

Planning and Financial Protection to Survive Disasters

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Inter-American Development Bank

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Many contacts with the academic, private commercial and public sectors, and the review of a host of studies have contributed to the ideas included in the document. The different stages of the paper have been peer reviewed by Gabriela Basurto, Diego Rodriguez and Kim Staking of the IDB and by Omar Dario Cardona of the Universidad de los Andes, Colombia, Ivar Petteresen, Center of Economic Analysis (ECON) of Norway and Thomas Schaefer of GTZ of Germany. A working document version of the paper was also made available for the review by more than 30 participants in the second session of the Regional Disaster Dialogue organized by the Bank in Washington, D.C. May 2002.

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FOREWORD

Natural disasters have always been a part of the physical and human landscape in Latin America and the Caribbean and they will continue to have a significant impact on the development of the region. Experience has shown that the economies of developing countries such as those in Latin America and the Caribbean are more vulnerable to losses than the developed economies. They also suffer more fatalities. There is an urgent need to manage risk in the region.

Risk management and emergency response need to be very clearly distinguished. Risk management calls for *ex-ante* planning and investments to reduce vulnerability while emergency response involves *ex-post* expenditures which may be greatly reduced through *ex-ante* planning and investments in prevention and mitigation.

While the occurrence of natural events can not be prevented, there is a possibility to reduce the vulnerability of populations through risk management. The IDB Action Plan for natural disaster risk reduction of 2000 included recommendations in two important areas: (i) planning with the purpose of the identification and reduction of risk by integrating prevention and mitigation measures into development plans and programs and (ii) financial protection, provided by the transferring of risk to others or spreading it in time. This paper deals with both of these aspects.

Without adequate risk management disasters may seriously threaten the development objectives by the borrowing member countries and jeopardize successful implementation of Bank mission in the region. There is a special need to balance risk reduction with risk transfer.

An important incentive to the preparation of the present document was given by the request to the Bank by the Hemispheric Summit in Quebec City of April 2001. It asked the IDB to analyze the applicability of various financial instrument for disaster risk reduction in Latin America and the Caribbean. This paper is the first in a series to address this issue.

The ongoing discussions of the Policy and Evaluation Committee of the Board of Directors of the Bank on the theme of disaster risk management further inspired the writing of the document. It is one of the themes to be addressed in the carrying out of the Bank's vision of environmentally sustainable economic growth in Latin America and the Caribbean in the coming years.

Walter Arensberg
Chief, Environment Division

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OVERVIEW

The Impacts of Disasters

One of this century's biggest challenges for sustainable development in Latin America and the Caribbean is how to reduce the risk of natural disasters. The fundamental problems facing development in the region contribute to its vulnerability in the face of natural disasters. It is estimated that damages from disasters in the region have reached some US\$20 billion annually over a ten-year period, leaving a toll of 45,000 deaths and 40 million people affected (ECLAC, 1999). Major catastrophes have impacts that go beyond the direct damages (which are normally quantified in loss of life, number of people injured and economic damages to those who are directly affected) given that they also have negative consequences for GDP, the balance of payments, the level of indebtedness, the fiscal balance and investment.

Prevention and Mitigation

The economic and social development of the countries of the region will continue to be adversely affected if adequate disaster prevention and mitigation measures are not adopted. To this end, risk management is a key concept. In the case of disasters, risk is defined as a function of two factors: hazard and vulnerability. The former is relatively easy to detect, but its impact is hard to reduce if no plans are instituted for reducing vulnerability. Therefore, it is indispensable to adopt a full-range approach to risk management, a process that consists in identifying, analyzing and quantifying the likelihood of loss and, on that basis, undertaking preventive or corrective activities. These activities may include both structural investments and nonstructural actions to reduce vulnerability; among the

latter are financial protection mechanisms against the potential losses resulting from a catastrophe.

Building Awareness for Making Decisions

During the nineties (which the United Nations designated as the *International Decade for the Reduction of Natural Disasters*), the region made big strides forward in terms of understanding the concepts of vulnerability and risk and the need to plan prevention and mitigation actions. Nevertheless, pertinent officials appear to have little knowledge of the range of existing options for obtaining financial protection against the risk of disasters.

In the scientific and academic sector, major knowledge has been gained regarding physical and financial protection against risk but, by and large, this information has not been transferred to governments or to the private sector. This has led to a situation in which decisionmakers continue to be ill-equipped to reduce the risk of natural disasters or to adopt measures tending to establish financial protection against risks that cannot be reduced.

Financial Protection

A cost-benefit analysis to evaluate their long-term profitability will determine the mitigation and prevention measures that a country ought to establish in order to reduce the high costs of responding to emergencies, as well as costs associated with rehabilitation and reconstruction. However, financial protection systems are required because preventive and mitigation measures cannot eliminate all risks. As part of this process it will be necessary to assess the potential effects that the catastrophes may have on the country's econ-

omy. This evaluation of the risk and of its possible levels of transfer will affect the impact that a disaster may have on the government budget, since in Latin America and the Caribbean, governments frequently shoulder the greatest part of the risk, acting as insurers of last resort. Clearly, the government's financial burden can be lessened if other actors assume part of the risk.

The Credit System

The development of an efficient savings and credit system through the region's banks as well as informal and microcredit institutions, would contribute to the mobilization of the resources needed to finance investments in prevention and mitigation as well rehabilitation and reconstruction.

The contingent credit mechanism makes it easier to obtain financing in the event of a disaster. Yet, this requires that the client commit to an annual expense, and although a relatively low-cost instrument will, nevertheless, increase indebtedness. Thus, to avoid this, clients often prefer to obtain loans after a disaster has occurred, especially if they can gain expeditious access to them.

However, because it is generally difficult to obtain new loans immediately following a disaster, clients seek to refinance existing loans. This option has several disadvantages. First, it distorts the goals of the original credits. Second, it reduces the efficacy of the execution of the original projects by the clients who now seek to make use of the resources for emergency situations. Third, it contributes to bad management of the original credits by the financial entity, if it expects that the funds may be used to finance emergencies rather than for the purpose for which it was originally extended. Finally, it makes clients dependent on this kind of *ex post* financing, instead of encouraging them to carry out pre-

vention and mitigation investments to diminish risk.

Risk Transfer

The countries of the region are interested in creating risk transfer instruments based on mechanisms currently in use in developed countries, especially insurance. Since insurance premiums are a function of prevention and mitigation measures taken by the insured party, the establishment of insurance mechanisms would increase awareness of the need to invest in such measures and to put them into practice. Financial protection against disasters through insurance mechanisms is attractive since it offers the opportunity of transferring part of the risk, while avoiding the need to increase indebtedness as a result of an emergency. Financing through *ex ante* credits would offer even more incentives to mitigate risk because risk transfer instruments tend to offer opportunities to contain moral risk or adverse selection problems. The principal benefit of the transfer mechanisms relates to the distribution of risk that results in the reduction of risk management cost.

The development of insurance markets requires updating the pertinent legislation and normative framework. Although most of the weaknesses that exist are on the demand side (such as the lack of enforcement of building codes and difficulties in establishing asset values, as well as the generally low capacity of clients to pay premiums), supply-side adjustments are also necessary. These include strengthening independent supervision systems to improve monitoring of the solvency of insurance companies and eliminate conditions that favor anticompetitive practices. To meet this need, the supervisory entity should enjoy adequate oversight powers as well as the ability to exact appropriate penalties. Insurance companies should also be encouraged to adopt international standards in order to

maintain solvency, increase efficiency, and promote transparency through the timely publication of detailed and precise financial statements.

There is also a need to establish the necessary conditions for the use of innovative capital market mechanisms such as parametric catastrophe bonds, and weather-related derivatives. These instruments, which hold the interest of international financial entities, avoid the major obstacles related to asset valuation and loss settlement procedures, but have to be implemented at pool or governmental levels.

Establishing Priorities in the Use of Available Resources

In the event of a disaster, the resources of existing and lower-cost sources would typically be employed first. If a fund for calamities, with adequate resources, is already in operation (as in the case of Mexico's FONDEN, see Box 4), or coverage is available by means of insurance or catastrophe bonds, they should be used first. However, since such instruments don't yet play an important role in most countries, the trend is to first transfer funds from the government budget and from development funds (municipal, social, urban, rural, etc.) to meet critical needs. This is usually followed by a search for international donations. Another instrument that could be highly useful is contingent credit, although it entails an annual administrative payment and indebtedness if the emergency takes place.

It is noted that instruments such as insurance mechanisms, common in countries with developed financial markets, are not yet being employed in Latin America and the Carib-

bean. Governments can adopt a range of measures to promote their development, including opening up the countries to international competition. As a first step they can improve existing practices by insuring their own critical assets through international tenders. On the other hand, international financial agencies such as the IDB could adopt stricter policies and require mandatory catastrophe risk coverage, especially for private sector projects.

Comprehensive Approach

Risk management implies the important task of reducing vulnerability and, as a result, risk itself, an undertaking that has barely begun in the region. Hitherto, the predominant paradigm in the region has been to respond to emergency situations when they occur. This means that there is a response to the phenomenon's effects but without eliminating or mitigating the causes of the vulnerability that causes these effects. Ideally, prevention and mitigation measures ought to be combined with financial protection instruments in a coordinated action by the government and private sector. In addition to having a national emergency plan or strategy for *ex post* actions, each country ought to design a consistent national plan or strategy to manage disaster risk. Those plans should be developed jointly with input from finance and planning ministries, sector ministries and local governments, the private sector and civil society. Providing effective mechanisms for *ex ante* financial protection is essential because it facilitates the availability of funds when they are needed most, and can reduce the *ex post* financial burden of recovery and reconstruction following a catastrophic event.

DISASTERS IN LATIN AMERICA AND THE CARIBBEAN

Frequency of Disasters

Given the upward trend in the frequency and seriousness of natural disasters in Latin America and the Caribbean, one of the most important challenges for sustainable development in this century will be how to manage the risk that they pose.

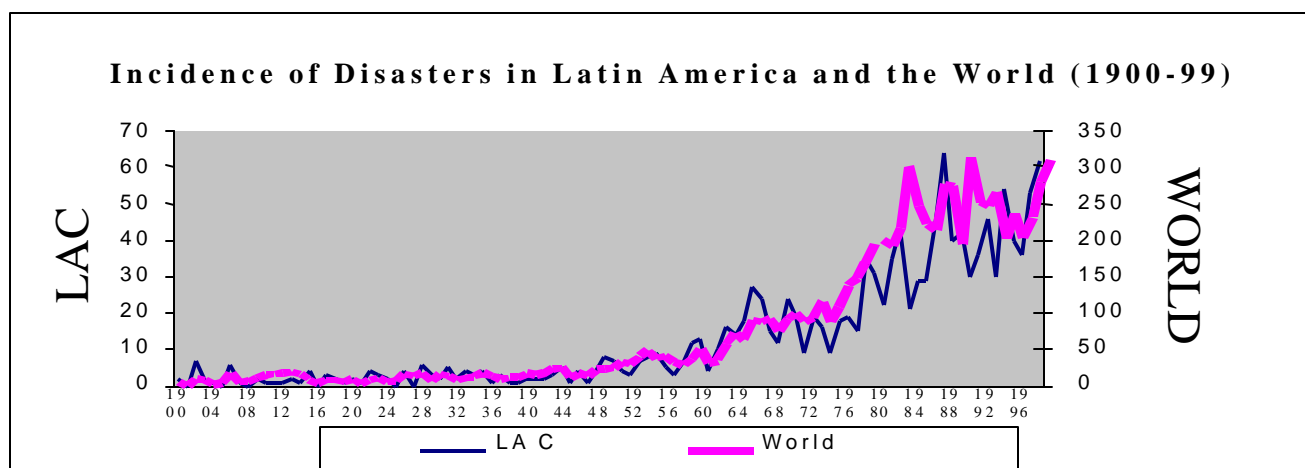
The region is threatened by a wide range of seismic and weather-related phenomena. The increase in the frequency of recorded disasters and in related damages in recent years could be a consequence of greater vulnerability. That increased vulnerability could, in turn, result from an growing concentration of people, structures and other assets in urban centers, making them more susceptible to disasters. Likewise, the lack of general awareness regarding the importance of preventing and mitigating catastrophes, as well as institutional weakness, the persistence of poverty, the degradation of the environment and, possibly, climate change, are leading to an increase in the seriousness and frequency of these natural events.

The disaster recorded during the last ten years resulted in over 45,000 deaths and affected 40 million people, causing more than US\$20 billion in damages in Latin America and the Caribbean (ECLAC-IDB, 2000). As overwhelming as these figures are, they probably underestimate the real cost of disasters in the region, since they do not include the effects of many events of lower intensity that go unrecorded. The increase in the incidence of disasters is not limited to Latin America and the Caribbean. As Figure 1 shows, it is a world-wide phenomenon.

Direct and Indirect Damages

Direct damages to goods and assets include the total or partial destruction of dwellings and other buildings, infrastructure and facilities, machinery and equipment, means of transport, warehouses, furniture, harvests, cultivated land, dams, irrigation systems, etc. These direct damages are a function of the type, geographical range and magnitude of the particular natural phenomenon, as well as of

Figure 1



Source: Charveriat (2000).

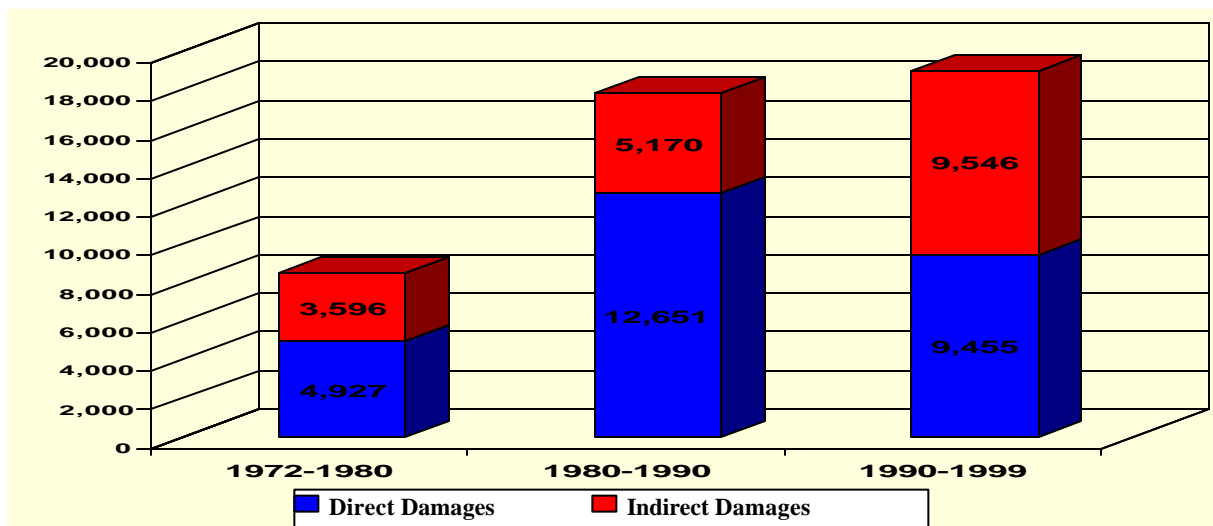
the vulnerability of the affected area (ECLAC, 1999a).

The economic impact of a disaster goes beyond direct damages and also encompasses indirect ones, which are a consequence of the destruction of productive capacity and of the social and economic infrastructure (see Figure 2). These damages, which are very often hard to quantify, are cumulative and persist until the reconstruction and restoration of productive capacity are complete. The damage to goods and assets (buildings, machinery, live-

stock, cultivable land, etc.) may have a significant impact on poverty because it impairs people's ability to find employment and generate income. It is precisely the lack of income that, in many cases, delays economic recovery.

Some of the damage caused by natural catastrophes are irreversible. This is the case of the deaths as well as of the irreparable destruction of natural resources like forests and cultivable land. Consequently, they make poverty more acute and may increase social tensions, with

Figure 2. Losses Due to Natural Disasters in Latin America and the Caribbean



Source: ECLAC (1999a)

Box 1. The Impact of Disasters on GDP: Hurricane Mitch

It is calculated that the damages caused by Hurricane Mitch in Central America reached US\$6 billion in 1998, equivalent to 16 percent of the region's GDP that year, 66 percent of its exports, 96.5 percent of its gross fixed capital formation and 37.2 percent of its foreign debt. The most affected sector was agriculture (49 percent), followed by infrastructure (21 percent), the social sectors (13 percent) and industry (10 percent). In Honduras, the damages reached almost US\$4 billion or 81.6 percent of GDP, 174.3 percent of exports, 343.9 percent of gross fixed capital formation and 94.1 percent of the foreign debt.

GDP growth in Central America averaged 4.3 percent per year between 1992 and 1998. Before Hurricane Mitch, GDP growth for 1999-2003 was forecast at an average annual rate of 4.8 percent. This rate of growth meant that by 2004 the region's per capita GDP would have returned to the 1978 level (US\$1,166). More current ECLAC estimates place the region's average annual growth rate for that period at only 3.6 percent, 1.2 percentage points less than it might have been. Consequently, the region will take a further three years to recover the "lost decade" and to reach the level of per capita GDP it had in 1978.

Source: ECLAC (1999b).

potentially negative repercussions on the sustainable development process. However, with appropriate planning and financial protection, even a country with a relatively high incidence of natural hazards can safeguard its economic growth potential.

Macroeconomic Effects

Natural disasters of a sufficiently large magnitude may harm the economic development of an entire country, adversely affecting GDP, the balance of payments, the level of indebtedness, the fiscal balance and investment (see Box 1). ECLAC (1999a) and IIASA (2000) refer to these macroeconomic consequences

of disasters as “secondary effects.” Catastrophic events that affect large sectors of the economy generally reduce the pace of growth. For example, following a disaster, government revenues tend to decline while expenditures increase, leading to an increase in the government deficit. Additionally, the decline in productive capacity and large public and private investments for reconstruction are likely to reduce exports and increase imports, leading to a trade and balance of payments deficits (which may be partly offset by the inflow of public and private disaster relief). Table 1 presents examples of the magnitude of losses resulting from past natural disasters in Latin America and Caribbean.

Table 1.

| Examples of GDP Reduction Due to Natural Disasters | | | |
|---|-------------|-------------------------|-----------------------|
| Country | Year | Type of Disaster | GDP losses (%) |
| Argentina | 1985 | Flood | 1.48 |
| Barbados | 1987 | Hurricane | 6.86 |
| Bolivia | 1982 | Flood | 19.80 |
| Chile | 1985 | Earthquake | 9.10 |
| Costa Rica | 1991 | Earthquake | 8.87 |
| Honduras | 1993 | Hurricane/Flood | 3.39 |
| Jamaica | 1988 | Hurricane | 28.21 |
| Mexico | 1985 | Earthquake | 2.18 |
| Nicaragua | 1994 | Drought | 8.74 |
| Paraguay | 1983 | Flood | 1.36 |
| Peru | 1983 | Flood/Drought | 5.96 |

Source: Charveriat, 2000

RISK MANAGEMENT

The Concept of Risk

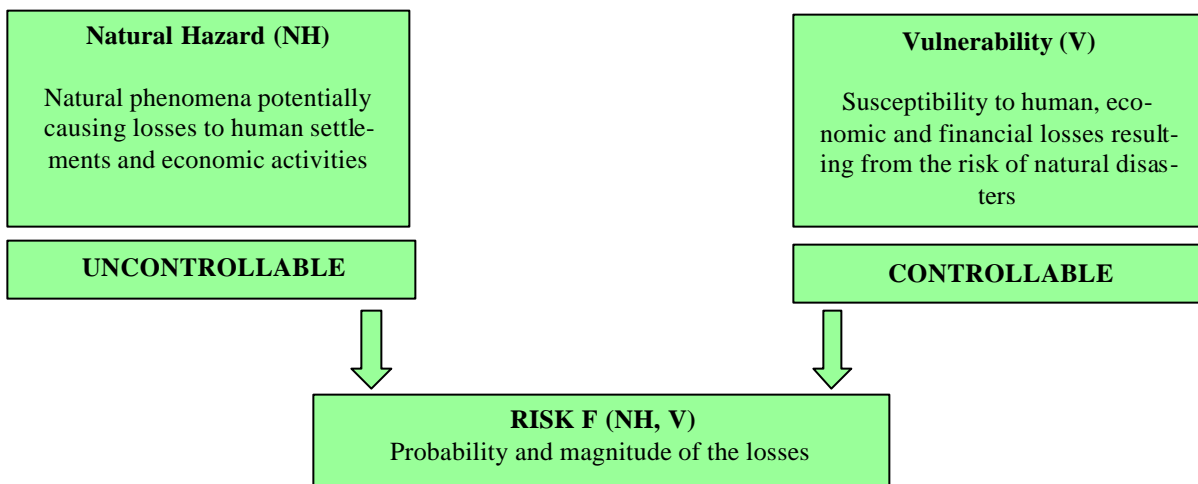
The management of risk is essential to reducing the damages associated with disasters. Risk is defined as a function of two factors: the natural hazard and vulnerability (see Figure 3). It is the probability and magnitude of the losses associated with a specific natural event at a particular geographical point and time. The incidence of natural events that could cause disasters lies beyond human control; however, vulnerability can be controlled.

The estimate of natural threats is characterized by the analysis of the frequency, magnitude and location of disasters. This exercise should include both historical data and continual vigilance of current natural threats, and the preparation of forecasts, making use of the technological progress that has taken place in fields such as seismology, vulcanology and meteorology to estimate future threats. In Latin America and the Caribbean, the most common threats recorded in the twentieth century were (in descending order of frequency): floods, hurricanes, earthquakes, landslides, droughts, volcanic eruptions and

fires. Among these threats, the first three account for 77 percent of all catastrophic events (OFDA-CRED, 1999).

Risk management is defined as the process of identifying, analyzing and quantifying the probability of losses in order to undertake preventive or corrective actions (Schaming, 1998). This involves two types of activities: 1) planning actions to reduce vulnerability in areas where risk can be controlled, and 2) establishing protection mechanisms against the potential economic losses resulting from uncontrollable factors in order to offset the financial threat. A comprehensive approach to disaster risk management should emphasize both *ex ante* measures (prior to a hazard) and *ex post* activities (see Figure 4). The main elements of the *ex ante* phases of risk management are: 1) identification and analysis of the risk; 2) mitigation and prevention; 3) protection via risk transfer; and 4) preparations (see the Annex). The subsequent phases of rehabilitation and reconstruction are better known.

Figure 3. Natural Hazard, Vulnerability and Risk



Box 2
Risk Management:
Implementing the IDB Action Plan

The mandate of the IDB Group (the Bank, the Inter-American Investment Corporation and the Multilateral Investment Fund) is to contribute to the long-term economic and social development in the region, which also includes sustainable growth. As a result, this implies helping member countries to create a favorable environment for efficient risk management. Over the last 40 years, the Bank has financed activities for the construction and reconstruction of basic infrastructure, urban and rural development, environmental protection and natural resources management, many of which have contributed to reducing vulnerability to disasters. The Bank has also helped governments to establish sector policies and reforms and to reorganize the public institutions that may play a positive role in the prevention of catastrophic events. Nevertheless, there have been relatively few cases in which a reduction in vulnerability was a main objective of the investments backed by the IDB or by other financial entities. In order to have a greater impact, it is essential to go beyond the customary rehabilitation or reconstruction and to take proactive measures to define, understand and reduce risk. Thus, it is necessary to carry out a wide range of risk identification, prevention, mitigation and transfer activities, as defined in the Bank's Action Plan for 2000.

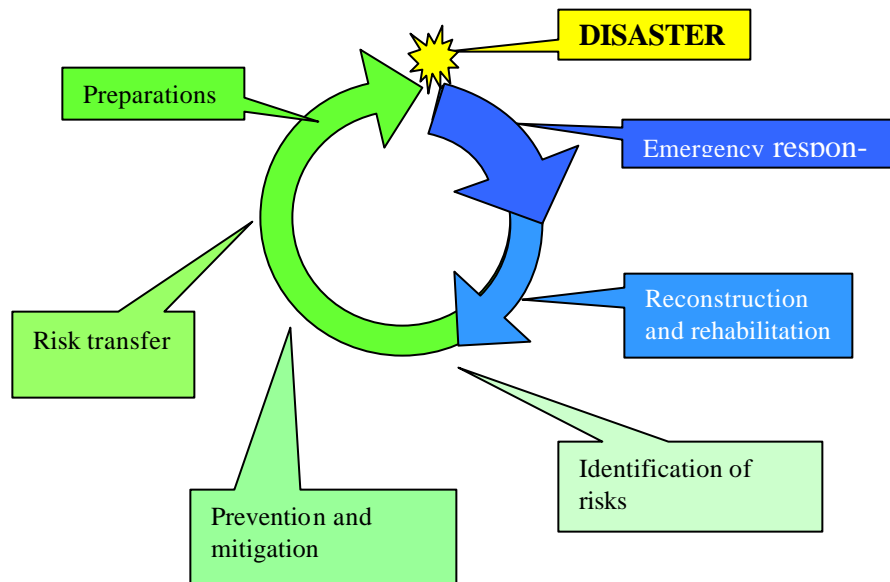
Source: IDB, 2000

Lester (2000) argues that private companies tend to maximize the net current value of their capital with horizontal planning variables. Politicians, on the contrary, work with chronological frameworks related to election cycles. Both actors may prefer shorter periods than those that are required by disaster risk management, since not only is it difficult to predict beforehand and with precision when they will strike, but their recurrence may take place at extended intervals. Typically, it is only when a catastrophe with serious economic, social and, therefore, political consequences happens that governments are motivated to take precise and concrete actions to respond to the disasters and to prevent future ones. This means that risk management tends to gain in importance only after the damage has occurred.

Ex ante and Ex post Actions

Countries affected by recurring events often find themselves in a vicious circle of disaster-reconstruction-disaster, wherein each new catastrophic cycle can increase the vulnerability to future threats, as well as increase indebtedness owing to the necessary investments in rehabilitation and reconstruction.

Figure 4. Risk Management as a Virtuous Circle



This evidently has negative repercussions for economic development over the medium and long term. However, the economic losses faced by a country that is frequently affected by disasters can be minimized through prevention, mitigation and risk transfer because the losses resulting from a disaster tend to be greater than the cost of preventive investments and financial protection. For this reason, both prevention and mitigation actions to reduce the amount of capital exposed to natural threats, and establishing financial systems to transfer risk and increase available *ex post* financing, could be very profitable political, economic and social strategies. Countries may have different optimum combinations of mitigation and risk transfer depending on their situation. Economically, risk transfer tends to be favored, while socially, high levels of mitigation may be more acceptable.

Although investments in prevention and mitigation, and financial risk transfer arrangements are apparently highly profitable, reality is sometimes more complex. For many governments in the region, *ex ante* risk management measures may involve costly outlays that appear unjustifiable in terms of a normal four-year political cycle. They also tend to be economically unattractive when international donations are easily available for eventual

reconstruction. In a certain sense, current policies for the allocation of donations by bilateral cooperation agencies and of low-interest loans by multilateral banks act against initiatives to boost comprehensive risk management. Although the increase in the level of indebtedness may have negative future repercussions, the availability of these emergency resources may counteract any existing incentive to carry out preventive actions.

Nevertheless, *ex post* international assistance will never be able to fully offset the negative impact of a disaster on GDP, which can be very significant. In addition, the international response may be inadequate. International aid is frequently in-kind, which has two major disadvantages. First, the goods received may not necessarily be the ones that are most urgently needed and, second, dealing with in-kind aid uses scarce resources during the emergency (means of communications and human resources), which are then unavailable to deal with more highly desired assistance. In other cases, the promised international assistance does not materialize in time. For example, the US\$190 million committed by the European Union for Central American reconstruction after Hurricane Mitch, had yet to be disbursed 18 months after the disaster took place (BBC, 2000).

VULNERABILITY REDUCTION

Risk Identification and Analysis

To identify the risk of natural disasters at an individual, local or national level, it is necessary to estimate the potential magnitude and probability of natural hazards, as well as to evaluate the vulnerability to each of them. Insurance companies typically use simulation models in their efforts to try to quantify of likelihood of occurrence of natural hazards and the related vulnerabilities. However, the models are useful only if the basic information on which they rely is adequate.

Vulnerability may be evaluated from various standpoints (physical, social, political, technological, institutional, environmental, cultural and educational). Vulnerability to natural disasters is the result of anthropic factors; that is, factors that result from the interaction between human beings and nature. Additionally, vulnerability is a consequence of the individual and political decisions that a society makes before a hazard occurs, which are evident once the disaster takes place (ECLAC-IDB, 2000).

Freeman *et al.* (2001) analyze the components of different types of vulnerability and cite studies make an effort to measure the potential physical, social and economic consequences of natural phenomena. Those who concentrate on physical vulnerability analyze the impact on buildings, infrastructures and agriculture. For example, the Council on Applied Technology publishes vulnerability studies on the earthquake resistance of 50 types of structures (ATC, 1985). Those who focus on social vulnerability estimate the impacts on especially susceptible groups such as the poor, single-parent families, pregnant women and infants, the handicapped, children

and youths. Those interested in economic vulnerability calculate the potential impacts on economic processes and assets.

The results of the hazard analysis and of the evaluation of vulnerability are then combined to yield an estimate of risk (defined as expected loss per period). A full scope evaluation of risk encompasses the appraisal of potential losses generated by the disaster and identification of those affected by the risk. The evaluation of the risk makes it possible to develop risk management strategies with two basic components: i) prevention and mitigation actions to reduce potential human, social or economic losses, and ii) measures to establish financial protection against the risks that cannot be reduced.

The availability of information is critical for any action aimed at reducing the impact of disasters. Projections of the likelihood of their occurrence and estimates of their impact allow decisionmakers to evaluate the total risk to a country, a geographical area or a specific sector, as well as to establish concrete prevention and mitigation measures and investments.

Currently, there is a scarcity of risk information in the region. Although shorter methodologies exist that generate adequate results in the field of project evaluation, formal risk analyses tend to be lengthy and costly (Bender, 1991). In addition, before moving on to the design stage of a project, a cost-benefit analysis can give a more detailed idea of the usefulness of investing in risk identification.

In Latin America and the Caribbean, several attempts have been made at identifying and measuring disaster risks. Among them is the

joint undertaking of the World Bank and the OAS in Saint Lucia, Saint Kitts and Nevis, and Dominica (Vermeiren and Pollner, 1994). The World Bank study of Mexico (Kreimer *et al.*, 1999) is also a good example of this type of analysis.

Freeman *et al.* (2001) make reference to several additional sources in the literature on the subject of vulnerability, among which are *Environmental Hazards: Assessing Risk and Reducing Hazards* by K. Smith (1996) and the brochures produced by Swiss Re and Munich Re, available in their electronic pages (www.swissre.com and www.munichre.com).

Prevention and Mitigation

Prevention and mitigation actions require a good understanding of natural threats, vulnerability and risk. The phenomena that have recently affected Latin America and the Caribbean show that, on many occasions, investments in prevention and mitigation in the affected countries were not adequate to withstand the natural threats. However, positive examples also exist (see Box 3), and several countries in the region, in many cases with the support of the IDB, have already begun to adopt measures in this regard. Even so, the idea still persists that prevention and mitigation represent a cost and not an investment. Among the most common mitigation meas-

ures are the construction of structural projects such as the reinforcement of bridges, hospitals and other public buildings. They also include urban improvement programs, mountainside stabilization work and surface drainage to reduce the danger of mudslides and floods, as well as investments to safeguard natural resources. The Flood Rehabilitation Project in Argentina provides an example of flood mitigation efforts. The project invested US\$153 million in structural improvements that saved approximately US\$187 million (in 1993 dollars) in damages during the 1997 floods, generating an internal rate of return on investment of 35 percent (World Bank, 2000b: 161-176).

There are several nonstructural measures that can also be implemented, among them, adopt national laws and regulations to better respond to risks, land use planning, establishing municipal zoning regulations and construction codes, as well as education, training and improving awareness of the general public of risk, prevention and mitigation. According to ECLAC data (1999b), 75 percent of the damage caused by Hurricane Mitch was related to the inadequate location of buildings and infrastructure, such as dwellings built in flood prone areas or roads and bridges built on unstable soil. Adequate land use planning, zoning and construction codes require political backing since they may imply restrictions on

Box 3

Mitigation Works: The Case of the Sabaneta Dam in the Dominican Republic

The Sabaneta dam, built by the Dominican government in the 1980s to regulate the volume of the San Juan river, presented a great danger because the unfinished spillway structures considerably increased the risk of rupture in case of strong rainfall.

In 1993, at the request of the Dominican government, the IDB approved the financing of a US\$48 million investment project that encompassed preventive reconditioning work on the dike and other fundamental structures of the dam. The repair work, which cost US\$10.7 million, was completed during the first half of 1998, just before Hurricane Georges struck. The areas most affected by the hurricane's rainfall included, precisely, the province of San Juan de la Maguana, where the Sabaneta dam is located. The San Juan river basin received an average 320mm of rain during the hurricane. Nevertheless, the dam, the spillways, the power plant and the dampening basin operated normally and did not suffer major damage, leading a panel of experts to the conclusion that the work that had just been completed had been very successful.

the use, purchase and sale of property, and affect its value.

To reduce risk it is necessary to develop mitigation plans that determine who, what, when and where regarding the implementation of preventive or corrective activities. These plans must include a cost-benefit analysis to evaluate the long-term profitability of the prevention and mitigation measures. Even when the broadest prevention and mitigation plans exist, damages from some truly catastrophic events may only be partly reduced. In such cases, at least part of the risk should be transferred by means of financial protection against unavoidable damages.

Among useful documents regarding mitigation are the work by K. Smith (1996) referred to by Freeman *et al.* (2001) and quoted above as well as FEMA's electronic page, www.fema.gov/mit.indes.htm. The Caribbean Disaster Mitigation Project has published numerous texts on practices in that region, which are available at www.oas.org/en/cdmp/publist.htm.

Disaster Mitigation in Asia and the Pacific, produced by the Disaster Preparedness Center of the Asian Technology Institute identifies exemplary mitigation measures in Asia (Davis and Gupta, 1990).

FINANCIAL PROTECTION

Multiple Sources of Financing

To correctly identify a country's financial protection options against disasters it is necessary to know its tolerance to risk. Without a measure of tolerance, the cost of transferring the risk may appear excessive in comparison with the alternative of absorbing cost in some other manner (for example through taxation or foreign aid). The governments of the region will have to analyze the different options on the basis of their level of risk aversion and of domestic and external constraints that affect their economic and financial behavior. The aim of such an analysis is to adopt the most appropriate financial protection, or to transfer or assume the risk and assure the availability of financing after a disaster.

Traditionally it is assumed that, unlike the private sector, governments have a neutral attitude *vis-à-vis* risk, an assumption based on their capacity to impose taxes and transfer the risk to taxpayers. Government administrations are less limited by solvency or liquidity considerations than major corporations. However, the government of Latin America and the Caribbean have not been able to absorb the risk of losses caused by disasters (maybe because tax collection is inefficient or very limited).

As a general principle, importance is given to mobilizing existing resources and seeking new sources of funds. The latter includes identifying new instruments to increase the supply of financing. The countries of the region have access to a variety of sources of financing, among them *government resources* and *national and international credits or donations*, to finance both the *ex ante* and *ex*

post investments related to disasters. Nevertheless, and as pointed out above, *ex post* international resources may have drawbacks (donations are often in-kind and the financing may be slow for the handling of emergencies).

It is useful to strengthen national financing, especially through the banking system. The development of an efficient savings and credit system, both by commercial banks and through microfinancing entities, will facilitate private financial protection against risk. It is possible to turn to *contingency credit* for emergencies offered by international banks, or by governmental and private domestic ones. However, this entails annual administrative expenses during the period prior to the disaster. It also increases the debt burden of the country.

Existing *development and social funds* may serve as instruments to finance the prevention and mitigation of disasters and, to a lesser degree, reconstruction. *Specialized reserve funds* for disasters have been created in several countries, normally for *ex post* financing. In the case of Colombia, these funds also provide resources for *ex ante* investments.

In some countries of Latin America and the Caribbean, risk transfer contracts have been established with *insurance* or *reinsurance* companies, basing their payouts either on real losses or in some cases on parametric activation triggering indicators (for example, payment to the insured would be tied to the intensity of an earthquake, say, a ranking of 6.5 on the Richter scale, independently of the real level of loss). Other instruments, such as *catastrophe bonds*, also exist, although they are

still considered very new in the region. The private sector also has the direct investment option.

The community-wide formal and informal financing instruments, perform a very important role at the local level by supplying resources, particularly in poorer areas. Regardless of the source of financing, the implementation of these mechanisms requires close cooperation between the public and private sectors, especially in reference to the establishment of the appropriate legal and regulatory framework.

Table 2 summarizes the potential sources of *ex ante* and *ex post* disaster financing. The *ex ante* non-reimbursable and reimbursable financing mechanisms without risk transfer, include donations and credits. The corresponding risk transfer instruments encompass insurance and catastrophe bonds, which can cover the damage based on real losses (indemnification) or through the parametric acti-

vation of payments. Financing instruments established *ex post* include donations, taxes and emergency and reconstruction loans, and refinancing of existing loans.

In the event of a disaster, immediately available and lowest-cost financing options would typically be used first. For example, financing through an existing calamity fund and/or insurance, reinsurance or catastrophe bonds would have priority. Similarly, part of budgeted resources from existing government programs would be transferred to meet immediate emergency needs. In some cases, development funds (municipal, social, urban, rural) may also be used. At the same time, the government would seek as much international aid and donations as possible and resort to contingency credits. If the government has access to emergency credits such as the IDB's Emergency Reconstruction Mechanism (IDB, 1999), it would request them and would also begin negotiations to direct resources from existing loans to finance disaster recovery

Table 2. Provisional Classification of Disaster Financing Mechanisms

| <i>Ex ante</i> Sources ^{a)} | | <i>Ex post</i> Sources |
|--|--|--|
| <i>Instruments without risk transfer</i> | <u>Nonreimbursable resources</u> ? Calamity funds ? Reserve funds or diversion of national budgetary resources ? Development and social funds | <u>Nonreimbursable resources</u> ? Emergency donations ? Taxes <u>Reimbursable resources</u> ? Emergency credits (for example the IDB's Emergency Reconstruction Mechanism) ? Reconstruction loans ? Reformulation of existing loans |
| | <u>Reimbursable resources</u> ? Contingent credits ? Development and social funds | |
| <i>Instruments with risk transfer</i> | ? Insurance and reinsurance with damage coverage based on real losses ? Insurance and reinsurance with parametric activation of payments ? Catastrophe bonds with damage coverage based on real losses ? Catastrophe bonds with parametric activation of payments | |
| | | |

Note:^{a)} To finance prevention and mitigation investments (not losses), special mechanisms may be used both as donations or loans (through the IDB's Sector Facility for Disaster Prevention, for example). In addition to the contingent credit, private sector companies can use contingent equity as an instrument. The table excludes other, less common instruments such as weather derivatives, swaps and pools.

investments and request new reconstruction credits. Special taxes can also be used to finance reconstruction (this option was employed successfully in Colombia following the 1999 earthquake in Armenia).

Mobilization of Government, Multilateral and Bilateral Resources

A posteriori financing is currently the most widely used instrument by the countries of the region, mainly via the *diversion of resources of the national budget* toward rehabilitation and reconstruction activities. Even though the use of these resources does not entail a financial expense in the form of commission or interest payments, its opportunity cost can be onerous for the national economy. Although new taxes could be levied, as was the case of Colombia in 1999, this is not a viable alternative for most Latin American and Caribbean countries.

When large-scale disasters take place, governments assume *de facto* roles as financing sources of last resort. These financial commitments can be divided into three categories: i) funds allocated to cover the financial cost of the damages to public sector infrastructure; ii) financing made available as a result of political pressures to private businesses who lacked sufficient insurance coverage; and iii) funds to meet the government's obligations to care for the poor. The lack of comprehensive risk management adequate insurance markets, together with the governmental's inability to absorb losses out of current revenues means that the public sector may take on new financial commitments that increase significantly its debt burden.

Bilateral and multilateral assistance may take the form of reimbursable or nonreimbursable financing and, in some cases, the refinancing or forgiving of past debts. The availability of *ex post* financing via donations or through

low interest loans tends to create perverse incentives, insofar as governments may prefer to depend on these soft foreign resources rather than adequately manage risk to forestall the impact of disasters. As has been noted, foreign aid is not always immediately available, nor does it always come in the form that would be required by the particular country at a time of crisis. One way to guarantee the availability of *a posteriori* financing would be through a system of *contingent credit lines* through international banks. In the event that speedy access to financing has a major impact on the rate economic recovery (and hence on the government's budget), the call option may be a valid alternative (Lester, 2000). Although international financial entities such as the IDB may not formally offer a contingent credit instrument, they may act as *de facto* sources of contingent lines of credit through the reallocation of existing loans to rehabilitation and reconstruction. If these entities charged a premium for this service, it would help countries to internalize the cost of this form of financial protection.

Multilateral and bilateral international agencies (like the IDB) can offer major assistance in analyzing the feasibility of different financing mechanisms given a country's economic circumstances and risk aversion. This would enable the transfer and diversification of risk. Additionally, basic studies can allow countries to assess fundamental aspects of risk management, namely: i) risk identification, ii) prevention and mitigation to protect essential infrastructure and human lives, and iii) efficient disaster responses. The IDB can also help countries to adopt institutional and political mechanisms allowing the creation of the permanent technical and operational capacity to guarantee a sustained investment in risk reduction (see the Sectorial Facility for Disaster Prevention in Box 3). Lastly, and although it is not the preferred procedure, the Bank and other agencies can help the coun-

tries of the region by providing immediate financial resources to meet the emergency needs and promote the speedy restoration of basic services (see the Emergency Reconstruction Mechanism in Box 4).

Financing Prevention and Mitigation

Prevention and mitigation funds finance the reduction of vulnerability. In order not to run the risk of exhausting their resources in case of an event that causes significant losses, these funds should not provide financial protection to the public or private sector after a disaster. Consequently, their by-laws should clearly stipulate that their resources are not available to finance emergency, rehabilitation or reconstruction activities. The composition of their governing boards must clearly reflect

this commitment (development agencies vs. civil protection agencies).

There is a wide array of *development funds* that can be used to finance investments in prevention and mitigation. In Latin America and the Caribbean there are municipal (urban and rural) development and environmental funds that can allocate resources for the prevention and mitigation of catastrophic events in addition to their normal activities. Some of these funds operate with reimbursable resources and allow the financing of major investments. They could be used for the reconstruction or rehabilitation of critical installations like hospitals and schools, water and sanitation infrastructure, or major roads. Other funds operate with non-reimbursable financing and could be applied, for example,

Box 4

The IDB's Sector Facility for the Prevention of Disasters and Emergency Reconstruction Mechanism

Sector Facility for the Prevention of Natural Disasters

In March 2001 the Bank approved a new financial mechanism to carry out and strengthen actions prevent and mitigate disasters. The Sector Facility for the Prevention of Disasters will support the establishment of pilot programs in the full-range management of risk reduction and disaster prevention. These programs will also help to reinforce institutional capacity before larger-scale programs are carried out.

The Facility will provide reimbursable resources of up to US\$5 million per project that are aimed at strengthening disaster prevention and risk management systems. These investments cover many areas, including policy and institutional development to prevent establishment and adaptation of innovative financial instruments (risk reduction funds, contingent financing agreements and insurance systems, etc.); forecasting and monitoring of potential threats; early warning systems; and priority strategies and mitigation investments. Other areas include education and training, development of risk reduction technologies and information systems for monitoring and evaluation. There are several projects in the Bank's pipeline that request financing through this instrument.

Emergency Reconstruction Mechanism

The Bank created the Emergency Reconstruction Mechanism (ERM) in December 1988. The ERM allows the Bank to respond quickly to disasters with loans of up to US\$20 million from ordinary capital or US\$10 million in resources from the Special Operations Fund (concessionary resources). Its goal is the immediate availability of the necessary resources to finance a pre-established menu of eligible activities, which includes assistance to re-establish basic services, financing for immediate repairs and cleanup work in the period following a natural disaster. A country's request launches an accelerated process of approval of the financing which can take two to four weeks. Due to the high demand for ERM resources, the original US\$100 million endowment has already been exhausted. The program is being reevaluated in 2002.

Sources: IDB (1999) and IDB (2001).

for studies to evaluate risk and the vulnerability of populations and assets, as well as for land use planning and zoning (see the Annex). In ex-post financing prevention and mitigation investments are often included in an effort to ensure that actions are taken to reduce future vulnerability to disasters.

For each of these funds there is a wide array of basic considerations that require special attention in the design stages. This refers to their legal structure and sources of capitalization, operating policies and rulings for the financing of projects, etc. Administrative and financial independence from political authorities (public or private administration) and the systems established to administer the resources are important additional planning factors that affect the financial sustainability of these funds.

Insurance and Reinsurance

In developed countries, the traditional way of transferring the financial cost of disasters over time and among the various actors is through insurance offered by private companies. It is a mechanism that allows the transfer of financial risk from one entity or individual to a

collective. This group can be expanded even further through international reinsurance. In several countries of the region, the government also insures some of the public assets. Insurance coverage for the latter lessens the financial burden of reconstruction for the State after a disaster, thus allowing governments to be less dependent on contingent international assistance and to avoid diverting already allocated resources from the national budget to emergency investments, rehabilitation and reconstruction.

In addition to guaranteeing quick access to funds for reconstruction, insurance mechanisms have the advantage of promoting prevention and mitigation actions, for example through discounts in premium levels and deductions offered to customers who have made progress in those fields. At the same time, insurance companies carry out inspections to review the condition of the assets insured, both during and after a disaster, which promotes improved care of those assets. The use of insurance allows risk diversification among the parties and reduces variation among the insured, in addition to facilitating the segregation of the risk (Freeman and Kunreuther, 1997).

Box 5 Mexico's FONDEN: A Calamity Fund

Mexico's *Natural Disasters Fund (FONDEN)* is a government effort to reduce the negative effects of natural catastrophes, strengthen disaster preparedness and response capabilities. The goal is to be able to deal with the effect of unforeseeable natural disasters whose magnitude surpasses the response capability established by the authorities. The aim is to create resources that make it possible to handle the damages without altering public finances for normal federal, state or municipal government programs.

FONDEN has been requested to undergo a decentralization process to reduce its bureaucracy, regulations and discretionality, and increase the agility of gaining access to its resources. Actions have already been undertaken to improve the transparency of the allocation of resources, and reduce the time needed to process, deliver and employ resources in the affected areas.

The Fund's resources have averaged about US\$100 million per year. Between 1996 and 1999, 70 percent of the payments to handle losses were for hurricanes and floods, 19 percent for droughts and frosts, 10 percent for earthquakes and 1 percent for fires.

Sources: EIRD (1999); Mexican Senate (2001); Freeman and Mechler (2001).

As is shown in Table 3, insurance coverage for natural disaster losses varies significantly throughout the world. It reached 3.9 percent in Latin America during 1985-1999, compared to 34.3 percent in the United States and Canada, 26.7 percent in Europe, and 4.3 percent in Asia. Penetration is even low insurance against natural disasters. For example, according to the World Bank, of the total 16 million dwellings in Mexico only 150,000 (less than 1 percent) had disaster coverage in 1998 (World Bank, 1999). It is evident that in Latin America and the Caribbean there is only an incipient market for insurance in general. When measured in relation to the GDP, the proportion of premiums for all types of insurance in the two sub-regions reaches only between 0.5 percent and 2.7 percent (in comparison, in the U.S. it has reached 3.4 percent).

Various factors account for the scarce development of the insurance market in the region, among them are: the lack of competitiveness and competition in the insurance and reinsurance market; the absence of control and supervision of the quality and stability of the insurers; the exclusion of foreign investment in the insurance sector; the lack of training and professionalism among insurance brokers; inefficiency in the timely payment of the coverage; the financial weakness of the companies, and the fact that the legislation, regulation and supervision of insurance does not

adhere to international standards (IFC, 2000; Skipper, 1997).

To counteract these deficiencies and to develop the insurance market, actions of the following kinds will be required: eliminating normative obstacles, including the access barriers that affect the entry of foreign companies into the market; establishing and enforcing construction codes; carrying out land-use planning and zoning on the basis of potential damages; disseminating information regarding risk; and making governments and donors commit themselves not to guarantee the financing and re-establishment of those lost assets that could be insured. These measures to stimulate the markets would help to lower insurance premiums and make them more accessible to medium- and low-income groups.

The creation and strengthening of insurance markets is a long-term strategy for transferring and reducing risk. Such markets provide some payment transfer mechanisms and constitute an additional source of financial resources for the insured after a disaster. At the same time, depending on the payment structure of the premiums, these mechanisms can also be used by the insurers to promote the adoption of preventive and mitigation measures by their customers. Figure 5 describes the process of defining insurance premiums that would constitute the basis for comparing

Table 3. Insured Natural Disaster Losses 1985-1999

| | Insured losses (US\$ millions) | Percent of total losses |
|-----------------------------|---|--------------------------------|
| North America | 116,940 | 34.5 |
| Europe | 29,990 | 26.7 |
| Australia and Pacific | 4,330 | 25.7 |
| Africa | 610 | 8.9 |
| Asia | 17,640 | 4.3 |
| Latin America and Caribbean | 420 | 3.9 |

Source: Munich Re 2000.

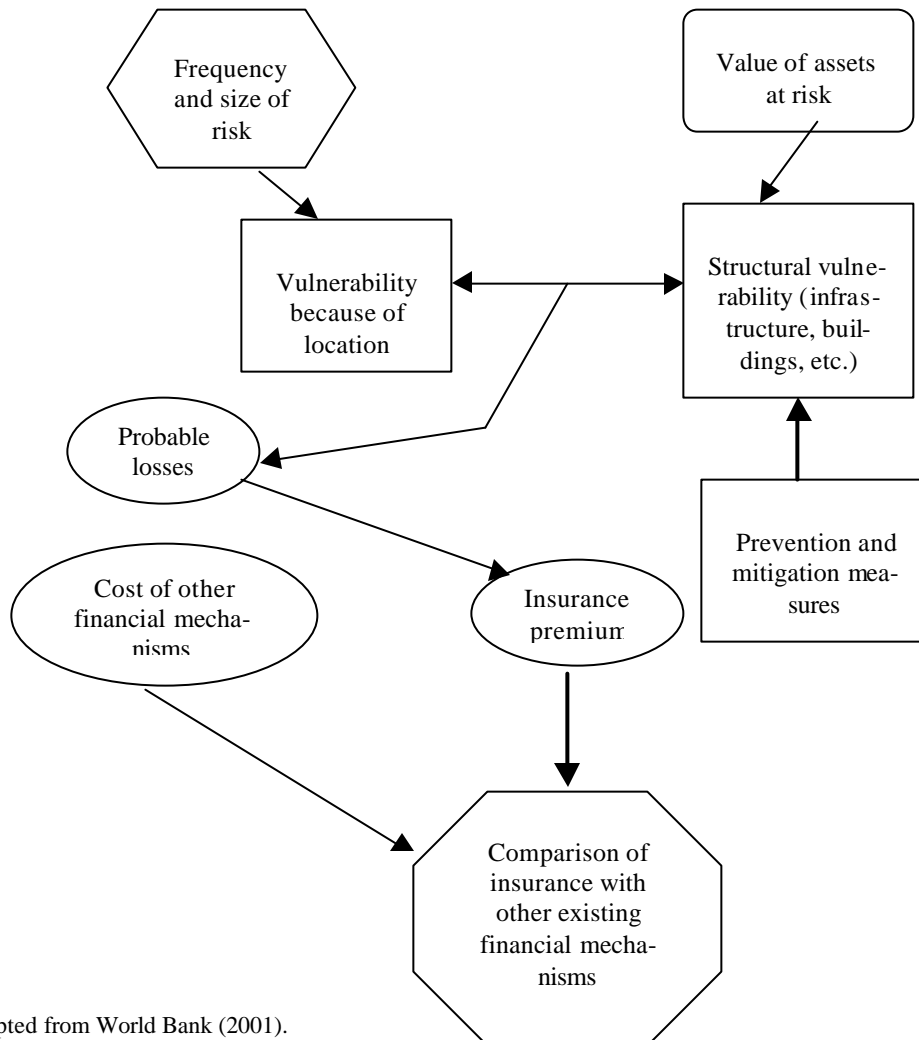
that instrument with other available financing mechanisms.

Insurance markets can exist thanks to Bernoulli law of large numbers, according to which, for a series of independent variables, the variation of the average compensation diminishes with an increase in the number of claims. However, the covariant nature of this type of risk (i.e., the fact that many of the insured will suffer the same calamity at the same time and in the same place) may eliminate the benefits of the insurance if the companies do not diversify their portfolio to several geographical areas and over time. In addition, it should be recalled that insurance

systems harbor four types of potential problems: adverse selection, moral risk, base risk and credit risk (Andersen, 2002).

Adverse Selection. This is based on the assumption that the insured may know more about his own level of risk than the insurance company. Consequently, the demand for insurance coverage usually comes from those facing higher risks, thus raising the probability of losses. The premiums may be increased even for those who face lower risks. This problem can be mitigated through an improved gathering of information regarding the insured (Rotschild and Stiglitz, 1976; Hillier, 1997).

Figure 5. Process for Comparing Risk Premiums and the Cost of Other Financial Mechanisms



Source: Adapted from World Bank (2001).

Moral Hazard. This presents itself when the existence of insurance coverage causes riskier behavior by the insured, for example, by building in an unstable location or with poor quality materials. Moral risk can be reduced by adjusting the premiums according to the conditions of the risk and the adoption of mitigation actions (Grossman and Hart, 1983; Doherty, 2000).

Basis Risk. This emerges from discrepancies between the risk indicators employed in the financial instruments and the positions that these instruments attempt to cover. For example, if the value of the index maintained by the instrument to cover the risk differs significantly from the value of exposure to the risk that it must cover, the instrument will face a larger base risk, since it is difficult to apply a general index to an individualized risk portfolio (Andersen, 2002).

Credit Risk. Concern may exist over the level of credit risk of the solvency of the issues of an insurance policy. For example, disaster risk coverage provided by an insurance company with a low credit reputation endangers future coverage, since a natural disaster entails additional pressures on the solvency of the weak companies in the sector. The use of derivative financial instruments that are traded on stock exchanges, or the issuing of guarantees in capital markets, will reduce or eliminate the credit risk of the counterpart (Andersen, 2002).

The insurance industry has created mutual funds that allow a group of insurance companies (normally national ones) to transfer the highest risks to a common fund; that is, to spread the risk among a larger number of actors and a wider geographical area. This may be voluntary, as in the case of the California Earthquake Authority, or compulsory, as in the Norwegian national system. For these funds to work a certain level of development

must exist within the insurance industry, which is normally more likely in big countries, or requires a regional context to facilitate certain levels of diversification.

The creation and strengthening of insurance markets is a long-term strategic goal for transferring and reducing risk. Such markets provide some payment transfer mechanisms and constitute an additional source of financial resources for the insured after a disaster. At the same time, depending on the premium payment structure, such mechanisms can also be used by insurers to promote the adoption of preventive and mitigation measures by their customers. Figure 5 shows how to establish insurance premiums and compare them to other available financing mechanisms.

Regional catastrophic events have surpassed the capacity of national insurance and reinsurance industries to provide coverage at a reasonable price. In industrialized countries, where coverage is high, only part of the risk of natural threats is transferred internationally via reinsurance. However, in Latin America and the Caribbean—where many local insurance companies are not sufficiently capitalized to handle natural disasters—most premiums are turned over to international reinsurance companies. In the Caribbean, for example, the real estate insurance market turns over approximately 80 percent of the premiums to reinsurers in Europe and the United States. For consumers, this tends to raise the price of premiums, which instead of being subject to the risk conditions of the local user, are subjected to international appraisals (Pollner, 1999; see also Box 6). In some cases the international reinsurance companies accept virtually the entire risk at all levels covered by insurance, while the local ones act more as brokers, a practice that tends to increase the price of the premium for the consumer.

Box 6
The Case of Insurance in Barbados

In 1990, the average premium for real estate insurance in Barbados was 0.4 percent of the estimated value of the asset. This means, for example, that to insure a property appraised at US\$100,000 the owner would have to pay a premium of US\$400. Following Hurricane Andrew, premiums rose to 1.3 percent, despite the fact that Andrew did not hit Barbados. This 300 percent increase in the price of insurance went into effect even though there were no changes in the underlying risk in the country. It is possible that the premium before the hurricane was too low; nevertheless, it is also likely that a full-range sub-regional management of the risk, as well as the availability of better information on the particular situation in Barbados, would improve the stability of premiums.

Source: World Bank 2000

A study by the International Financial Corporation for Central America indicates that coverage for buildings losses caused by disasters has traditionally been combined with fire insurance policies. In the case of Honduras, these policies amounted to 20.3 percent of the value of all the insurance premiums in the country in 1998. Payments for losses caused by Hurricane Mitch that same year reached US\$160 million, while total losses were US\$3.8 billion. As a result of this limited coverage, several of the affected companies suffered economic losses for not having reinsurance (IFC, 2000).

As mentioned, in addition to indemnification insurance that covers real losses, there are parametric insurance instruments. Payment of the claim using parametric insurance is not calculated on the basis of the real loss, but according to a *triggering indicator*; for example, an earthquake measuring 6.5 on the Richter scale would trigger a predetermined payment). Because the payment does not depend on an appraisal of real losses for each insured party, the high administrative costs associated with damage inspection and appraisal are significantly reduced. This instru-

ment has the advantage that it does not demand title deeds to the insured assets. Parametric instruments are employed in areas with a shortage of data because they rely on indicators that are easy to measure (such as wind speed in the case of hurricanes, rainfall in the case of floods or droughts, or the intensity of an earthquake) to determine the compensation owed to the insured. They are considered especially important when coverage for the poorer segments of society is involved.

Catastrophe Bonds

Recognizing the lack of financial capacity in the face of natural disasters, the insurance industry has attempted to transfer part of these risks through capital markets by floating catastrophe bonds, options and similar instruments. Catastrophe bonds could also complement the use of the special funds (mentioned earlier) to transfer the higher levels of risk faced by them (Pollner, 1999). This, likewise, involves derivatives indexed to weather conditions (although these often only provide protection against events that are not very extreme), as well as contingent financing (such as retroconvertible debt). Both allow the refinancing of the investments lost in a disaster, at low interest rates.

The most promising instruments in this system are variations of the catastrophe bond itself, the basic mechanism of which is very simple. The party that wishes to transfer the risk would issue a special bond. In the event of a disaster, interest payments by the issuer may be cancelled or s/he may receive a percentage of the bond's principal. The percentage would depend on the magnitude of the catastrophe (*triggering indicator*) and on the terms of the contract. In both cases, the funds available to the issuer, be it for not paying the interest or for receiving part of the principal, would act in practice as the payment of an insurance claim. The investors (buyers of the

bonds), for their part, run the risk of not receiving the payment of interest or that the principal may have diminished when the bond is redeemed. Thus they would charge higher interest rates for running these risks (see Box 7).

Box 7
Earthquake Bond: Tokyo Disneyland

In May 1999 the Oriental Land Company, the operator of the Tokyo Disneyland, issued a bond to cover against the risk of financial losses in the event of an earthquake. This bond is a type of catastrophe bond. It does not offer financial protection against direct damages like the destruction of buildings, but against cash flow losses that might ensue from a reduction in the number of visits. The funds obtained by floating the bond, equivalent to US\$200 million, were deposited in a special account in the Cayman Islands. Oriental Land believes that the Tokyo Disneyland infrastructure would not suffer major damage even in the event of a very intense earthquake. However, if transport means were destroyed or if consumer confidence were lacking, visits to the park could be significantly reduced. The company calculates that it would take 10 months to restore the public's confidence and that US\$180 million would be needed to survive that period.

If an earthquake takes place within a 75-kilometer radius of the location of Tokyo Disneyland, the terms of the bond would allow Oriental Land to receive a percentage of its principal, which would depend on the intensity of the earthquake. Investors, for their part, run the risk that the principal may have diminished when the bond falls due in five years.

Source: Nikkei (1991).

Some of the new financial instruments might be applied in Latin America and the Caribbean, as long as there exist legal and regulatory frameworks, adequate institutional mechanisms and the corresponding risk information allowing the development of the

market. However, these highly specialized instruments will not necessarily lead, on their own, to a reduction in the losses caused by disasters. For them to be successful, the public must become aware of the multiple effects of catastrophic events and have incentives to adopt prevention and mitigation measures to reduce the costs of coverage.

Table 4 summarizes the advantages of reinsurance contracts and catastrophe bonds (both parametric bonds and those based on real losses) in the face of adverse selection, moral risk and credit and basis risk. It also indicates the level of market acceptance of each instrument. As shown, parametric instruments have lower adverse selection and moral risk than those based on real losses. Credit risk is greater for reinsurance than for catastrophe bonds. At the same time, it is estimated that catastrophe bonds based on real losses may have lower market acceptance than reinsurance contracts or parametric bonds. According to the author of the table, the base risk may be relatively acceptable for all four options analyzed.

Community Strategies

Community financing mechanisms channel resources to the populations that need them most; they are particularly important for reducing the vulnerability of impoverished groups. Included in this category are: i) social or municipal funds, which are frequently financed in part with multilateral or bilateral resources that are disbursed through municipal governments and other local entities; ii) community development projects financed by national and international nongovernmental organizations; iii) microenterprise credit programs, and iv) informal financing mechanisms such as local informal credit markets.

Table 4. Risk Elements (+ = high risk level) and Expected Market Acceptance († = acceptance) for Reinsurance Contracts and Catastrophe bonds

| Instrument | Adverse selection | Moral risk | Base risk | Credit risk | Market reception |
|-----------------------------|--------------------------|-------------------|------------------|--------------------|-------------------------|
| Reinsurance contract | | | | | |
| - Parametric | - | - | - | + | ✗ |
| - Real loss | + | + | - | + | ✗ |
| Catastrophe bonds | | | | | |
| - Parametric | - | - | - | - | ✗ |
| - Real loss | + | + | - | - | - |

Source: Andersen (2002).

Decentralization policies in the region have led to the delegation to local governments of greater responsibility for supplying public services. This opens the opportunity for channeling resources from multilateral or bilateral agencies directly to those local governments. (The limiting factor is often, however, the need for sovereign guarantee of international financing through loans). This new role for local administrations also requires improvements in their fiscal management systems and the diversification of their sources of income. Capable municipalities are better able to administer resources aimed at mitigation and prevention activities and to enforce local rulings that reduce risk. It is the communities themselves that, in many cases, can best identify their vulnerability and thus direct the investments toward those areas where they will have the greatest impact.

Vatsa and Krimgold (1999) distinguish between two types of risk management strategies at the individual or community level: i)

those designed to reduce risk and ii) those designed to cope with risk. Risk reducing strategies involve diversifying the family's sources of income and include, for example, taking on a second (or third) job, avoiding dependence on one crop, etc. Families can engage in a variety of activities that generate additional income, increase and diversify their assets to protect against the seasonal economic shocks, and ensure an adequate flow of income after a catastrophic event. Strategies designed to cope with risk seek to minimize losses in well-being and prevent interruptions in consumption. These include, for example, having access to loans and savings and insurance.

The main disadvantage of community mechanisms is the difficulty in transferring risk given that all members of a community tend to suffer the same calamities. The geographic limitation of a community would call for cooperation with other regions in the risk-taking.

CONCLUSIONS AND RECOMMENDATIONS

Prevention and Mitigation versus Financial Protection

A cost-benefit analysis to evaluate the profitability of long-term mitigation and prevention measures will determine those activities that will help reduce the high costs of responding to emergencies, as well as rehabilitation and reconstruction expenses. Since prevention and mitigation measures cannot eliminate all potential damages, risk cannot be totally suppressed, making financial protection systems necessary.

The participation of governments, the private sector and civil society in prevention, mitigation and financial protection schemes can be very varied. In Latin America and the Caribbean, the government frequently assume the greater part of the risk, acting, to a certain extent, as insurers of last resort. Consequently, the evaluation of the risk and how it might be transferred under different types of disaster scenarios will affect the potential impact of disasters on the government budget. Clearly, the government's financial burden can be reduced if the private sector assumes part of the risk

Government-backed prevention and mitigation activities can be financed through the national budget, with private sector resources through municipal, social, urban or rural development, or environmental funds. Some Latin American and Caribbean countries (for example, Colombia) have established special prevention and mitigation funds.. Some multilateral banks and bilateral international agencies have also established mechanisms that can contribute to this type of financing. An example is the Inter-American Develop-

ment Bank's Sector Facility for Disaster Prevention (IDB, 2001).

Specific country studies should be carried out to determine the risks faced and the likely impact of different disaster scenarios on the national economy. This analysis should provide answers to the following key questions: How would the rehabilitation and reconstruction of public assets (like road infrastructure) be financed? How will the resulting increase in social spending be financed? Will the government compensate the private sector and communities for damages to important assets such as dwellings? In order to reduce their exposure to risk, national authorities must develop a national risk management plan that establishes who would carry out prevention and mitigation activities, what activities would be involved, when and where they would be carried out and what would be the most desirable financial protection strategy (Cardona, 2001).

Toward Development of a Risk Mitigation Protocol by the Banking System

The mobilization of resources to finance prevention and mitigation investments, as well as rehabilitation and reconstruction could be enhanced by the development of an efficient savings and loan system through the banks as well as informal and microcredit entities.

Commercial banks are exploring measures to reduce the natural disaster risk in their portfolio. One of the mechanisms considered consists in establishing a self-imposed prevention and mitigation protocol on the financing of investments in rehabilitation and reconstruction. Such is the case of Brazil's "Green Protocol," through which environmental risk

management measures were incorporated into financing programs through the banking system (Bayon *et al.*, 2000). The goal of a disaster mitigation protocol is to prevent the replication of vulnerability and promote sustainable economic development; thus contributing to the financial health of the banking system over the medium and long term. It would serve to break the vicious circle of providing financing for projects whose design does not incorporate appropriate measures to withstand the impacts of a disaster, by making prevention and mitigation components a compulsory part of loan projects. Disaster risk evaluations should be part of the feasibility studies of development projects (EIRD, 2002).

The successful adoption of a protocol of this nature would be based on existing legislation in each country. The protocols would not be a law but a code of conduct and a set of best practices that would help the signatory institutions to incorporate ecological concerns into their decision-making processes. Nevertheless, some banks could be reluctant to adopt this type of measure, perhaps because a proactive approach on their part could have undesired legal consequences. For example, in the United States a bank that places specific conditions on risk management in the projects

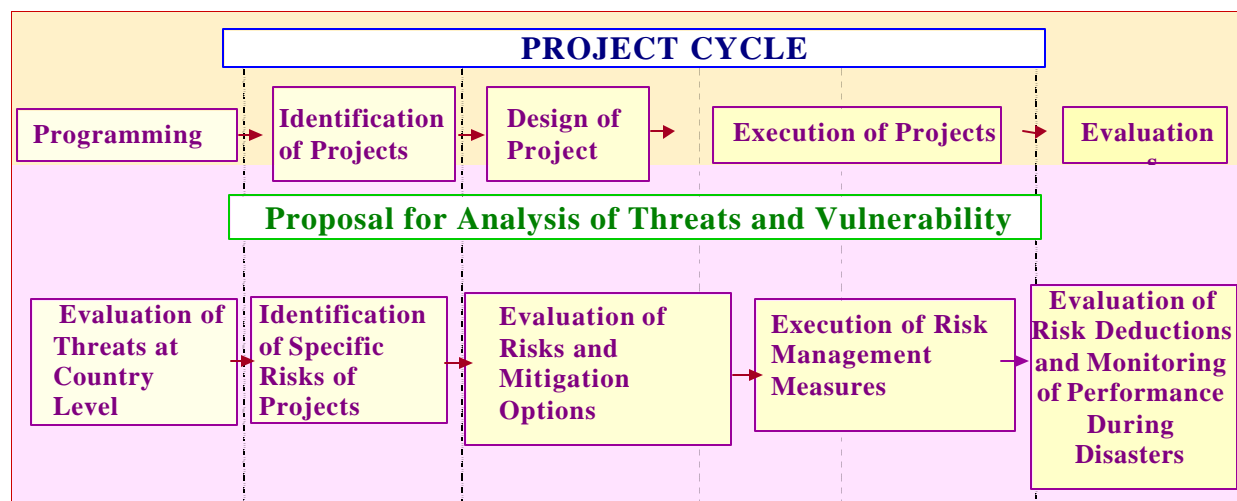
it finances may also assume legal responsibilities if those conditions are fail to provide the protection envisioned. This is because court decisions have equated the imposition of conditions with an implicit obligation to make sure that those conditions are appropriately met.

Multilateral and bilateral banks can also help their public and private sector clients to identify disaster-related vulnerabilities and risks in the projects they finance. In the case of the IDB, the role of the Committee on the Environment and Social Impact (CESI) should include an assessment of measures to reduce vulnerability and of the necessary financial protection available to ensure the project's sustainability. These evaluations will identify the degree to which the investments could be affected by natural disasters, as well as the appropriate preventive measures to reduce the risk to acceptable levels. Figure 6 shows how risks analysis should be carried out in the Bank's project cycle.

Risk Transfer

The countries of the region are interested in establishing risk transfer instruments, using as a model the mechanisms applied in developed

Figure 6. Proposed Disaster Risk Management in the IDB Projects Cycle



Source: IDB (2000).

countries, especially insurance. Financial protection against disasters via the development of an efficient insurance market offers the opportunity to transfer part of the risk, and avoids indebtedness as a result of an emergency. The development of this market would involve updating the legislation and the regulatory framework, strengthen independent supervision to monitor the solvency of insurance companies, and eliminate incentives for anticompetitive behavior. To this end, the supervising entity should enjoy appropriate jurisdictional and punitive powers. The establishment of insurance instruments also requires the existence of measures such as certifications of compliance with accepted design and structural guidelines for the project that will be insured.

Insurance companies would benefit from the adoption of international standards that promote solvency, efficiency and transparency. It would result in the generation and timely publication of detailed and precise financial statements for public use. The creation of an appropriate technical infrastructure for the insurance system to operate adequately constitutes an important part of the strategy to promote risk transfer. Such an infrastructure is needed, among other things, for carrying out appraisals and risk management. Among the staff needed are building inspectors, insurance adjusters and risk rating agencies. Lack of information can be an important limitation for the development of the insurance market. Insurance and reinsurance companies can generate information. International development agencies may help in the process. The IDB (2002), is an example as it will be implementing the Information and Indicators Program for the Risk Management of Natural Disasters for the benefit of some 10 countries in Latin America and the Caribbean.

In addition to the above initiatives, it is important to foster demand for transferring risk

by building public awareness of the benefits of risk management and insurance. At the same time, continued research should go into the use of innovative capital market instruments such as catastrophe bonds.

Emergency Response: Available Instruments Should be Used First

In the event of a disaster, existing and lowest cost resources should be used first. If a calamity fund is already in operation (Mexico's FONDEN, see Box 4), or coverage is available by means of insurance or catastrophe bonds, these sources would receive priority. However, since these instruments do not yet play an important role in most countries, the trend is to first rely on government resources by transferring funds from existing programs and development funds (municipal, social, urban, rural, etc.) to meet critical needs. A search for the greatest possible amount of international donations usually follows. Another instrument that could be highly useful is contingent credit, although it entails an annual administrative payment and indebtedness once the emergency takes place.

Since prevention and mitigation actions cannot fully eliminate the risk of disasters, measures for the financing of losses will be required. Countries tend to give priority to their use according to vulnerability and to the availability of the instruments. Although instruments such as insurance have not yet become popular in the region, governments can adopt a range of measures to promote the development of insurance markets, including opening them up to international competition. As a first step they could insure their own critical assets through national or international tenders. Another instrument that could be very useful? although it incorporates an annual administrative payment and indebtedness in case the emergency presents itself? is con-

tingent credit. This has the advantage of avoiding the potential distortions that can be caused by the common practice of reallocation of resources from existing programs to rehabilitation and reconstruction.

Comprehensive Approach

Until recently, the countries of Latin America and the Caribbean have tended to respond to emergencies rather than to prepare for them through the establishment of prevention and mitigation measures in order to reduce their vulnerability to catastrophic events. It is here that the comprehensive risk management that has been described in the preceding pages

begins to play a fundamental role. Prevention and mitigation measures, combined with public and private financial protection, play a significant role in the process of building such a comprehensive approach. It is essential for each country to develop a consistent strategy or plan to manage the risk of disasters, with the participation of the finance and planning ministries, sector ministries and local governments, the business sector and civil society in general. It is also necessary to have a structured plan for meeting emergencies once they take place. The supply of effective *ex ante* financial protection mechanisms is essential because it makes funds available when they are needed most.

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ANNEX

| Key Risk Management Factors | | | | | |
|---|--|---|---|--|--|
| Before the Emergency: Risk Prevention and Reduction | | | | After the Emergency: Recovery | |
| Identification of Risks | Mitigation and Prevention | Risk Transfer | Emergency Preparedness | Emergency Response | Rehabilitation and Reconstruction |
| Evaluation of natural threats (frequency, magnitude and location) | Physical and structural mitigation works | Insurance and reinsurance of public and private assets | Early alert and communications systems | Humanitarian assistance | Rehabilitation and reconstruction of damaged critical infrastructure |
| Evaluation of vulnerability (exposed population and assets) | Land use, planning and construction codes | Financial market instruments (catastrophe bonds, etc.) | Shelters and evacuation plans | Cleanup, temporary repairs and re-establishment of services | Macroeconomic and budgetary management (stabilization, protection of social expenditure) |
| Evaluation of risks (hazard and vulnerability) | Economic incentives to promote the adoption of mitigation measures | Development of new instruments: hedge funds indexed according to weather conditions | Plans for unforeseen events (public service companies); network of institutions that respond in emergency situations (local and national) | Evaluation of damages | Revitalization of the affected sectors (exports, tourism, agriculture, etc.) |
| Monitoring of natural threats and preparation of forecasts (SIG, cartography and formulation of hypothetical situations) | Education, training and awareness raising on risks and prevention | Privatization of public services with regulation of safety issues (power, water, transport, etc.) | Calamity funds (national or local); contingent credit | Mobilization of resources for recovery (governmental, multilateral, insurance) | Incorporation of disaster mitigation components in reconstruction activities |
| <p>Creation and strengthening of national systems for preventing and responding to disasters: These systems form a comprehensive and intersectorial network of institutions that broaches all the above phases of risk reduction and recovery after a disaster. Backing is required in the areas of regulation and planning, including the reform of legal and normative frameworks, coordination mechanisms, strengthening of participating institutions, national action plans, prevention policies and institutional development.</p> | | | | | |

Source: IDB 2000