy in Asia with annual growth rate of more than 8%. It is forecast that India may overtake Japan in terms of nominal GDP by 2020. The newly industrialized Asian economies, including Hong Kong, Singapore, Taiwan and Korea, witnessed a rapid growth rate of 8.4% in 2010 whereas ASEAN countries, led by Indonesia, grew by around 8%, gradually enhancing their position in the global economics (IMF, 2011).

It can be seen that after the global crisis which emerged in the second half of 2008, Asian countries are now firmly recovering despite the modest recovery in the major developed countries. It is forecasted that the region's GDP growth rate will be 7.8% in 2011 and 7.7% in 2012, of which most of the growth forecast in 2011 is attributed to the resource-rich economies. However, besides high inflation rate and rising oil and food price, the region is also forecasted to continue struggling with a number of unexpected natural disasters. The most striking example is possible power shortages and ongoing risks associated with the crisis at the Fukushima Daiichi nuclear power plant due to tsunami and earthquake in Japan in early March 2011 (ADB, 2011). Therefore, there is an urgent need to understand the natural disasters that have occurred in Asia for the purposes of mitigating their possible impacts on Asia's economic development.

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*"Information technology has especially developed in some of the Asian countries in recent year with the remarkable case of India, now one of the world's largest exporters of software and other information technology related services."*

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*"With the characteristics of being agricultural and resource-based and export-driven economies, any natural disaster occurring might lead to serious impacts on the region's economic development."*

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**4. Impacts of natural disasters on the economies of Asian countries and case studies of earthquakes and tsunamis in Japan, and storms and floods in Vietnam**

**4.1. The impacts of natural disasters on the Asian economies**

The Asian continent is most at risk from natural disasters because it is situated in the world's hazard belts, which are highly subjected to natural disasters such as cyclones, floods, earthquakes, landslides, drought and tsunamis. More specifically, cyclones occur most frequently over the Northwest Pacific, the southern end of the Bay of Bengal, east of India and south of Bangladesh. The Philippines, Bangladesh and Vietnam suffer most frequently from this phenomenon. Bangladesh, China and India are flood-prone countries in the region. Hilly and mountainous areas such as China, India, Nepal, the Philippines and Thailand are most prone to landslides, which are aggravated by deforestation and cultivation that destabilizes slopes. Countries along or a near seismic zones such as Afghanistan, China,

India, Iran, Nepal and Philippines, are more vulnerable to seismic events, while countries along the Pacific Rim are at risk from volcanic eruptions, particularly Indonesia, Japan and the Philippines (IRIN, 2010; UNEP, 2011).

Among the top 15 countries rated as at extreme risk of experiencing natural disasters, ten are Asian countries including Bangladesh, Indonesia, Iran, Pakistan, Philippines, India, China, Sri Lanka, Myanmar, and Afghanistan (Figure 1).

In 2010, among the top 10 countries most hit by natural disaster, there were 6 Asian countries (Figure 2). It is said that 64.5% and 37.5% of the world geophysical and hydrological disasters in 2010 occurred in Asia (Guha-Sapir, Vos, Below, & Ponserre, 2011).

The impact of natural disasters on the Asian region is severe and includes losses in people and finance. In 2010, most world victims from hydrological, meteorological as well as climatological disasters were in Asia (95.3%, 78.8% and 53.4%, respectively) (Figure 3). Similar to the number of victims they caused, hydrological disasters caused the most damage in Asia with a rate of 68.4% (Figure 4) (Guha-Sapir, Vos, Below, & Ponserre, 2011).

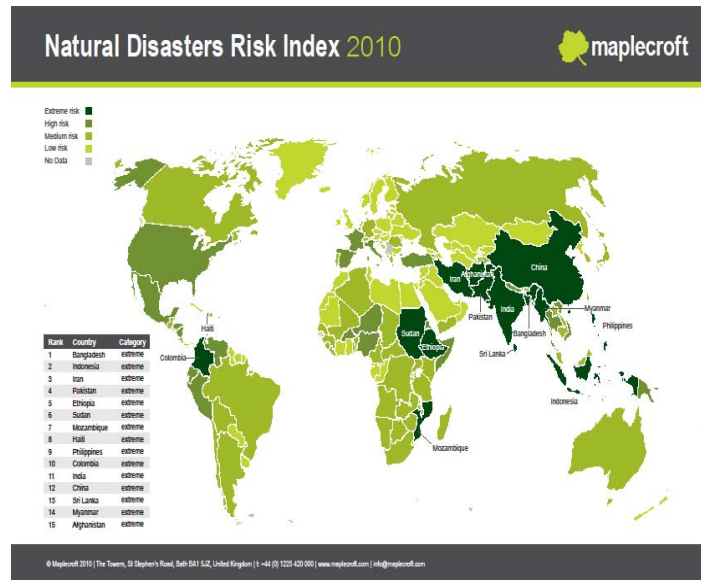


Figure 1. Natural disasters risk index 2010.  
Source: IRIN (2010).

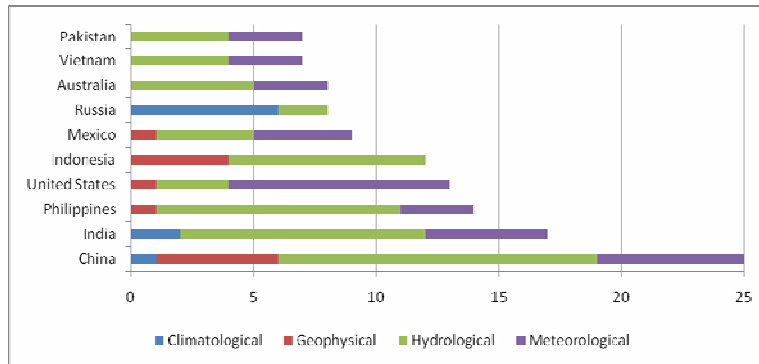


Figure 2. Top 10 countries by number of reported events in 2010.  
Source: Guha-Sapir et al (2011).

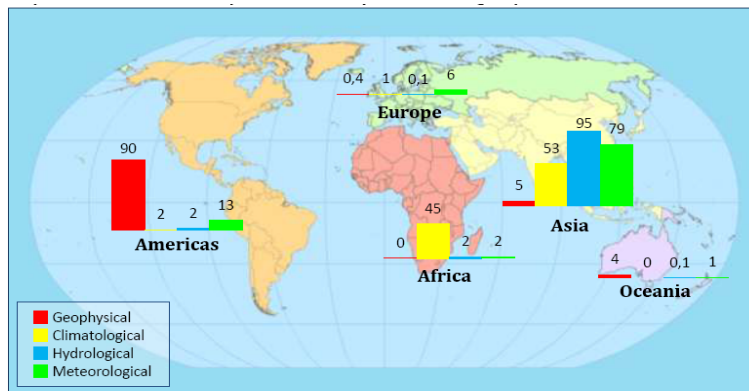


Figure 3. Percent share of reported victims by disaster sub-group and continent in 2010<sup>(6)</sup>.  
Source: Guha-Sapir et al (2011).

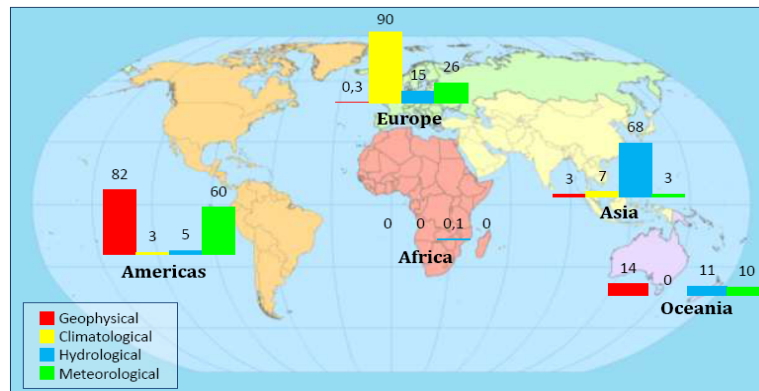


Figure 4. Percent share of reported economic damages by disaster sub-group and continent in 2010<sup>(7)</sup>.  
Source: Guha-Sapir et al (2011).

<sup>(6)</sup> Percentages equal and smaller to 0.05% are displayed as zero.

<sup>(7)</sup> Percentages equal and smaller to 0.05% are displayed as zero.

The Asian countries find themselves not only more exposed to natural hazards but are also the least prepared to deal with such disasters. Damages caused by natural disasters and vulnerability to disasters are closely linked with population density, poverty, environmental degradation, economic resources, natural resources endowment and infrastructure whereas the Asian region is among the most-populated and richly endowed by natural resources regions in the world. Moreover, the Asian region's environmental degradation is proceeding most rapidly and the region lacks the necessary infrastructure to mitigate the impacts of natural resources (UNEP, 2011). Almost all Asian countries are at low or medium levels of economic development and consequently their resources and conditions are not adequate for efficiently adapting to the negative impacts of natural disasters (Ma. Sn, 2005).

Each Asian country's economy is an integral part of the overall economy of the Asian block.

For example, *"When a country faces natural disasters and its economy is under the influence of the disasters, the economies of other Asian countries are also somehow affected."*

Asian economy in different economic sectors such as investment, tourism and trade. Disaster in Japan led to a slowdown in growth rate of the Asian economy in 2011 which has been estimated to be 7.5% to 8% compared to the growth rate of 9% in 2010. Difficulties faced by the Japanese economy may reduce foreign investment within the Asian region because Japan is the largest foreign direct investor in a number of Asian countries. Japan is an important trading partner in the region - buying a large amount of iron ore, coal, gas and other raw materials from other Asian countries, and

contributing to about 10% of total exports of the region. Japan is also a source of tourism revenue especially for Asian countries like Thailand and Vietnam who have welcomed one million Japanese tourists every year. Japan is widely accepted as a pool of components of the world in general and of Asia in particular. Therefore, the earthquake which

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*"The fact that Asia is at extreme risk of experiencing natural disasters and has incurred extensive ongoing impacts of these disasters confirms that coping with such disasters requires both the individual and cooperative efforts of the Asian countries."*

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destroyed many important infrastructure and plants of Japan caused production disruption in almost economies in the world including the developing countries in Asia (Đức Phú, 2011).

#### **4.2. Case study of earthquakes and tsunamis in Japan in March 2011**

Japan is an island nation in East Asia with a total of 6,852 islands extending along the Pacific coast of Asia. The islands of Japan are located in a volcanic zone on the Pacific ring of fire and therefore, they are affected by large oceanic movements occurring over hundreds of millions of years and destructive earthquakes often leading to tsunami occurring several times each century.

The earthquake off the coast of Japan on March 11<sup>th</sup> 2011 was one of the biggest recorded since the year 1900. Measured at 8.9 on the Richter scale by the US Geological Survey, the earthquake struck at 14:46 local time (05:46 GMT) at a depth of about 24km (BBC, 2011). The earthquake triggered destructive tsunami waves of up to 12 meters in height, which struck about 400km north-east of Tokyo and devastated many areas in Japan. At Sendai Port (Miyagi Prefecture), the nearest major city to the earthquake, tsunami waves

were as high as 10 meters. The runway at the Sendai airport was submerged in water, and many cars, ships, buildings and other constructions were swept away by walls of water. Dozens of people stood on the roofs of buildings to wait for rescuers. Many other regions, such as Iwate and Tohoku were also under serious effects from the tsunami. When the tsunami waves swept towards Japan, large areas of the northern Pacific coast were swamped by the devastating tsunami, engulfing entire towns (ABC News, 2011).

This earthquake and tsunami in March 2011 have resulted in serious damage to Japan's economy (Figure 5). Japan has lost considerable physical and human capital. According to the Japanese National Police Agency, around

12,554 persons were killed, 2,866 injured and 15,077 missing across eighteen prefectures. The tsunami destroyed a lot of infrastructure, in which 208,112 homes and buildings, 2126 roads and 56 bridges were destroyed or damaged partially by the quake and the tsunami. Around 230,000 automobiles and trucks were damaged or destroyed in the disaster. Besides, many highways in Tohoku, a province in the north of Japan, were damaged, causing the transportation network of Japan to be in serious disruption. The tsunami in Japan has also led to the accumulation of a large amount of rubbish from the destroyed infrastructure which has severely polluted the environment and affected human livelihood (Nanto, Copper, Donnelly & Johnson, 2011).

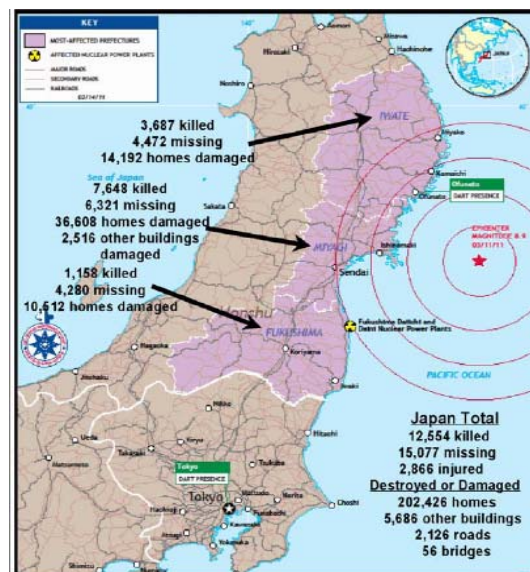


Figure 5. Damages by earthquake and tsunami in Japan.

Source: Nanto et al (2011).

The damage of the tsunami and earthquake in Japan is being compounded by the nuclear crisis at the Fukushima Nuclear Complex. After the earthquake, Fukushima I nuclear power plant, which is 220 kilometers from Tokyo, was damaged and leaked radioactive materials. More than 85,000 residents in this area were forced to evacuate (Việt Hà, 2011).

The nuclear power plant Fukushima I, Fukushima II, Onagawa, and Tokai with a total of 11 nuclear reactors were shut down. That led to power shortages in around 4.4 million households in northeastern Japan and plants in this area must reduce power consumption by 15% (VOV, 2011).

The earthquake and tsunami followed by the nuclear crisis have resulted in substantial economic losses. Totally, it is estimated that Japan suffered a loss of around USD 309 billion, accounting for 5.7% of Japan's GDP and 2% of capital stock. *In the industrial sector*: many plants, especially car plants, have been destroyed or obliged to reduce their production due to the shortfall in electricity and a scarcity of gasoline. Japan's production of automobiles, semiconductors, and electronics is likely to be affected the most, which in turn has negatively affected the global supply chain because Japan plays a vital role in supplying component parts and also in manufacturing final products (Nanto, Copper, Donnelly, & Johnson, 2011).

The tsunami has also destroyed or damaged aquaculture facilities such as fishing vessels and harbors in prefectures quite distant from the epicenter, causing substantial damage to seafood cultivation and aquaculture in Japan (Việt Hà, 2011). The earthquake and tsunami have raised

concerns about soil contamination and its effects on future planting of crops. *In the export sector*: Japan's key export goods are cars, electronic devices and computers whose production have been seriously affected by tsunami and earthquake. Besides, Japan also exports fishery and other agriculture products. Because of leaking radioactive materials that have resulted in contamination of different types of Japan's agricultural products, exported products from Japan have fallen

under heightened surveillance and quarantine measures from many countries such as the United States, the European Union, Canada, Australia, New Zealand, India and other Asian nations such as Thailand, Hong Kong, Indonesia, Malaysia, Singapore and Vietnam. Some countries such as the United States have even prohibited agricultural products exported from Japan. Import restrictions vary depending on each country's policies but generally cover milk and milk products, vegetables, fruit, seafood and meat from the prefectures with a perceived risk of contamination such as Fukushima, Ibaraki, Tochigi and Gunma. Global concerns about the safety of food produced in Japan are closely monitored by some international organizations including those of the United Nations. Thus, it can be seen the tsunami and earthquake followed by radioactive contamination have led to serious consequences including raised fears about the safety of Japan's food production system and its food export as well as the possibility of any increase in its food imports both presently and in the long term (Johnson, 2011).

As a direct result of the earthquake, the Japanese financial and currency market also suffered big changes. Investors, hedge funds, and speculators bought JPY (Japanese Yen) in anticipation that Japan's wealth holders, insurance companies, and possibly the government will have to repatriate overseas investments in order to finance insurance payouts and rebuilding. The value of JPY attained a record of JPY 76.25 per USD on March 17 before retreating to the JPY 80 level after the G7 (Group of Seven of Industrial Nations) agreed to "cooperate as appropriate" to address excessive and volatile movements in the foreign exchange market with the purpose of intervening to weaken the value of the JPY. The Nikkei index of the Japanese stock market slipped 5% after the earthquake occurred. As of March 17th, the Bank of Japan injected USD 418 billion (JPY33 trillion) into financial markets in an effort to ensure financial stability in the context of a stock slump and credit risk



reduction increases (Nanto, Copper, Donnelly & Johnson, 2011).

In 1995, Japan had to cope with a fierce earthquake at Kobe, which caused 6,400 deaths and USD 119.2 billion worth of financial damage. However, the tsunami and earthquake this March have caused much bigger and more devastating consequences. Within some minutes, about 5.7% of Japan's GDP were swept away. The direct damage from Japan's earthquake and tsunami were concentrated in the northern region of the country, some distance from Japan's industrial heartland, but the financial and economic effects however, have spread throughout the Japanese economy and the Asian region as well as the global economy.

#### **4.3. Case study of storms and floods in Vietnam**

Vietnam is located on the Indochina Peninsula, Southeast Asia and has land borders with China to the north, Laos and Cambodia to the west, and the East Sea to the east, south and southwest. The country stretches over 15 degrees of latitude and has a long coastline of about 3,444 km. Due to its diverse topography and stretched shape, climate conditions can vary greatly between regions. The average humidity is 84% throughout the year. Vietnam's average annual rainfall ranges from 1,400 to 2,400 mm and annual hours of sunshine are between 1,500 and 3,000 hours. With this climate and a long coastal line, Vietnam has a long history of dealing with natural disasters. On the average, every year, Vietnam is affected by six to eight typhoons and tropical cyclones. Flood in Vietnam occurs frequently in river deltas and low-lying areas in recent years. From 1996 to 2001, extreme floods occurred in Vietnam's Red River Delta, Mekong Delta, and Central Region caused damage to millions of houses, thousands of classrooms and hundreds of hospitals as well as to over 400,000ha of rice-growing areas with total damage estimated at USD 680 million

(Collins, Nguyen, & Pham, 2009; Ministry of Natural Resources and Environment, 2010).

One of the largest and worst floods recorded within the past 24 years since 1984 is the flood that occurred on the night of October 30<sup>th</sup> 2008. Torrential and persistent rainfall lasted for nearly 10 days from the night of October 30<sup>th</sup> 2008 to November 7<sup>th</sup> 2008 with three days of heavy raining, exceeding all forecasts and causing a remarkable flood in Hanoi and other provinces in the North and Central of Vietnam. This rainfall was seen as the most unusual phenomenon on record because generally mid-October is the time of year when the rainy season ends in Vietnam (CNN, 2008; Communist Party of Vietnam Online Newspaper, 2008; VnExpress, 2008; Wikipedia, 2008).

The torrential rainfall in 2008 led to destructive flood and subsequent waterlogging, which caused considerable physical and human damage in Hanoi, the capital city of Vietnam, and many other provinces in North and Central Vietnam such as Lang Son, Thai Nguyen, Bac Giang, Phu Tho, Ninh Binh, Hung Yen, Hoa Binh, Vinh Phuc, Thanh Hoa, Nghe An, Ha Tinh and Quanh Binh. In Hanoi alone, there were 63 places deeply waterlogged including 26 places under about one meter deep of water. 17 people were killed, 13,000 houses were damaged and around 1,500 households were evacuated in Hanoi. The flood damaged completely destroyed 50,000 ha of winter crops and 9,000 ha of aquaculture areas. Traffic networks in Hanoi were chaotic and thousands of vehicles were damaged because of submersion (VietNamnet, 2008; VnExpress, 2008). The total loss for Hanoi was estimated at VND 3,000 billion.

In other areas in the North of Vietnam, many dikes were badly damaged; some of them were broken and caused a great threat to Hanoi and the Northern provinces' livelihood and production. Many people in Hoa Binh and Bac Giang, who had just started to return to their normal living after the Kammuri flood in August 2008 and typhoon Hagupit in

September 2008 were seriously impacted by this October flood. Overall, around 85 people were killed or left missing in the flood and 600,000 people altogether were badly affected in Vietnam. Also, the flood damaged 180,000 houses, of which 99 houses were swept away and 100,000 were inundated. Almost 100

schools, 208,000 hectares of crops and 26,000 hectares of fish farms were submerged or damaged in the floodwaters (Table 1) (Communist Party of Vietnam Online Newspaper, 2008; International Federation of Red Cross and Red Crescent Societies, 2008; VietNamnet, 2008).

Table 1. Damages caused by 30<sup>th</sup> October 2008 flood in Vietnam

Number of People badly affected	Houses flooded/ damaged (houses)	Rice/ vegetable fields (hectares)	Aquaculture Resources (hectares)	Drainage Systems (units)	Dykes Damaged (m <sup>3</sup> )	Rural roads damaged (m)
600,000	180,000	208,000	26,000	457	84.847	168.451

Source: International Federation of Red Cross and Red Crescent Societies (2008).

After the floods, Vietnam's economy continued to suffer from heavy losses, in which normal production and functions of the economy were disrupted and price of goods and services increased abnormally. Many offices, markets and schools were heavily damaged and had to be closed temporarily, making it impossible for many office workers to go to work and children unable to go to schools. Houses were submerged and people could not go out to buy food but had to eat noodles stored at home instead. Transportation to and from the submerged areas was extremely difficult and residents were forced to take creative measures in moving from one place to another. To do this many used water cans and cooler bottles as floatation devices. Isolated areas without markets needed government assistance in purchasing food supplies transported in by truck. Areas with markets experienced an increase in food prices, especially prices of meat, fish, vegetables and fruit, because of food shortages in the post flood period (International Federation of Red Cross and Red Crescent Societies, 2008). For example, the price of a bunch of spinach increased from VND 3,000VND in the pre-flood to about VND 15,000 to 20,000 VND. A kohlrabi cost VND 3,000 before the storm and flood but VND 5,000 after (VnExpress, 2008).

In fact, storms and floods occur frequently in Vietnam and caused considerable damage

every year throughout the country, especially in the Centre of Vietnam. This region has high mountains and rivers there are often narrow and steep. Floods in the regions usually come suddenly right after heavy rains, which often follow typhoons and tropical storms because of the steep slope of the river beds. Almost no river dyke can be built to ensure safety in the region (Pham & Pham, 2010). The Centre is also a region with many beautiful places such as Hoi An (Thua Thien Hue), Phong Nha - Ke Bang (Quang Binh), Cua Lo (Nghe An) and Nha Trang. Summer is tourist season, but summer is also the season when the Central provinces are under the highest risk of storms and floods. Therefore, annual storms and floods in the Centre have resulted in big losses in physical, human and financial aspects. Cuu Long River Delta in the South of Vietnam is also another region that copes with serious storms and floods every year. This region has a favorable climate for agriculture development, especially the cultivation of rice and food crops. It supplies over 50% of the rice output in Vietnam and its average food production per capita is 2.3 times the national level. Storms and floods every year submerges thousands of hectares of rice in the region that is the main pool of rice of Vietnam and damages thousands of tons of rice every year. As an agriculture country, this damage for Vietnam is of great concern. Last but not least,

storms and floods in all regions also pollute the living environment for people. Securing hygienic conditions becomes difficult for many families because they lack clean drinking water when sewage water mixes with water from the rain and spreads out. People are faced with the high risk of disease out-breaks such as diarrhea and sore eyes...

In short, storms and floods in Vietnam caused twofold destruction. In the first sense, floods and storms lead to the death and injury of people, to damages to homes, property and infrastructure and destruction of crops. In the second sense, floods and storms can reverse hard-won development gains, which in turn threatens the sustainable development of Vietnam.

### **5. Conclusions and some policy implications for the Asian region**

The Asian countries, including both the developed and developing nations are highly prone to natural disasters which have seriously threatened the socio-economic development of individual country and the whole region, as specified in the case studies presented of Vietnam and Japan. Natural disasters will affect long-term economic growth through a number of channels including loss in people, devastating damages to agriculture, fishing and forestry, and negative impacts on financial markets. Also specified previously, the Asian countries find themselves not only more exposed to natural hazards but are also the least prepared to deal with such disasters. The Asian region is among the most-populated, with low or medium levels of economic development and with resources and conditions that are not adequate for efficiently adapting to the negative impacts of natural disasters.

Therefore, in the context of the global climate change, where natural disasters are more damaging and more complex to handle, and clearly increasing in frequency over the long term, the Asian countries should consider

some following groups of solutions to increase their capacity to cope with natural disasters.

*Firstly, the Asian countries should improve their capacity in preparedness for natural disaster.* Upgrading the forecasting system, early warning systems and risk assessment and mapping of climatic and water-related hazards are of great importance for the Asian countries. Application of modern equipment and technology to better forecast the weather conditions plays an important role in increasing the capacity of countries in their preparedness for dealing with disasters. Increasing investments in infrastructure such sea dikes, river dikes, roads, bridges, health care centers, forecasting centers and communication system would make the countries more disaster resistant.

*Secondly, the Asian countries should improve their capacity to deal with natural disasters when they occur.* Strengthening regional and international cooperation is vital for the Asian countries in dealing with natural disasters. When natural disasters occur, their effects are normally destructive as shown in the two case studies of Vietnam and Japan. In such cases, the close coordination with regional and international organizations such as ADPC (the Asian Disaster Preparedness Center), UNDP (United Nation Development Program), UNICEF (United Nations International Children Fund), WHO (World Health Organization), international Non-Governmental Organizations members of the disaster management group and other countries is vital to support the countries to recover more quickly and efficiently from the disasters. These organizations will support the local authorities in the provision of food and non-food items, the improvement of water and sanitation facilities for evacuated and returning families, targeted health education and the repair or rebuilding of homes. With regional and international cooperation, countries also have the chance to share experience in coping with natural disasters and the technical knowledge and facilities for forecasting efficiently natural

disaster, supporting the countries to be more resilient in the event of a unexpected natural disaster. A good communication system with faster processing of incidents and access to real time data and video should be put among top priorities because it would allow for better decision making process and faster response times when natural disaster occurs.

Thirdly, the Asian countries should focus on educating people on the way to deal with natural disasters and improve their livelihood, especially for vulnerable residents in natural disaster-prone areas. In fact, the educational component helps to reduce human fatalities as a result of disaster. Thus, educating people to strengthen their capacity in dealing with natural disaster and helping them better prepare for less predictable weather patterns are greatly needed. School-based disaster preparedness programs, specifically designed for children, who are most at risk when natural disaster hits, should be paid attention to. Besides, it is also necessary to educate people about their roles in natural disasters issues such as encouraging them to participate in preparation of community disaster management plans. Experience from many countries in the world also shows that the promotion of diversified income sources to minimize the livelihood impact of losing crops of fishing equipment in extreme weather events is another solution to mitigate the destructive impacts of natural disasters.

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## Tác động của thiên tai đối với các nền kinh tế châu Á: Các nghiên cứu trường hợp về động đất, sóng thần ở Nhật Bản, bão và lũ lụt ở Việt Nam

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**Tóm tắt.** Bài viết xem xét tác động của thiên tai đến các nền kinh tế châu Á thông qua nghiên cứu hai trường hợp thiên tai ở Nhật Bản và Việt Nam. Bài viết sử dụng các số liệu và thông tin đã được xuất bản, dựa trên quan điểm của các chuyên gia và các phân tích cá nhân để xem xét hai trường hợp này, tập trung vào thảo luận tác động của thiên tai đến nền kinh tế của hai quốc gia và sau đó mở rộng phân tích sang các kinh tế châu Á khác. Bài viết cho thấy thiên tai đã có ảnh hưởng lớn đến cuộc sống và sự phát triển kinh tế trong dài hạn của các nền kinh tế châu Á và đưa ra các hàm ý chính sách giúp giảm tác động của thiên tai đối với nền kinh tế. Trong ba nhóm giải pháp được đưa ra, bài viết nhấn mạnh rằng các nền kinh tế châu Á cần hiểu rõ vai trò của tự nhiên, hợp tác chặt chẽ với nhau để bảo vệ thiên nhiên và giảm đến mức tối thiểu tác động của thiên tai.