Theme: Reducing risks of extreme events and weather-related disasters

Submitted by: Kyoto University Graduate School of Global Environmental Studies

Climate and Disaster Resilience Initiative (CDRI)

Background

Asia is the epicenter of the current urbanization surge where some 1.1 billion people will move to cities in the next 20 years. Its urban areas are experiencing ever increasing risk due to changing climate. According to the United Nations Human Settlements Programme 2007, 'there is a constant pressure to keep pace with, if not lead, change in regional and global economic development. This, in turn, can be a force contributing to uncontrollable urban expansion and the generation of more vulnerability to disasters'. Moreover, since Asia is the most disaster-prone region, the incidences of climate-induced disasters and extreme events are also high compared to other regions. Past disaster trends suggests that high density population in Asian cities increases the mortality and the number of affected people in a typical disaster event, which in turn also result in increasing economic losses in the region. There is a serious concern that the targets of Millennium Development Goals may not be effectively achieved if disaster risk reduction is not prioritized in development planning in general and urban development in particular.

Moreover, climate change is affecting significant changes in precipitation, temperature, frequency and intensity of some extreme events. These changes will affect natural and human systems independently or in combination with other determinants to alter the productivity, diversity and functions of many ecosystems and livelihoods around the world. Yet these impacts will not be distributed or felt uniformly, as those 'with the least resources have the least capacity to adapt and are the most vulnerable'. Despite growing recognition of 'building resilient communities and enhancing adaptation to climate change', Asian urban communities are not yet receiving adequate attention. These climate change impacts will also affect their livelihoods, property, environmental quality and future prosperity since climate change is expected to alter the frequency, severity and complexity of climate-related hazards. Livelihood systems that do not have built-in buffering mechanisms are especially vulnerable.

In most cities in developing countries, the size and vulnerability of informal settlements appear to greatly increase their susceptibility to risk. These are generally built in unstable areas such as coastal zones, flood-prone planes and ravines, and geologically unstable slopes. In this context, enhancing resilience to cope with climate and disaster related events at different levels (from government to community and individual) is becoming increasingly important. In the attempt of building a resilient community, key questions that need to be answered are:

- How to enhance resilience of the community?
- What are the indicators that need to be addressed to be able to characterize and measure Climate Disaster Resilience?
- How can we create an effective index to assess the level of climate disaster resilience of a vulnerable urban community?

Outcome and Good Practice

International Environment and Disaster Management (IEDM) Laboratory of Kyoto University Graduate School of Global Environmental Studies, along with its partner organizations like CITYNET and UN ISDR (International Strategy for Disaster Reduction), has started a program to seek answers to these queries by focusing on capacity development of Asian urban cities. This study looks at different dimensions of resilience from the lens of urban communities and is mainly focused on three characteristics: (i) capacity to absorb stress or destructive forces through resistance or adaptation; (ii) capacity to manage or maintain certain basic functions and structures during disastrous events; and (iii) capacity to recover or 'bounce back' after an event.

The objective of this study is to measure the existing level of climate disaster resilience of the targeted areas using a Climate Disaster Resilience Index (hereafter CDRI) which is developed considering five resilience-based dimensions: natural, physical, social, economic and institutional. The whole process of CDRI is to make city managers and practitioners aware of the existing and future city risk for climate related disasters. The scope of this study is limited to climate-induced disasters (hydro-meteorological disasters), such as cyclone, flood, heat wave, drought and heavy rainfall induced landslide.

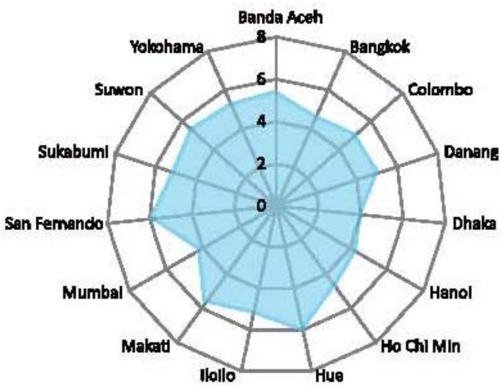
Sixteen cities were selected from different countries of Asia. Selection was done in a way to have representation of urban communities from large, medium and small cities. In this study, large, medium and small cities are referred to those having a population of less than one million, between one and five million and above 5 million inhabitants respectively. Questionnaire survey was the prime means of data collection. Secondary data was also collected to supplement collected data.

Table1. List of variables considered in CDRI five dimensions

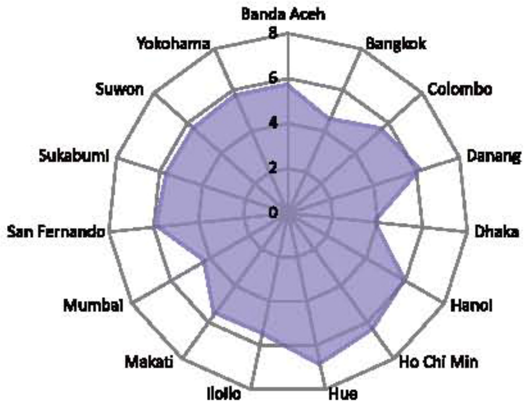
Dimensions	Variable considered
1. Physical	Electricity, Water supply, Sanitation, Solid waste disposal, Internal road network, Housing and land use, Community assets, Warning system and evacuation
2. Social	Health status, Education and awareness, Social capital
3. Economic	Income, Employment, Households' assets, Access to financial service, Savings and insurance, Budget and subsidy
4. Institutional	Internal institutions and development plan, Effectiveness of internal institutions, External institutions and networks, Institutional collaboration and coordination
5. Natural	Hazard intensity, Hazard frequency

Initially, rating scale has been constructed and weight has been assigned subjectively based on how the city officials perceive the vulnerability of each variable by comparing them one by one. Each dimension (natural, physical, social, economic, institutional) correspond to various variables (Table 1) through which their respective scores are calculated. For each city individual case, resilience information is presented as overall resilience (combination of all five dimensions), and separate physical, social, economic and institutional resilience. Overall resilience factor varies between 0 and 10. Physical, social and institutional all have a range between 0 to 4, and economic resilience between 0 and 6. Higher values of resilience are equivalent to higher preparedness to cope with climate and disasters and inversely. Policy points and recommendations are based on the results, and provide encouragement of city governments’ engagements in specific cist services, institution and capacity building.

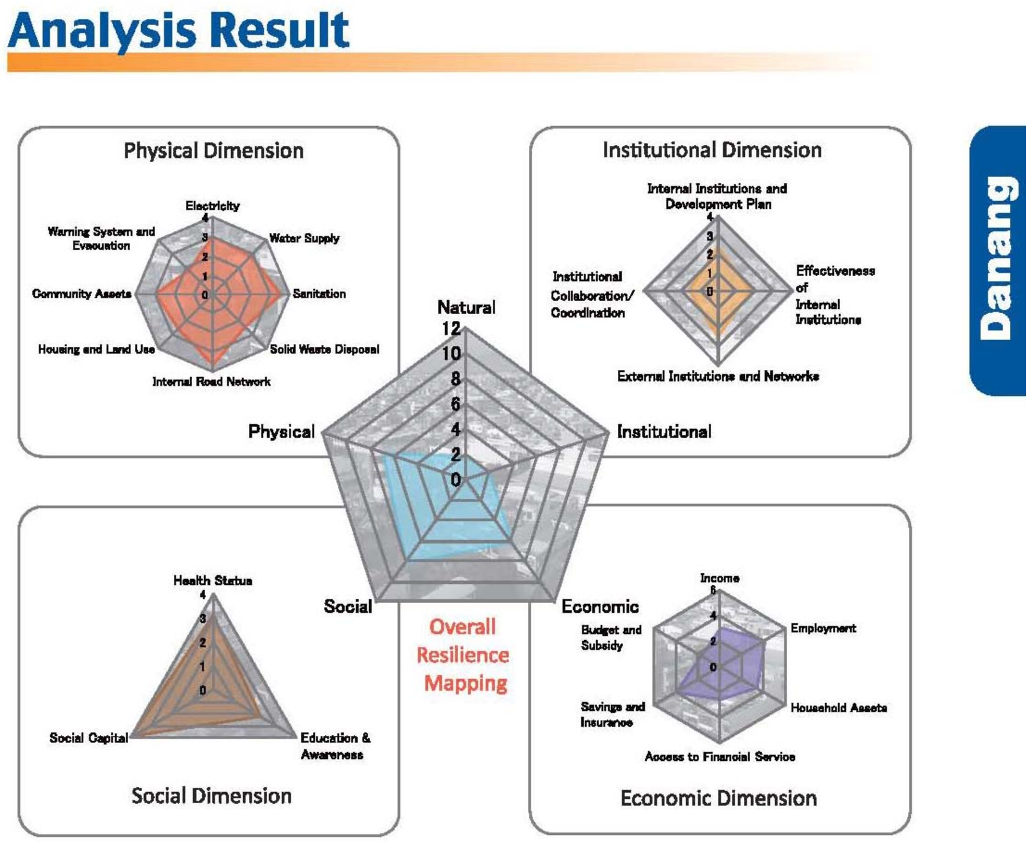
Figure: Left: Overall CDRI index, Right: Economic dimension, Below: City specific analysis of Danang



City's Resilience Mapping based on CDRI



Economic Dimension



Lessons Learned and Future Perspective

It is important to note that the questionnaires were filled up by the city officials. The quality of results is very much dependent on the data quality, and proper understanding of the questionnaires. Needless to say, results presented in this paper are not absolute values, but are broad policy guidance and scope of improvements in selected sectors of the climate and disaster related problems in the respective cities.

The CDRI methodology could be used as a training tool for city governments. A training program conducted in Danang, in central Vietnam pointed out the need of continuous training process. The city governments were asked to set their CDRI targets through self assessment matrix, and this could be measurable over a period of 1 year (short-term), 2-3 years (medium-term), and 5-10 years (long-term).

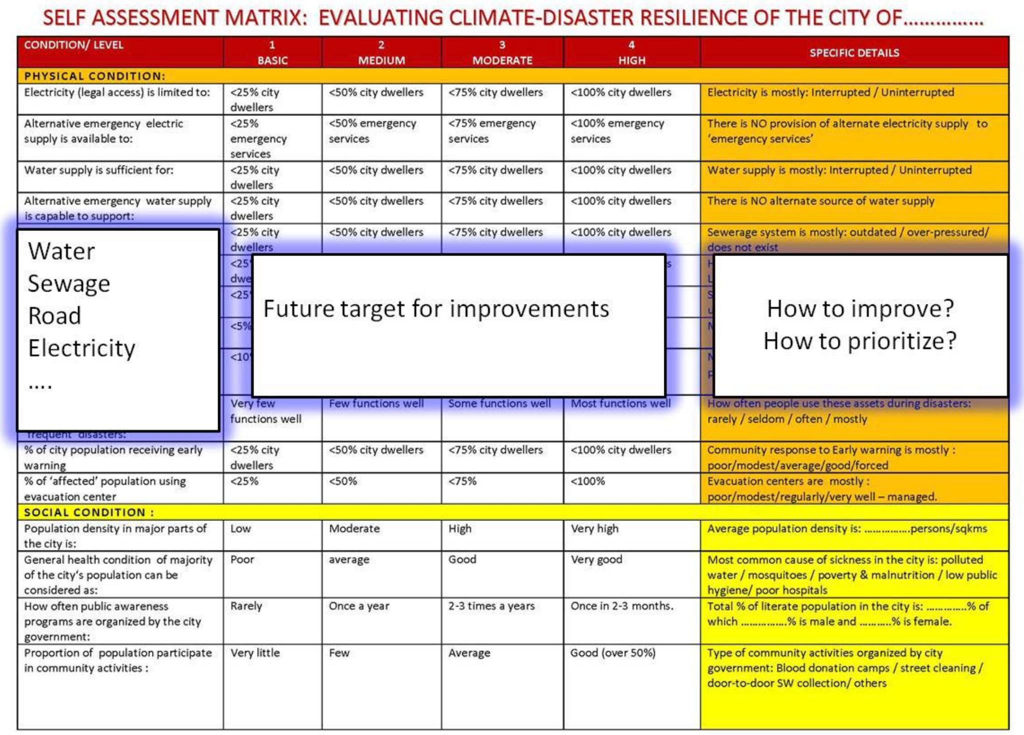


Figure: CDRI Self assessment matrix to monitor future adaptation activities in cities

As future initiatives, customized analysis will be done. For examples, 70 Indian cities are currently being analyzed which have different nature: mountain, river, coastal and arid area cities. Some of these cities are small, some are medium, and some are mega cities. A training program was conducted in Delhi in September 2009, in collaboration with National Institute of Disaster Management (NIDM) and SEEDS. Similar approaches are currently being taken for 17 cities and municipalities in Metro Manila along with Metro Manila Development Authority (MMDA). The other approach of the CDRI is to bring the analysis to ward levels in respective cities for micro level decision making and enhancing actions. Chennai and Mumbai are the two cities selected for this analysis.