

Introduction

A System of Indicators for Disaster Risk Management

Risk is not only associated with the occurrence of intense physical phenomena, but also with the vulnerability conditions that favor or facilitate disasters when these phenomena occur. Vulnerability is intimately related to social processes in disaster prone areas and is also usually related to the fragility, susceptibility or lack of resilience of the population when faced with various hazards. In other words, disasters are socio-environmental by nature and their occurrence is the result of socially created risk. This means that in order to reduce disaster risk, society must embark in a decision-making processes. This process is not only required during the reconstruction phase immediately following a disaster, but should also be a part of overall national public policy formulation and development planning. This, in turn, requires institutional strengthening and investments in reducing vulnerability.

All types of risk management capabilities need to be strengthened in order to reduce vulnerability. In addition, existing risks and likely future risks must also be identified. This cannot be accomplished without an adequate measure of risk and monitoring to determine the effectiveness and efficiency of corrective or prospective intervention measures to mitigate or prevent disasters. The evaluation and follow-up of risk is needed to make sure that all those who might be affected by it, as well as those responsible for risk management are made aware of it and can identify its causes. To this end, evaluation and follow up must be undertaken using methods that facilitate an understanding of the problem and that can help guide the decision-making process.

The methodology proposed in this report measures risk and vulnerability using relative indica-

tors at the national level. The aim is to provide national decisionmakers with access to the information that they need to identify risk and propose adequate disaster risk management policies and actions. The proposed system of indicators allows for the identification of economic and social factors that affect risk and risk management, as well as the international comparison of these factors.

To make sure that this methodology is easy to use, it must include a limited number of aggregate indicators that will be of use to policymakers. While this methodology is national in nature, the research also evaluated subnational and urban data using a similar conceptual and methodological approach in order to illustrate the application of this model at the regional and local levels. The goal of this research program was to adjust the methodology and apply it to a wide range of countries in order to identify analytical factors (economic, social, resilience, etc.) to carry out an analysis of the risk and risk management conditions in those countries. The integrated system detailed in this report allows a holistic, relative and comparative analysis of risk and risk management (Cardona 2001; 2004). In accordance with program requirements, this methodology is expected to have three major impacts at the national level.

First, it should lead to an improvement in the use and presentation of information on risk. This will assist policymakers in identifying investment priorities to reduce risk (such as prevention and mitigation measures), and direct the post disaster recovery process.

Second, the methodology provides a way to measure key elements of vulnerability for countries facing natural phenomena. It also provides a way to identify national risk management capacities, as well as comparative

data for evaluating the effects of policies and investments on risk management.

Third, application of this methodology should promote the exchange of technical information for public policy formulation and risk management programs throughout the region.

In addition, the research program is expected to help fill an important information gap for national decisionmakers in the financial, economic, environmental, public health, territorial organization, and housing and infrastructure sectors. The methodology provides a tool for monitoring and promoting the development of risk management capacities. Because the data is comparable across countries, it will make it possible for policymakers to gauge their country's relative position and compare their evolution over time. Finally, the results of the Disaster Risk Indicators Program yield a tool that the IDB can use to guide its policy dialogue and assistance to member countries. It also contributes to the Bank's Action Plan and, in particular, to promoting the "evaluation of methods available for estimating risk, establishing indicators of vulnerability and vulnerability reduction and stimulating the production and diffusion of wide-ranging information on risks." It is also related to an IDB strategic area; namely, it provides information on risks in order to facilitate decision-making (Clarke and Keipi, 2000).

A Measurement Approach Based on Composite Indicators

Creating a measurement system based on composite indicators is a major conceptual and technical challenge, which is made even more so when the aim is to produce indicators that are transparent, robust, representative, replicable, comparable, and easy to understand. All methodologies have their limitations that reflect the complexity of what is to be measured and what can be achieved. As a result, for example, the lack of data may make it necessary to ac-

cept approaches and criteria that are less exact or comprehensive than what would have been desired. These trade-offs are unavoidable when dealing with risk and may even be considered desirable.

Based on the conceptual framework developed for this program (Cardona *et al.*, 2003a), a system of risk indicators is proposed that represents the current vulnerability and risk management situation in each country. The indicators proposed are transparent, relatively easy to update periodically, and easily understood by public policymakers. Four components or composite indicators have been designed to represent the main elements of vulnerability and show each country's progress in managing risk. The four indicators are the Disaster Deficit Index (DDI), the Local Disaster Index (LDI), the Prevalent Vulnerability Index (PVI), and the Risk Management Index (RMI).

The *Disaster Deficit Index* measures country risk from a macroeconomic and financial perspective according to possible catastrophic events. It requires the estimation of critical impacts during a given period of exposure, as well as the country's financial ability to cope with the situation.

The *Local Disaster Index* identifies the social and environmental risks resulting from more recurrent lower level events (which are often chronic at the local and subnational levels). These events have a disproportionate impact on more socially and economically vulnerable populations, and have highly damaging impacts on national development.

The *Prevalent Vulnerability Index* is made up of a series of indicators that characterize prevalent vulnerability conditions reflected in exposure in prone areas, socioeconomic weaknesses and lack of social resilience in general.

The *Risk Management Index* brings together a group of indicators that measure a country's

risk management performance. These indicators reflect the organizational, development, capacity and institutional actions taken to reduce vulnerability and losses, to prepare for crisis and to recover efficiently from disasters.

The system of indicators covers different areas of the risk problem, taking into account issues such as: potential damages and losses resulting from extreme events; recurrent disasters or losses; social and environmental conditions that make particular countries or regions more disaster prone; the capacity of the economy to recover; the operation of key services; institutional capacity and the effectiveness of basic risk management instruments (such as risk identification, prevention and mitigation measures, financial mechanisms and risk transfer); emergency response levels; and preparedness and recovery capacity.

The Disaster Deficit Index relates assumed (deductive) indicators and depends on the simple modeling of physical risk as a function of the occurrence of a potentially extreme hazard (scientific prediction). The Local Disaster Index relies on indicators of past events with different impact levels (history). The Prevalent Vulnerability and the Risk Management indices are composites derived by aggregating quantitative and qualitative indicators. The indices were constructed using a multi-attribute technique

and the indicators were carefully related and weighted. The indicators and the variables used in their construction were chosen through an extensive review of the risk management literature, assessment of available data, and broad-based consultation and analysis. The program reports listed in the bibliography detail the conceptual framework, the methodology, and the treatment of the data and statistical techniques used in the modeling (Cardona *et al.*, 2003a, 2003b, 2004a, 2004b and 2005).²

This system of indicators has been designed to permit measurement and monitoring over time, and to identify risks and their causes. Its aim is also to facilitate comparisons across countries by using criteria related to hazard levels and the socioeconomic conditions that affect vulnerability. This system of indicators provides a holistic approach to evaluation that is also flexible and compatible with other evaluation methods. As a result, it is likely to be increasingly used to measure risk and risk management conditions. The systems main advantage lies in its ability to disaggregate results and identify factors that should take priority in risk management actions, while measuring the effectiveness of those actions. The main objective is to facilitate the decision-making process. In other words, the concept underlying this methodology is one of controlling risk rather than obtaining a precise evaluation of it (physical truth).

² See also <http://idea.unalmz.edu.co>