International Journal of Disaster Risk Reduction 13 (2015) 200–206

Contents lists available at ScienceDirect

International Journal of Disaster Risk Reduction

journal homepage: www.elsevier.com/locate/ijdrr

Lessons learned from two unprecedented disasters in 2011 – Great East Japan Earthquake and Tsunami in Japan and Chao Phraya River flood in Thailand

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ARTICLE INFO

Article history:
Received 31 May 2015
Accepted 31 May 2015
Available online 20 June 2015

Keywords:
Natural hazard
Risk assessment
Disaster management
Urban planning
Special deregulation policy

ABSTRACT

This paper focuses on two mega natural disasters that occurred in Asia: the Great East Japan Earthquake (GEJE) in March of 2011 and the Chao Phraya Floods from August to December of 2011. In each hazard, we investigated and analyzed actual situations through field survey and interviews to victims. We identified the problems of existing systems in the GEJE case, especially problems in urban planning for high-risk areas. We also found problems in relation to inviting foreign companies by special deregulation policy to areas that were revealed as having high flood-risk at the wake of the Thai flood, as well as serious damage induced by worldwide concatenation in the supply chains of various industries. Through these reviews, we points out lessons to be learned from two unprecedented disaster occurred in 2011. We also described lessons learned and recommend countermeasures for mega disasters, discussing what measures are required to build a disaster-resilient society in thefuture.

1. Introduction

On 6 March 2015, Margareta Wahlström, head of the UN Office for Disaster Risk Reduction, said “Despite many successes and greatly improved performance in disaster management, it is sobering to note that 700,000 people have died in disaster events over the last ten years. A total of 1.7 billion people have had their lives disrupted in some way. It is of great concern that economic losses in major reported disaster events come to $1.4 trillion.” Ms. Wahlström said that while 70% of deaths are caused by earthquakes, climate-related disasters now account for over 80% of all disaster events and contribute enormously to economic losses and short and long-term population displacement triggered by disaster events. 155 million people have suffered short or long-term displacement since 2008 [1]

Disaster risk reduction gained its full momentum when the Hyogo Framework for Action (HFA) for 2005–2015, first proposed and adopted at the World Conference on Disaster Reduction (WCDR) in 2005, was subsequently endorsed by the UN General Assembly (A/RES/60/195). On 18 March 2015, UNISDR announced the adaption of New International Framework for Disaster Risk Reduction at the occasion of the 3rd World Conference on Disaster Risk Reduction at Sendai. The new framework, Sendai Framework for Disaster Risk Reduction 2015–2030, outlines seven global targets to be achieved over the next 15 years: a substantial reduction in global disaster mortality; a substantial reduction in numbers of affected people; a reduction in economic losses in relation to global GDP; substantial reduction in disaster damage to critical infrastructure and disruption of basic services, including health and education facilities; an increase in the number of countries with national and local disaster risk reduction strategies by 2020; enhanced international cooperation; and increased access to multi-hazard early warning systems and disaster risk information and assessments [2]

In the midst of the tough negotiation in this process, the year 2011 saw the unprecedented natural disaster damage in history. This paper focuses on two mega natural disasters that occurred in 2011: the Great East Japan Earthquake in March of 2011 and the Chao Phraya Floods in Thailand from August to December of 2011. In a close analysis of the damage caused by each hazard, the investigation was conducted why Japan had suffered such huge damage by the earthquake and tsunami. For Thai floods, the classification was implemented why damage concentrated on certain locations in relation to economic incentives. Furthermore, some recommendations were proposed as countermeasures for mega disasters, discussing what measures are required to build a disaster-resilient society. These analysis can hopely contribute to new frameworks.

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http://dx.doi.org/10.1016/j.ijdrr.2015.05.008
2212-4209/

2. Methodology

In this research, a hypothesis was first developed after selecting representative cases derived from literature and other information. The hypothesis was used to conduct field investigations in which supporting evidence, as well as other issues, was found for further literature review. The process was repeated to deepen discussions to validate the hypothesis.

2.1. Survey methodology for the case of the Great East Japan Earthquake

With reference to the Great East Japan Earthquake and Tsunami case, comprehensive research was conducted to understand the disaster damage in Rikuzentakata city by employing literature review, statistical data analyses and interviews with disaster victims of Rikuzentakata city. Documents for the literature review and statistical data analyses were collected from a wide range of information sources from publication by the central government, Iwate Prefecture, Rikuzentakata city and newspaper publishers, to online articles and statistics, to historical documents available at the Special Library for Disaster Management, Municipal Reference Library, and Iwate Prefectural Library. General information on the disaster was obtained from the Cabinet Office, the Ministry of Internal Affairs and Communications, and the Fire and Disaster Management Agency, and information on disaster victims was acquired from documents made available by the National Police Agency. Geographical information was mainly from the Geospatial Information Authority of Japan, local information from Iwate Prefecture and the Iwate Restoration Network, and local statistical and historical information mainly from the document [3] listed in References at the end of this paper.

2.2. Survey methodology for the case of the Chao Phraya River floods

With respect to the Chao Phraya River flood case, two sets of investigation were conducted on the 2011 flood damage in Thailand, especially on its chain-reaction impact on economic activity. First, literature review and interview survey were undertaken in Japan for companies with factories affected by the floods, which was followed by interview survey in Thailand in May 2012. In Thailand, interviews were conducted with Japanese factories in four industrial complexes, nine Japanese companies with flood-affected factories, the Japanese Chamber of Commerce, Bangkok (JCC), and the Bangkok branch of the Japan External Trade Organization (JETRO). Some companies were introduced to us through the Japan International Cooperation Agency (JICA), with which International Center for Water Hazard and Risk Management-Public Works Research Institute (ICHARM-PWRI) is jointly involved in a Chao Phraya flood management project. Others are contacted thorough snowball sampling and the network of executives of Japanese companies in Thailand. Before interviews with individual companies, the authors visited JCC and JETRO to collect general information on expansion of Japanese companies in Thailand and their responses to the disaster. Then, individual factories in the industrial complexes, such as the Rojana Industrial Park, Hi-Tech Industrial Estate, Bang Pa-in Industrial Estate, and Factory Land (Wangnoi) of Ayutthaya Province and the Nava Nakorn Industrial Estate of Pathum Thani Province, were visited for interviews with representatives of each factory. Interviews were also carried out at their headquarters in Bangkok. In August 2012, the authors also conducted further investigation for 1370 Japanese companies in Thailand through the Internet with help from JCC.

3. Analysis of damage by the Great East Japan Earthquake

3.1. Outline of the damage

The magnitude (M) 9.0 earthquake produced huge tsunamis and wreaked destruction along the Tohoku coast of Japan in 2011. It was the largest magnitude earthquake recorded in Japan in historic times, and the combined impacts of the earthquake and tsunamis left 15,891 dead and 2579 missing [4]. Associated economic losses may approach US$ 140 billion, making it the most costly natural disaster of all time [5]. There was thought to be fairly good knowledge on the expected sizes and locations of expected large-scale events based on about 400 years of historical records that included M7 to 8 earthquakes in Tohoku, Japan. The highest water level (40.1 m) at Ryouri Bay in Iwate Prefecture was the greatest tsunami height ever measured in the country. Water heights were close to or exceeded 20 m in most populated coastal communities in Iwate and northern Miyagi prefectures [6].

3.2. Historical urban development in Rikuzentakata City

ICHARM-PWRI conducted on-site interviews with residents of Rikuzentakata City, which suffered tremendous tsunami damage, in addition to intensive literature review.

Fig. 1 shows the demographic changes in Rikuzentakata after 1960, when the Chili Tsunami hit the city along with other coastal areas. Comparison of the areas in the black circles reveals a rapid development of the Takata downtown area after 1960. According to demographic statistics provided by Iwate Prefecture, Rikuzentakata's population showed a 21% decrease between 1980 and 2010. On the other hand, the population of the Takata area increased from 6461 in 1950 to 7711 in 2005 [7]. This population increase, and hence the expansion of the Takata downtown area, reflected social conditions of the time. After the 1960 Chili tsunami disaster, tsunami protection projects were launched along with other national-land enhancement projects, thanks to rapid economic progress after the strong Isewan Typhoon Disaster in 1959. During those projects, over 5-m-high seawalls were constructed to protect the Takata area, which accelerated the area's development.

Based on information provided by Rikuzentakata City during our on-site investigation, the casualty rate of the downtown Takata area is 12%, which is twice as high as the second highest rate of 6% in Kesen Town. The interview [Appendix] comments of Takata residents coincide with these statistics and other information. The evidence from the interviews shows that the residents did not start evacuating right away, that they did not expect the tsunami to arrive so soon, and that they did not imagine the tsunami coming.

4. Analysis of damage by the Chao Phraya floods

4.1. Outline of the damage

Around the late July 2011, Tropical Strom Nock-Ten and heavy monsoon caused heavy rainfall and thus flooding from the upper northeastern part down to the central part of Thailand. Subsequently, the Chao Phraya River flooded and inundated 15 provinces of the country, killing 744 people as of December 12, 2011 [8].

Damage in agriculture, manufacturing and service industries decreased the country's GDP (market value) by about 33 billion baht and its economic growth by 3.7%. Consequently, the annual GDP growth resulted in a 0.1% increase in 2011, a huge drop from the estimated growth of 3.8% [9]. Besides these economic drops, the Chao Phraya floods drew global attention for one specific