

Abstract

Because of global warming, natural disasters are getting more frequent and stronger and causing increasingly large damage. Every part of the earth is suffering from natural disasters caused by climate change, as seen in 'Hurricane Katrina' of New Orleans, USA, the worst heat wave Europe has ever had in 150 years, 'Cidre', an ultra-powerful typhoon of Bangladesh, the worst tsunami of Japan in 2011, and 'Typhoon Maemi' of Korea.

However, the damage from climate-change-caused natural disasters is not equal among nations. Compared with developed countries, developing countries are afflicted relatively more from the same natural disaster. According to the data from the World Bank, the ratio of casualties from climate-change-caused natural disasters of developing countries was over eightfold higher than that of developed countries.

The temperature has risen on the global scale, and is projected to rise more drastically henceforth. Unexceptionally, in East Asia too temperature is expected to rise in every part of the region. What is a little peculiar about the region, this study found, is that areas with longer stretch of land adjoining the sea showed a relatively smaller temperature increase. But coastal areas are found to be more vulnerable to sea-level rise and tsunami.

This study has found that the most salient climate-change-caused natural disasters in the target East Asian countries are characteristically similar; they were all weather-bound, such as floods, typhoons, and sea-level rise. With drastic rise in temperature and precipitation expected henceforth, the damage from disasters is expected to increase more if the current state is maintained. The typical climate-change-caused disasters of the six target countries of this study are as follows.

- Vietnam : Floods due to tropical downpours and sea level rise.
- Philippines : Typhoons and floods due to tropical downpours.
- Indonesia : Floods and tsunami.
- Cambodia : Floods and droughts.
- Sri Lanka : Floods, landslides caused by floods, lightning, and typhoons
- Mongolia: Drought and drought.

The fundamental cause of large scale disaster-bound damage of East Asian developing countries is their poor disaster-preventive infrastructure. Because of financial shortage, the countries can't afford to invest in the disaster-preventive infrastructure, which results in a greater-scale damage when disasters take place. The investigation on the target East Asian countries' capacity to cope with natural disasters has led to the finding of the following features they commonly have:

- Insufficient or poor disaster-preventive equipment.

- Low efficiency of the government-aided facilities due to incomplete standardization.
- Low applicability of aided technology because of short professional manpower.
- Low applicability of the basic data from the past because of its poor systematical construction.
- Inefficient legal and administrative system.
- High vulnerability of housing environment to natural disasters.
- Inadequate education and training programs for disaster prevention.

To support the East Asian developing countries with poor capability to handle natural disasters, aid organizations and countries in the developed world have given ample financial and technological support. Korea has joined the force as a donor nation through KOICA(Korea International Cooperation Agency).

Although the amount of Korea's ODA(Official Development Assistance) is not small, it is relatively insignificant compared with the developed aid organizations and countries. The recipient countries can't perceive its existence tangibly either. Analysis of the projects supported by developed aid organizations, developed countries, and Korea and interviews with governmental officials in recipient countries indicates the need of the following strategic approaches.

- First, when giving aids, focus should be given more on practicable technology than on the financial scale of projects.
- Second, when constituting project programs, consideration should be given up to follow-up management.
- Third, in giving aids, the approach should be one that pursues mutual development with regard to each country's needs rather than one-sided giving.

To lessen damage from climate-change-caused disasters to East Asian developing countries, this study has made suggestions under three categories: hardware, software, and humanware.

Hardware is a category related with building structures and equipment. It includes: constructing disaster-preventive structures and installing facilities: maintaining and modernizing disaster preventive equipment: creating social infrastructure: securing equipment for post management.

Software is a category of non-structural sector. It covers: establishing clear-cut laws and institutions: establishing an administrative system prompt in disaster prevention: securing disaster-related budget: introducing precautionary preventive technology: assisting with technology geared for the global platform: assessing disaster-vulnerability: constructing data in a systematic way: modifying and reinforcing land use plans and architectural design standards: activating disaster insurance.

Humanware is a category related with people in the non-structural sector. It covers: increasing residential participation: supporting residents-based disaster prevention network: developing various educational programs: providing differentiated education

tailored for each income level: establishing a system that allows continuous exchange with recipient countries.

Since each recipient country has unique conditions in need of aids, priority should be given to preferentially important projects which are different for each country. Korea should take a strategy that focuses on software and humanware sectors.

Vietnam, a country with frequent floods, needs a disaster prevention system which is especially geared for handling floods. For the hardware sector the country needs projects such as: constructing drainage pump station facilities: improving the stream environment: installing emergency refuge shelters: creating detention ponds to control flood: renovating drainage channels, etc. For the software sector the country needs projects such as: reshuffling the administrative system to increase responsiveness to natural disasters: research to standardize disaster prevention equipment: digitalization of the past data and establishment of data base: establishing data bases on sluice gates and precipitation observation facilities: devising measures to support disaster-related insurance systems and developing related educational programs: making assessment of flood vulnerability: making flood danger maps: pilot application of reinforced water-resistance of buildings: establishing land use plans to reduce damage from disasters. For the humanware sector, the country needs: supporting programs(master's degree program) to train professional manpower dealing with climate-change-caused disasters, conducting joint research to standardize equipment and secure manpower to operate it.

The Philippines needs a disaster prevention system to reduce damage from typhoons and typhoon-caused downpours. For the hardware sector the Philippines needs: establishing disaster preventive information and communication facilities: extensive installment of an automated early warning system for small-and-medium size streams: clearing the floor of rivers and streams: establishing emergency refuge shelters: building levees. For the software sector, the Philippines needs projects such as: systematic investigation on river basins and establishment of data base: making specific action guidelines to reduce damage from disasters: verification and improvement of mathematical forecast model(currently MIKE): establishment of Chollan satellite data reception system: developing supportive measures for disaster-related insurance systems and education programs: establishing land use plans to reduce damage from disasters, etc. For the humanware sector, the country needs projects such as: training professional manpower specialized in meteorological radar: training experts for Chollan satellite data reception, etc.

Indonesia, a country composed of countless islands, needs a disaster prevention system reflecting its geographical features and expected sea level rise. For the hardware sector, Indonesia needs following projects: establishing communication transfer systems reflecting its geographical features(islands): creating detention ponds to control floods: installing multi-purpose emergency refuge shelters from disasters: developing

and applying high-tech construction methods to prevent coastal erosion: constructing tsunami-protection walls: constructing multi-purpose storm surge barriers, etc. For the software sector, Indonesia needs projects such as: making landslide danger maps and installing landslide management programs: establishing scenarios for national land change due to sea level rise, making assessment of tsunami vulnerability: establishing Chollian satellite data reception system(mid-scale) and giving technical support: drilling to cope with disasters and developing its management programs, etc. For the humanware sector the country needs projects such as: training and dispatch of professional manpower specialized in satellite data technology: supporting training programs(master's degree program) to foster specialists in climate-change-caused disasters: educating and training relevant government officials and NGO specialists: supporting(and sending personnel for) residential education to cope with natural disasters.

Cambodia, a country with very frequent floods and droughts, is in need of disaster prevention systems tailored for water management. For the hardware sector, the country needs projects such as: securing emergency refuge facilities against sudden floods: installing facilities to forecast and warn sudden floods: constructing multi-purpose dams: creating small-size reservoirs for drinking water only: clearing the floor of rivers and streams: constructing drainage pump facilities: building levees: repairing sewerage way: installing emergency refuge shelters: creating detention ponds for flood control: building a wide-range water supply network: installing pilot facilities to use rainwater. For the software sector the country needs projects such as: systematic investigation on river basins and according construction of data base: establishing a national master plan for disaster management: research for efficient overhaul of administrative system to deal with natural disasters: digitalization of the basic data from the past and establishment of data base: reshuffling legal system for disaster management: developing a drought index and building a national ground water observation network: establishing water conservation programs: improving emergency drinking water source supply system, etc. For the humanware sector, the country needs projects such as: developing disaster-related education and training programs: research on measures to support NGOs activities through aids, etc.

Sri Lanka needs disaster prevention system to deal with damage from floods, flood-caused landslides, and lightning. For the hardware sector the country needs: construction of torrent-control dams: projects to stabilize slopes: installment of earth-retaining structures: facilities to prevent damage from lightning, etc. For the software sector, the country needs projects such as: digitalizing the basic data from the past and construction a data base: making landslide danger maps and installing landslide management programs: reinforcing administrative capacity to cope with landslide: research on region-specific constructing methods to deal with landslide: developing supportive measures and education programs for disaster-related insurance systems, establishing land use plans to reduce damage from disasters, etc. For the humanware sector, the country needs projects such as: developing disaster-related specialized education

on and training programs for the government and NGOs: supporting (and dispatching personnel for) education and training to prevent damage from lightning: supporting (and dispatching personnel for) virtual training and education for refuge from disasters, etc.

Mongolia needs a disaster prevention system for dzud and drought. For the hardware sector, the country needs projects such as: installing facilities (cattle house, etc) to prevent dzud: establishing communication infrastructure to transmit disaster-related information: building multi-purpose dams: establishing wide-range water supply networks: installing pilot facilities to use rainwater: establishment of automated weather observing system (AWOS): supplying weather radar observation equipment. For the software sector, the country needs projects such as: reshuffling legal system for efficient disaster management: establishing a national master plan aimed at drought: developing drought index and establishing a national ground water observation network: making a program to conserve water: establishing an emergency drinking water supply system: establishing dzud forecasting and warning systems, etc. For the humanware sector the country needs: supporting education programs to enhance weather observation and forecast abilities of professional manpower: signing MOU with colleges to foster manpower specialized in disaster prevention and providing educational support.

At present, the Korean government has promised that it will increase official development assistance (ODA) for developing countries henceforth. The aid should be given to preferentially important projects of the target developing country while looking for ways to increase connectedness between projects. The outcome of this study will act as a guideline of aid projects for East Asian developing countries. There should be further study to carry forward the projects this study suggested for each country.