

STRATEGIES AND RECOMMENDATIONS FOR NATURAL DISASTER MITIGATION IN DEVELOPING COUNTRIES

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ABSTRACT

The great earthquake that occurred in the Indian Ocean in Aceh – Indonesia on December 26, 2004, and recently occur in the Pacific Ocean in East Coast of Japan on March 11, 2011 caused an unprecedented large tsunami, which successively struck more than ten coastal countries and resulted in more about 400,000 deaths and severe economics losses. The whole world was shocked by the tsunami and governments as well as scientific community all over the world were forced to reflect on the issue: how could mankind effectively utilize science and technology to cope with similar serious natural disasters? Many international efforts have been made to explore the serious problem. One of the international groups who took prompt action as soon as the Indian Ocean earthquake and tsunami occur was the Inter Academy Panel (IAP) on International Issues. This paper cited the study of the IAP, their recommendations on natural disasters mitigation especially in developing countries. IAP give suggestions to mitigation of earthquake, typhoon or hurricane, and flood as well as drought disaster. In addition, some natural disaster mitigation strategies which was prepared by Carla were also cited. This paper bring to the conclusion that the assistances and aids on the disaster mitigation in developing countries should be operated from a multidisciplinary perspective including sociology, economics, agriculture, environment studies, science, engineering, and education.

Keywords: natural disasters, tsunami, mitigation, economic losses.

1. INTRODUCTION

Natural disaster have brought about devastating economic losses and human suffering. The latest seven years examples include the manitute Richter scale 9.2 earthquake in Aceh Indonesia and the subsequent unprecedented tsunami in Indian Ocean in December 26, 2004, the hurricane in USA in August 2005, the severe snow storm in Southern China in February 2008, and another adversity that violently hit China in the summer of 2008, the Wenhuan earthquake with a magnitude of 8.0 Richter scale on May 12, 2008 in Sichuan Province of China, and the last few months the magnotide Richter scale 9.4 earthquake in the East coast if Japan which also the subsequent tsunami in the Pacific ocean in March 11, 2011. The first disasters badly affected the economic growth of the world's largest developing country, Indonesia.

The history of mankind is a history of struggle of man and nature, and natural disasters are a major problem affecting man's lives, security, and development. While we are unable to reserve the forces of nature once they begin, science and technolgy has given us tools to

reduce the effects of natural hazards and minimize the destruction they cause. However, our ability to mitigate the effects of natural disasters are now challenged by additional problems posed by climate change which are likely to exacerbate the problems caused by natural disasters. Thus, it is important to strengthen our capability for disaster emergency management as well as to intensify scientific disaster mitigation research.

Disaster management is the process of addressing an event that has the potential to seriously disrupt the social fabric of the community. Disaster management is similar to disaster mitigation, however it implies a whole-of-government approach to using community resources to fight the effects of an event and assumes the community will be self-sufficient for periods of time until the situation can be stabilized. Through disaster management, we cannot completely counter the damage but it is possible to minimize the risks through early warning, provide developmental plans for reoperation from the disaster, generate communication and medical resources, and aid in rehabilitation and post-disaster reconstruction.

2. NATURAL DISASTER MITIGATION STRATEGIES

Disaster mitigation is the on going effort to lessen the impact disasters have on people and property. Fewer people and communities would be affected by natural disasters with the use of this process. Because of the varying degree of each natural disaster, there are different mitigation strategies for each. The following are nine disaster mitigation strategies are issued by IAP [1]. IAP strategies are proposed to academics, governments, NGOs, related scientists, and policymakers on disaster mitigation using science and technology. While outlined in the table 2.1 to table 2.5 are displayed in the end of this paper are some important recommendations given by Carla, R.M. [2], for protection against disaster, propose more to the wide spread community in face of the disaster before, during and after disaster occurs.

- 2.1 Each member Academy should formulate medium and long-term natural disaster mitigation policies for adoption in their own countries, emphasizing the importance of science-based decision-making, and establish a platform of effective communication of these best practices.
- 2.2 IAP promotes workshop and seminars, especially involving developing countries, that bring together scientists and decision makers to exchange best practice and ideas.
- 2.3 IAP encourages the development of research into Disaster Science, placing the understanding of disaster phenomena against the background of global environment change, earth system science and evolution of the planet, and the natural disaster mitigation research be carried out in the spirit of harmony between man and nature.
- 2.4 Member academics assist in education and research programs on natural disaster mitigation in schools and for the general population with a view to increasing public awareness of the threat of natural disaster in their areas.
- 2.5 IAP establishes a Natural Disaster Mitigation Special Task Force with participation by member Academics. The task force would be responsible for organizing workshops, cooperative research programs, information sharing and exchange, training, and provide guidance on cutting-edge research.

- 2.6 IAP takes steps to ensure that funding is provided for international exchange of scientists, particularly those from nations with less advanced experiences and facilities for disaster mitigation.
- 2.7 IAP increases communication and cooperation with relevant organizations including the International Council for Science (ICSU), the World Federation of Engineering Organization (WFEO), the Global Earth Observation (GEO), and International Strategy for Disaster Reduction (ISDR) for information exchange on effective policies and best practices of disaster mitigation.
- 2.8 IAP should make efforts to improve capacity for disaster monitoring, forecasting and early warning by integrating the technologies of spaceborne-airborne-in-situ earth observation, data infrastructure, modeling, and information exchange on effective policies and best practices of disaster mitigation.
- 2.9 IAP should promote scientific and technical assistance to developing countries lacking mitigation facilities and capabilities.
- 2.10 IAP should encourage Government and Non-Government Organization to make efforts towards bilateral or multilateral sound policy agreements on disaster information collection on sharing to strengthen cooperation in disaster management.

3. IAP SUGGESTION TO SCIENTIFIC COMMUNITY

IAP [1] member academics should actively make an effort to organize and participate in all levels of S & T disaster mitigation programs, e.g. intergovernmental collaboration programs, and programs operated from international and regional foundations, and to undertake efficient exploration on the cutting-edge issues regarding S & T disaster mitigation. The tasks and basic research and multi-disciplinary studies on natural disaster reduction are strongly recommended for the science community as follows:

- 3.1 To identify areas subject to severe natural disasters against the background of climate change, to carry out scientific assessment and analysis with regard to the sensitivity and fragility of local people to natural disasters, and taking into account of different levels of social and economic development and S & T development status.
- 3.2 To conduct further research on the adaptability of human society to severe natural disasters and make a comprehensive study on the adaptability to natural disasters, taking into account societal sustainable development issues such as poverty and ecological environment protections.
- 3.3 To take into account on the one hand of the destructions side of natural disasters, to human beings and, on the other hand, of useful resources sometimes created as a by-product from natural disasters, to human beings' societal development, and to enhance the applications of earth observation technology and information communication (ICT) in disaster mitigation.

4. SPECIFIC SUGGESTIONS ON MAJOR NATURAL DISASTER MITIGATION

Among all natural disasters, earthquake, flood, drought, and storms (hurricane/typhoons) are the most harmful attacking both poor and rich countries. Recent unexpected large-scale natural disasters led to huge damage to human lives and wealth. Faced with the high risk to

the human society exposed to major natural disasters, the scientific community should shoulder the responsibility to make greater contribution to natural disaster mitigation.

On the basis of our knowledge about natural disasters so far, major natural disasters can be classified into those whose mechanisms we know much about, and those about which not much is clearly understood. For the disasters whose mechanisms are known (i.e. typhoon, flood, drought), we must make efforts to reinforce the capability for disaster forecasting, pre-warning, disaster reduction and emergency response. For the disaster about which many uncertainties remain (i.e. earthquake, tsunami), more attention must be paid to mechanism research, promotion of pre-warning and emergency management.

4.1 Suggestions for mitigation of earthquake and tsunami

Select typical key area or section in Himalayas-Tethys seismic zone, Eurasia seismic zone, and Circum-Pacific seismic zone to construct earthquake prediction experiment field, combine premonition forecast and earthquake prediction, carry out various kinds of monitoring including cross brand new active fault deformation measurement. GPS crust deformation measurement, circulating geomagnetism and gravity measurement, magnetic storm and ground electricity infrared monitoring, and middle and small earthquake monitoring, undertake extraction and recognition of abnormal premonition and establish recognition marks of various abnormal premonition of earthquake.

4.1.1 Study on Basic Theory and Warning Technology for Tsunami

Accurate tsunami warning is a basic task for disaster emergency response. It is important to undertake further research on the mechanism and warning technology of tsunami, especially the quantitative evaluation and prediction model of tsunami and warning technology.

4.1.2 Strengthen Capability of Tsunami Forecast and Information Sharing

Set tsunami monitoring float marker arrays in area at risk of tsunami, increase tide level monitor stations and earthquake monitor stations on islands and coasts, and strengthen global three-dimensional sea monitoring capability in order to fulfill the demand for prompt observation data by tsunami prevention and relief workers, we must establish a tsunami prompt observation data sharing mechanism as soon as possible.

4.2 Suggestions for mitigation of typhoon disaster

Some important recommendations and measures to mitigate typhoon or hurricane disaster are:

4.2.1 Enhancement of monitoring system of typhoon and disaster

Earth observational technology could play a very important role in typhoon/hurricane monitoring location and prediction, contributing to disaster preparedness and prevention. Satellite data and ground-based radar data together with GPS information

are of great help in defining the intercity position, and extent of a hurricane. The modern monitoring system should be strengthened and developing countries should be given timely assistance.

4.2.2 Strengthen research on typhoon/hurricane theory and hi-tech method for monitoring

- The theoretical research and operational forecasting of typhoon/hurricane and storm surge still face many difficulties and challenges, such as the forecast of the sudden change of structure and intensity and sudden increase of landing typhoons and tropical storms. They all still lack of very effective methods. The theoretical research of typhoon/hurricane and storm surges need to be strengthened in the future.
- Urgently promote research on data invention technology and data assimilation by using of meteorological satellite and doppler weather radar.
- Develop key monitoring technologies and predicting methods for determining the location intensity and trends of tropical cyclone.

4.3 Specific suggestions for mitigation of flood and drought

4.3.1 Strengthening comprehensive studies on flood and drought mitigation

In order to attain flood and drought mitigation strategies, we need to promote cross disciplinary and systematic integrated research, to incorporate related science in the development of flood and drought disaster mitigation, and provide science-based support and theoretical foundations for flood and drought mitigation and disaster management. The comprehensive science system should be set up based on further studies and modern technologies.

4.3.2 Developing better water regulation models of risk management for flood and drought

The basic goal for conducting research in determining characteristics of risk and strengthening the risk management in flood and drought disaster is to seek more a comprehensive water-regulation model that can prove to provide long-term benefits. Such model can help to define how to reach harmonious coexistence among humans, nature, and flood/drought. Research efforts could determine how to combine engineering and non-engineering measures originally, which means to promote an engineering system that is based on more scientific standards, reasonably planned and is safe and reliable through integration of legislative, administrative, economic, technological and educational procedures.

5. CONCLUSIONS

From the IAP suggestions and recommendations as well as disaster mitigation given by Carla, the following conclusions can be drawn:

1. The asistances and aids on the disaster mitigation in developing countries should be operated from a multidisciplinary perspective including sociology, economics, agriculture, environment studies, science, engineering, and education.
2. It requires to improve disaster mitigation management

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Keterangan:

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