ECONOMIC COMMISSION FOR LATIN AMERICA
AND THE CARIBBEAN
Santiago, Chile

October 5, 1994

AD HOC EXPERT GROUP MEETING:

CRITERIA FOR ESTIMATING EFFECTS OF NATURAL DISASTERS

(Washington, D.C. 21 October 1994)

Note by the Secretariat

CRITERIA FOR ESTIMATING EFFECTS OF NATURAL DISASTERS

An ad hoc expert group meeting is to be convened by the Economic Commission for Latin America and the Caribbean (ECLAC), in cooperation with the Pan-American Health Organization of the World Health Organization (PAHO/WHO). The meeting is to be held in Washington, D.C., on 21 October 1994.

The purpose of the meeting is to discuss a number of issues related to criteria that has been adopted by ECLAC for the application of a methodology for the evaluation of the economic effects of natural disasters. [1/] The discussion should enable ECLAC to acquire valuable inputs for improving its damage assessment methodology.

This document provides background for the items to be discussed during the meeting.

1/ See CEPAL Manual para la estimación de los efectos socio-económicos de los desastres naturales, Santiago, 1992.

INTRODUCTION

1. General considerations

Damages caused by a disaster can be direct or indirect. Direct damages are those inflicted on fixed assets, capital and inventories of finished and semi-finished goods, raw materials and spare parts. Indirect damages are those that affect the flows of goods that will not be produced or services that will not be rendered for a period of time. Direct damages are estimated in physical as well as monetary terms; indirect damages are measured only in monetary terms.

Direct and indirect costs represent the total of material and monetary damages caused. Secondary effects -expressed as the impact of the disaster on the overall economic performance of the affected national economy- are measured through the impact of the disaster on the most significant macro-economic variables.

Secondary effects of a disaster may be either negative (losses, damages, deterioration of the environment, etc.) or positive (employment generation for reconstruction, resource flows due to international assistance, insurance payments, etc., or improvement of fertility in soils affected by floods). The net effect is estimated on the basis of the variations in such variables caused by a disaster. The time frame for such effects is generally considered to be one year; nevertheless, depending on the time needed for the actual reconstruction or replacement to occur, it may be extended up to five years.

ECLAC -on the basis of its experience in conducting an economic evaluation of major natural disasters in Latin America and the Caribbean- has adopted general criteria for the estimation of actual costs of the repair and/or replacement or reconstruction of goods, services, and infrastructure destroyed or affected by natural disasters.

The question of how to assign value to direct damages -that is, the effects on capital assets- caused by a disaster is addressed in this note. Only marginal reference will be made to indirect damages or to the flows of goods and services affected by natural disasters. That is because there are clear cut means to assess the value of flows: namely, to apply current prices to those goods and services lost at the time disaster struck. In the case of direct damages, however, there can be a number of criteria to define the value that can be applied to goods destroyed or damaged by a disaster.

It is considered essential to engage into the technical discussion of valuation criteria and to try and come to a common

approach. Two extreme possibilities could serve as a framework to discuss alternatives: a) valuation of damages at "purchase" costs, and b) valuation at "replacement" costs.

A first conclusion -drawn from experience- indicates that in most cases it is not possible or even desirable to apply either of the extreme options to value damages. The answer seems to lie in applying the more relevant prices and costs in accordance with the assets lost, their age and estimated useful life at the time of the disaster and the existence of similar goods in the market at the time of the valuation.

2. Replacement cost of goods and services

In general when a valuation of damages is required to compare them with the capital assets of the national economy, the criterion adopted is to estimate their costs on the basis of purchase prices, depreciated depending on the useful life of those assets at the time of the disaster. Conversely, when the purpose of the valuation is to determine the cost of a reconstruction programme, the widely adopted valuation criterion is that of considering replacement costs of the goods that have been lost or damaged, since they will determine the amount of resources that will have to be disbursed and will affect the economy's financial requirements, investment programmes, foreign exchange needs, etc.

In the first case accounting techniques for present-value estimation of losses will be used, adopting the unit costs of goods and services equivalent to those that were lost or damaged. In the case of partial losses or damages only, a percentage figure will usually be applied to the above in order to take into account the partial nature of the cost.

In the second case, to evaluate the cost of replacing or reconstructing affected property, goods and services, different technical criteria come into play. They may include technological, social, financial or other considerations. In this case, part of the cost could be the provision of such goods and services on an interim or emergency basis for a certain period of time.

Destroyed assets or infrastructure that must be demolished should be valued at the cost of reconstruction of equivalent ones. In this concept, the functional equivalent of the lost asset will have to be ascertained. If such equivalence is not explicitly considered, there exists the risk of overestimating reconstruction or replacement costs.

On the basis of the above, it seems reasonable to say that there is a need to base valuation criteria according to the final purpose of the damage appraisal exercise that is to be conducted.

Given the time constraints involved in the execution and completion of appraisal exercises -there is usually a demand for delivering the appraisal in a short period of time to facilitate the appeal to potential international donors- after the disaster ECLAC has elected to adopt select specific criteria on a case by case basis, depending firstly on the availability of information at the time of the preparation of the evaluation.

It should be noted that in the appraisal intermediate criteria will most frequently be adopted. For example, there will be a gap between the cost per square meter of constructions lost in a marginal human settlement and the permanent housing that will finally be made available to the affected population, since in the end there will be a net improvement on housing standards.

SPECIFIC TECHNICAL CRITERIA TO BE DISCUSSED

There can be no unique or homogenous concept in the definition of cost and prices for the valuation of disasters' damages. The general criterion tends to be to value damages at the prices and costs relevant to each particular situation. Although this implies valuating at the prices and costs that are closer to the prevailing ones at the time when the disaster strikes, using a uniform time-frame to evaluate damages disregarding inflationary or deflationary effects that may ensue due to the disaster, other criteria, of a technical nature, will have to be discussed and applied.

The following sections describe a number of sectors where specific technical criteria need to be discussed and applied.

1. Replacement costs of machinery and equipment

A balance must be found between the obsolescence of lost equipment and the technological change that will be part of the replacement cost in the industrial production sector, even if the replacement is to be made with similar equipment.

Technological changes are occurring in most economic activities. This is specially true in the industrial sector and in services, where they occur at a faster pace than in other sectors. The valuation of assets destroyed in the industrial sector poses major difficulties. Adopting the "book" value of losses will be useless since, on the one hand, such a registry seldom exists and, on the other hand, there will not be a similar good available in the present market. If purchase costs are used to estimate losses an underestimation of the cost of replacement, specially for assets whose useful life-span is almost over, will result. Another complication arises in the case of countries having significant inflationary processes, where it will be necessary to estimate the

present value of the assets based on their "book" value. This requires calculating the price for the destroyed asset, appreciating it to the current value at the time of the disaster, and deducting the accumulated depreciation on that value on the basis of the average useful life of the destroyed asset.

The item to be selected for the valuation of equipment must be one that is as functionally similar to the one lost and one that can be purchased and financed by the enterprise that suffered the damage.

2. Replacement costs of social services

Social services -including hospitals and clinics, or education facilities at all levels- usually have a very high cost and adapt slowly to technological change. Their cost of replacement must explicitly consider whatever new scientific and technical standards prevail at the time following a disaster. Here again, a balance must be found, mostly depending on the kind of funding attainable for the reconstruction or replacement process. In past experiences it has been observed that the loss of some of these old services has led to a new, high quality replacement with lower operational costs and better technological level.

3. Replacement costs of infrastructure

It is recommended that assets that have been totally destroyed and buildings that are to be demolished should be valued at replacement cost at the time of reconstruction. Here again the functional equivalent of the lost asset should be determined; in other words, the cost of constructing an asset having equivalent functional characteristics. Once this value is estimated, it should be adjusted to the depreciated cost taking into account the average life of such a structure and its age. This would be the closest estimate of actual losses.

However, if the purpose of the evaluation is to estimate the global cost to the economy of replacing lost infrastructure, then the adoption of the replacement value of new assets will be necessary. This implies that the actual cost of damages and the amount of resources required for rehabilitation and reconstruction will not coincide.

a) Housing and similar types of buildings

The assessment of losses in the housing sector is easier than in other areas since technological improvements may imply cheaper and better quality materials and techniques. A problem in the evaluation lies with diminished land property values in view of high-risks to disasters (flooding, earthquake vulnerability, land slippage, etc.) that become evident following a major disaster.

Another consideration is that the replacement of a marginal or informal dwelling will have to be equaled to that of a more formal and permanent housing which will have to be provided to those affected by the disaster.

b) Transport infrastructure (roads, ports, communications and telecommunications)

In respect of this type of infrastructure, not only there is need for striking a balance between the obsolescence of lost equipment and the recent technological change that will be part of the replacement cost, but an estimate will have to be made of interim costs incurred in the rendering of the services for the period that permanent replacement of lost infrastructure takes. These indirect costs -which are normally assumed at least partially by governments- should be included in the total assessment of damages and will have an effect on the amounts available for reconstruction.

4. Damages in the agricultural sector

The damage to direct production or to areas under cultivation and plantations may be estimated on the basis of their production value or the estimated crop price at the time of the disaster.

Other less obvious damages such as more permanent effects of land movements, floods or climatic changes such as droughts, are not easily quantifiable but, in the case of secondary and long term effects, may result in an important cost that cannot be ignored. As an example, the resulting loss of soils brought about by mudflows or by erosion might be estimated indirectly as the amount of agricultural output that the soils will no longer produce during a period of -say- ten years.

5. Finance costs in the assessment of damages

Assessing losses at the existing prices and costs of equivalent goods, services or infrastructure will result in and underestimation of the actual replacement cost since lost property will always be valued at depreciated cost (in accordance with the age and useful productive future of assets lost).

The ECLAC methodology specifically excludes fihancial costs from the assessment of damages. However, replacement really must include not only the present-value cost of such assets but must incorporate the financial component associated with the required resources for rehabilitation and construction (whether they are obtained through loans or as grants or donations) since there always exists the possibility of using these funds for alternative, more lucrative or economical projects.

a) Public and private costs of damages

Whether property lost is public or private will have different financial implications, which should be borne in mind during the assessment. This additional criteria will lead to the consideration of social costs and the fact that governments will have to face replacement of lost public goods in accordance with their social priority while private losses will depend almost entirely on the capability of the owner of the asset destroyed to face the financial constraints of replacement. Insurance of disaster risks and damages will be an integral part of these aspects.

b) Insurance costs: relation between risk and insured replacement value

Following a major a disaster, insurance costs will increase whether lost property was covered or not. In the first case there will be a direct relation between insurance payments made due to the disaster and the cost of insurance premiums. In the second case, there will be a higher cost of insurance resulting from the need to insure the new property, goods or services. The effect of a more universal coverage could -contrary to what has been said of the first case- lower insurance premiums as more insurance is sold and the companies will have larger funds.

6. Social consequences of disasters

It is almost impossible to assign monetary values to the social costs of disasters but any serious assessment of the consequences of a disaster must include such costs. Although a complete methodology has not been developed for these aspects, an attempt has been made to incorporate them in the damage assessments made by ECLAC, differentiating the impact of different natural phenomena.

Some anticipated effects of disasters in the social area would include migrations (either temporary or permanent, displacement of communities due to the loss of housing and impossibility of reconstruction in the same site), loss of production activities and trade in specific areas, loss of agricultural production and capabilities, disorganization of markets and their operation, disruptions in transportation and communications, panic and general social disorders.

7. Indirect costs associated with prevention and mitigation

One of the recent conclusions reached by the international community (at the World Conference on Natural Disaster Reduction) [2/] is that prevention and mitigation are an integral part of the costs to be included in the reconstruction phase of disasters. Moreover, preventive actions are seen as a means of ensuring that when disasters occur, mitigation of some of their most devastating effects can be achieved.

Some concrete preventive actions are more obvious in some sectors than others.

a) In health campaigns

Health hazards are always associated with disasters, the most obvious being infectious diseases spread through the pollution of water sources and other vectors. Prevention attained through education and vaccination campaigns should be seen not only as part of health improvement programmes but also as part of the mitigation of hazards in case of disasters, whereby covered population will cope in better conditions with the risks of spreading diseases due to disasters.

b) In construction codes and regulations

In most cases, adequate construction reinforcement and retrofitting requirements become an integral part of the replacement and reconstruction costs. The change of regulations are closely linked to post-disaster actions. The economic cost of such changes should be incorporated in damage assessment.

c) In technological change

When losses have occurred in old installations, productive or otherwise, the immediate direct cost could be underestimated if proper account is not taken of the fact that reconstruction will have to be made at a higher technological level than the original and damaged good or property. Proper criteria to select the adequate technological level and measures to incorporate technological change are elements of damage appraisal to be taken into consideration.

A frequent problem is that, due to technological change, it is not possible to find goods in the market that are similar or equivalent goods to those that were lost or damaged. This is true particularly in the manufacturing sector, i.e. textile machinery; and can also be seen in the case of enterprises that produce or supply services. A case in point already mentioned are hospitals and health services, where strict replacement cost criteria are impossible to apply.

2/ Yokohama, Japan, 23-27 May 1994.

In all these cases the similar or functional equivalent criteria will be applicable. An alternative criteria would be to value according to its price of purchase when new and bring this to present-value costs.