Working Paper
Regional Expert Group Meeting on Capacity Development for Disaster Information Management

A Proposal for Asia Pacific Integrated Disaster Risk Information Platform

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Considering:

Effective disaster risk reduction (DRR) requires risk based decision making process and this in turn relays on reliable information. In other words, without reliable, available and accessible information, risk cannot be analyzed and defined; and DRR cannot be implemented;

The foundation for disaster risk management (DRM) is understanding the hazards and the exposure and vulnerability of people and assets to those hazards. By quantifying the risks and anticipating the potential impacts of hazards, governments, communities and individuals can make informed prevention decisions. Such information can be used to set priorities for development and adaptation strategies, sector plans, programs, projects and budgets;

Credible and useable information on risks is essential to inform the design of disaster risk management strategies, at all levels, from household and community level, through local governments, sectors and businesses and into national economic planning and management;

One of the main reason for lack of effective implementation of risk reduction is due to the fact that risk information is often not translated into policy partly because policy makers either do not find them reliable or are not able to use such information effectively;

HFA guiding principles that sound prevention and reduction of disaster risk are based on risk-informed decision-making, which requires freely available, publicly accessible science-based risk information, including on disaster losses and socio-economic impact, hazards, exposure and vulnerability;

HFA call for implementation of systematically recording and accounting for all disaster loss and impact, periodically estimating the probability of disaster risks to the population and to economic and fiscal assets in the context of a changing and variable climate, and convening national multi-stakeholder risk platforms and outlook fora to this aim;

Lack of consensus and consistency of disaster related data, including the number of lives lost, number of people affected and economic damage, among various disaster databases, regionally and globally; as well as limited number of institutions available to provide capacity development training on multi-hazard risk assessment as well as damage, loss and needs assessment;

The lack of systematic, reliable and comparable data constrains the understanding of various components of disaster risk such as hazard, vulnerability and exposure;

Extensive scientific knowledge on natural hazard and building behavior that need to be integrated for reliable risk analysis and its results to be disseminated toward risk communication and risk reduction;

Sensitivity of the built environment (urban building, lifeline and infrastructure) data and information especially in developing countries is a barrier in data exchange and sharing and openness;

Most countries do not have a commonly agreed system of data collection with harmonized definitions and standards. As such, many countries follow various practices of data collection, and as a result, the collected data is not comprehensive and often lack disaggregation; and

ESCAP with the emphasis on the fact that data availability for effective disaster risk management is a critical gap and remains one of the biggest challenges facing policymakers and practitioners; establishment of APDIM following ESCAP resolution 67/4 was a necessity to work and implement strategy based on South-South and Regional Cooperation for Capacity Development in Disaster Information Management for Risk Reduction with the objective of providing: (i) short-term capacity development training in seismic micro-zonation, building codes, disaster database organization, (ii) medium-term capacity development activities in developing risk assessment tools and techniques, and (iii) long-term collaboration and partnership in disaster information management.

To develop Asia Pacific Integrated Disaster Risk Information Platform; HFA had raised the following issues on data and information managements that need to be addressed in the development process of the Asia Pacific Integrated Disaster Risk Information Platform:

- Open data: Does the country have in place policies and standards that promote open data sharing and exchange and which guarantee unrestricted public access to hazard, exposure and risk information?
- Data platform: Does the country maintain a data platform enabling users to access and exchange disaster loss data, risk profiles and assessments, exposure and vulnerability data, disaster scenarios and other relevant risk information?
- Trans-boundary cooperation: Does the county have formal cooperation arrangements and protocols with neighboring countries to address trans-boundary risks, including risk monitoring, information sharing, early warning, contingency planning and response?
- Education: Are risk information and the results of research incorporated into the educational curriculum at primary and secondary levels?
- Emergency operations center (information management): Does the country have an emergency operation center which coordinates information management during disaster?
- Early warning: Does the country have a multi-hazard early warning system? How public has access to early warning information and is this inclusive of gender, age and disability?
- Early warning protocols: Do communication protocols and agreements exist with radio, television, telecommunication providers and others, to provide early warning information to households and businesses? Does this information reach the entire country?
- Provide capacity building on national spatial data infrastructure and risk information platform, standardization of disaster related data, disaster databases, including disaster loss database, damage and loss assessment.

Proposal for Asia Pacific Integrated Disaster Risk Information Platform

Risk information as the basis for good and effective management provides a critical foundation for managing disaster risk across a wide range of sectors. In the land use and urban planning sectors, robust analysis of flood risk likewise drives investment in flood protection. In the construction sector, quantifying the potential risk expected in the lifetime of a building, bridge or critical facility drives the creation and modification of building codes. At the community level, an understanding of hazard events - whether from living memory or oral and written histories - can inform and influence decisions on preparedness, including life-saving evacuation procedures and the location of important facilities. And in the insurance sector, the quantification of disaster risk is essential, given that the solvency capital of most non-life insurance companies is strongly influenced by their exposure to natural catastrophe risk.

Holistic evaluation of disaster risk centers on the development of databases and models for hazard, exposure, predicted casualty and property loss assessment, and more completely on the social and economic vulnerability aspects. Focusing on the development of integrated risk tools and harmonized databases to facilitate the development of indicators and indices will help decision-makers, stakeholders, researchers, and others to address seismic risk in a manner that allows:

1) Emphasizing on holistic view of risk where interactions between natural and social systems are as part of a dynamic system;
2) Mainstreaming of socio-economic factors in policy discussions;
3) Evaluation of loss, damage and socio-economic factors at different time and space scales for benchmarking exercises;
4) Recognition of the fact that both causes and solutions for earthquake loss are found in human, environmental, and built environment interactions; and
5) Development of a common dialog to reduce risk and strengthen resilience to earthquake.

Information and datasets are the critical starting point for most assessments and are based on best practice that can be replicated. APDIM team of expert can work on the development of platform for uniform datasets, based on the latest developments in the field and what can be obtained. This can be continuously enhanced for increased use at the local community level.

The following information and datasets should be developed at Asian-Pacific region for all natural disasters. The dataset should cover all information related to risk assessment as a basis for intelligent-based risk management, as shown in Figure 1.

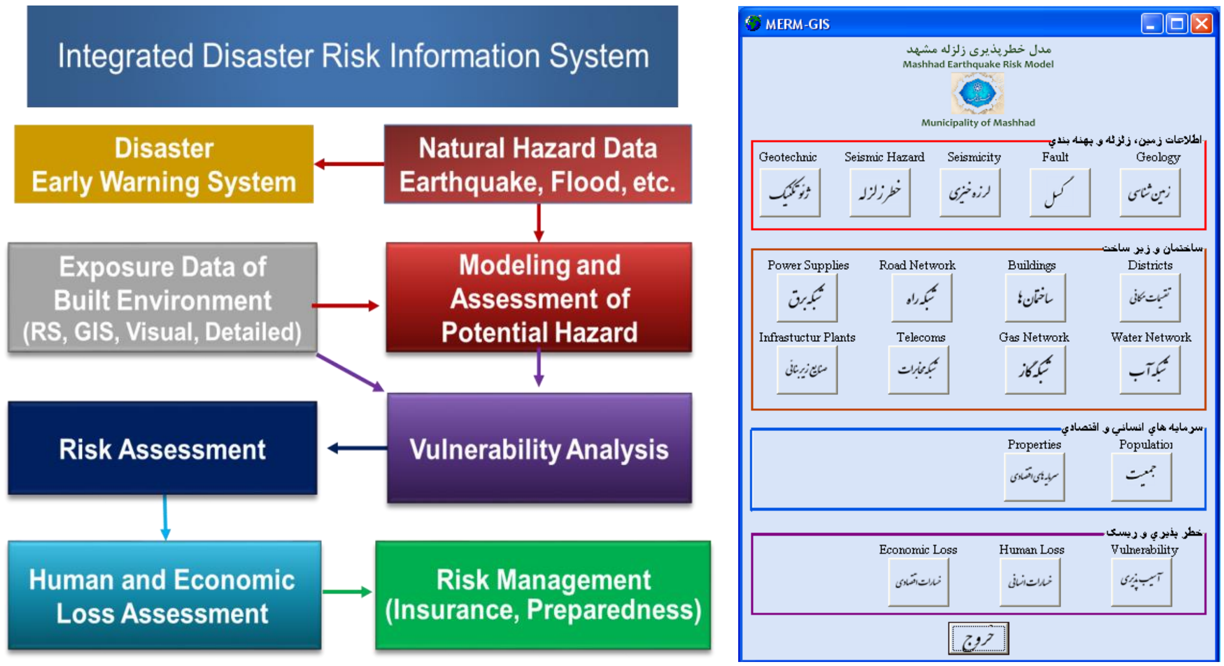

Figure 1. Integrated Disaster Risk Information System: sample of the implemented GIS-based information system for Mashhad Earthquake Risk Model, Iran

1. Natural Hazard Data

Today, natural hazard data are grouped in two time windows: historical data (before 1900) and instrumental data (after 1900).

- **Historical Data Catalogue**

To understand the natural hazard, and considering that natural events have no boundaries, a regional historical database for reliable analysis of the future events. Most of the data that are available at national level should be homogenized to be used at regional scale. In case of earthquake, a catalogue database of event for the time-window of 1000-1900 should be developed.

- **Instrumental Data Catalogue**

A catalogue of all recorded and measured data from the characteristic of natural hazard is required for mathematical modelling of events for the assessment of future events.
For earthquake, local data and the ISC-GEM Global Instrumental Earthquake homogenized Catalogue that cover more than 110 years of earthquake history should be collected. The catalogue can be used for global hazard assessment and serves a starting point for compilation of more detailed regional catalogues.

- **Geodetic Strain Rate Model**

The global geodetic strain rate model is numerical model that is based on almost 6000 GPS stations worldwide plus 1200 in China that measure plate motion, as well as 14000 from literature. The model is of great relevance to improve understanding of seismicity as strain rate is a proxy for earthquake potential. Development of the regional Geodetic Strain Rate Model is a significant improvement for understanding the occurrence of the future earthquake and reliable seismic hazard estimation.

- **Active Faults Database**

The knowledge of fault positions and current activity is of vital knowledge for the calculation of seismic hazard. The current state of the art only consists of a number of national and regional databases that are compiled according to different criteria and parameters. A regional unified database that could incorporate all of the information from different sources and formats. It should also be accompanied by a tool for capture of new data, so that the database can continue to compile faults from around the globe.

- **Strong Ground Motion Database**

Strong ground motion data are required for the development of the ground motion prediction equation, as well as for the building damage analysis. A regional database will provide valuable resources for the earthquake engineering community of Asia and the Pacific.

- **Ground Motion Prediction Equations (GMPE)**

Ground Motion Prediction Equations (GMPE) plays a key role in the seismic hazard estimation. There are many GMPEs that had been developed in the Asia and Pacific region. A database of the GMPEs that is reliable and compatible with the region need to be formed. Then, three or four GMPEs should be selected for each tectonic regime (subduction zones, active crustal regions, stable continental regions) and one for component substitution.

- **Tsunami Models**

- **Weather Reports and Climate Models**

2. Exposure Data of Built Environment

Considering the sensitivity of this data, APDIM should develop a GIS-MIS based platform for the compilation and collection of the exposure data at local level that contain information on buildings and people from the country-level all the way down to the individual building. To achieve this objective, APDIM should count on governments, companies, engineers, researchers, other organizations and individuals to contribute, feed data and implement the dataset, so that its value continues to increase and it can become a resource for many types of applications. The system should also aggregate information on population and the number/built area/reconstruction cost of residential and non-residential buildings at an agreeable resolution (1 km is good). Detailed datasets on single buildings should become available for a selected number of areas and will increase over time. It should be noted that the detailed database will remain at the city and its detail will not be shared and only the results or the lessons learned from them will be open to the region after approval and release by the owners. It shall also be noted that what will be developed for earthquake risk assessment; can also be used for many different types of hazards, natural and man-made, because people, buildings (and in a later stage perhaps infrastructure) are always the key elements being exposed to them.

This part of the information should include:

- **Natural Hazard Consequences Database**

Detailed data on the consequences from past natural hazard events (earthquakes, tsunamis, floods, storms, etc.) are of great importance as it allows us to understand their effects and helps to better estimate the risk from future events including damage to buildings, critical facilities, economic losses, social consequences and risk to life. From consequence data, experts can develop and improve fragility functions (for buildings and other elements at risk) that are needed to estimate future possible loss under a certain event scenario.

The database can be used as a framework for development of more detailed consequences datasets of any natural hazard events at various resolutions (country, province, municipal and even specific locations) that can form the backbone for estimating risk.

- **Building Taxonomy**

It is a very comprehensive regional classification scheme for buildings, able to capture all different building types that exist around the globe, and it is accompanied by tools that allow you to easily work with the building taxonomy. The taxonomy and glossary will be used as a basis for the regional exposure database and consequences database, as well as by the inventory data capture tools, for adding new information on buildings to the APDIM data platform. The general engineering information can also be used to facilitate the growth of joint knowledge on the diversity of seismic vulnerability of all the buildings that exist around the globe.

Considering the existence of the EERI's World Housing Encyclopedia, the GEM Building Taxonomy that consisted of engineering information from 217 building reports from 49 countries, the APDIM building taxonomy can be built on the existing data.

The required information for the APDIM building taxonomy are:

1. Structural system (attributes: Direction; Material of the Lateral Load-Resisting System; and Lateral Load-Resisting System)
2. Building information (attributes: Height; date of Construction or Retrofit; and Occupancy);
3. Exterior attributes (attributes: Building Position within a Block; Shape of the Building Plan; Structural Irregularity; and Exterior Walls),and
4. Roof/floor/foundation (attributes: Roof; Floor; and Foundation).

- **Physical Vulnerability Functions Database**

Vulnerability functions represent the probabilistic relationship between natural hazard intensity (i.e. earthquake Intensity PGA) and cost of repair for a particular asset (building) or asset class (category of buildings). Fragility functions on the other hand represent the relation between natural hazard intensity and the probability of reaching or exceeding a certain limit state – a condition beyond which a structure no longer fulfills the relevant design criteria – such as collapse. Both are of key importance in estimating the probability of damage or loss caused in the event of a natural hazard. Bringing all functions together in a single dataset, with guidelines for applications, as well as present methods for creation of new functions where they are currently lacking in the region. These kinds of functions are very important for the earthquake risk analysis and good amount of literature exists. This need to be developed for other natural disasters.

- **Socio-Economic Database**

In socio-economic analysis; various factors such as land use planning, public awareness, governance, population growth and its density, migration, resilience, resource allocation, wealth or poverty, etc. can lead to adverse consequences of natural disaster. On the other hand, in the aftermath of an event, communities may suffer from human harm or economic losses as the results of direct and indirect losses such as human casualties, security treats, property damage, business interruption, infrastructure damages, loss of jobs and income and other adverse consequences of disasters.

A set of a comprehensive, spatially enabled databases for indices of social and economic vulnerability need to be developed at the national and city level. Based on the socio-economic vulnerability studies, there are many socio-economic variables that affect the human and economic losses. The indicators should be classified according to a broad range of taxonomies that includes hazard, built environment, land-use, vulnerability, population and human influence, economy and wealth, resilience (health, education, governance) and infrastructures. The collection, harmonization, construction and analysis of the available data sets at city and national level are shown in Figure 2. Today, the socio-economic database and information in comparison with the natural hazard and built environment building and infrastructure data are less available and developed; thus extensive efforts by APDIM is required. A decision need to be made on selecting the data type for basic and uniform socio-economic analysis and the available data in the region need to be collected.

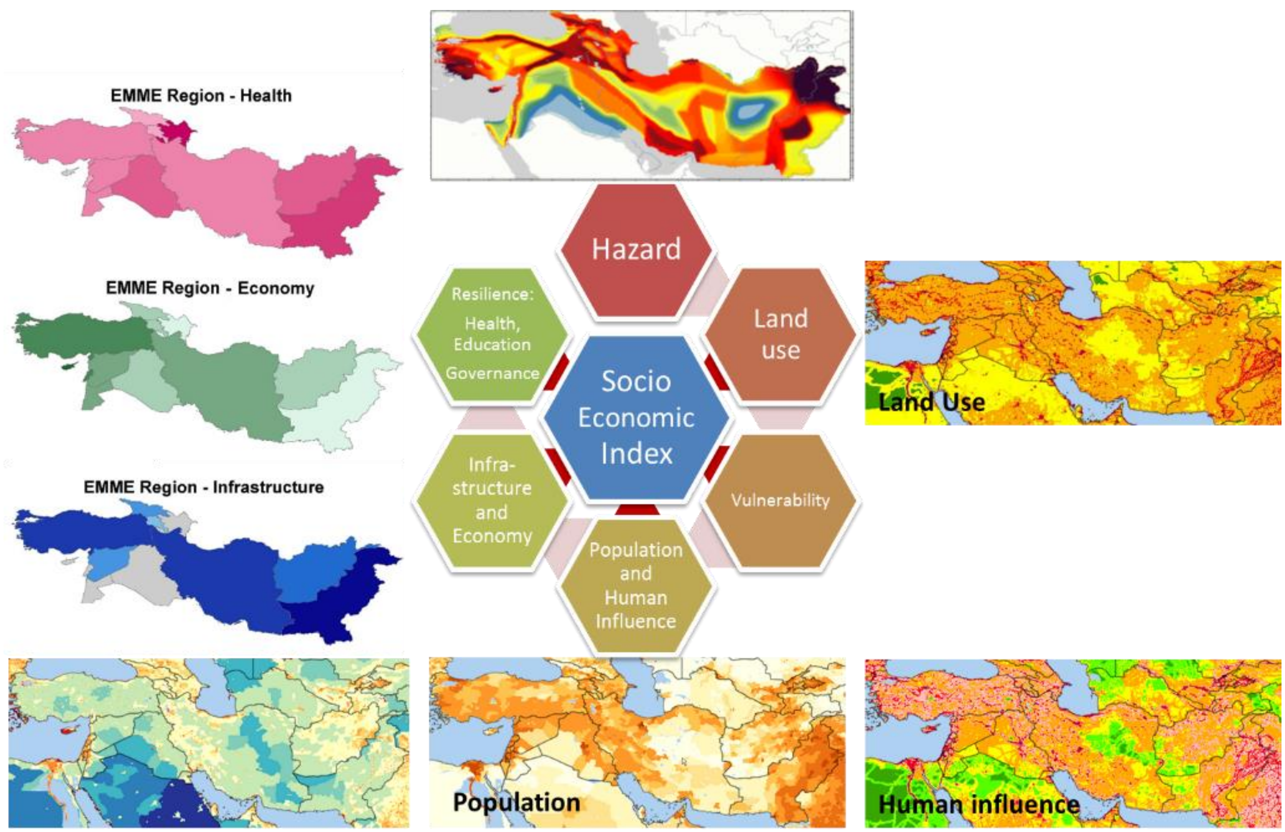

Figure 2: Main parameters affecting socio-economic vulnerability indices and analysis.

The results of this database can help the countries assess human casualties (number of death, injured and hospitalized) and economic damage in monetary term for each taxonomy group of risk in a reliable way. This estimation can be presented in the form of maps, graphs and tables in GIS format showing spatial and temporal distribution of socio-economic indexes such as:

1. Estimated number of casualties in day and night
2. Fatality ratios by various geographical resolutions (Grid, city, provinces, country)
3. Estimated Economic losses
4. Probabilistic Annual Mean Loss ratios (AML) and or Probable Maximum Loss (PML)
5. Maps showing AML's and PML's by different building taxonomies.
6. Map representing dependencies of casualty and economic loss rate to other socio-economic factors.