MANUAL FOR
ESTIMATING THE SOCIOECONOMIC
EFFECTS OF NATURAL DISASTERS

Part One

METHODOLOGICAL AND CONCEPTUAL ASPECTS

INDEX

I. TYPES OF DISASTERS AND THEIR SUBSEQUENT PHASES

There are many types and kinds of disasters. Disasters are generally violent or unexpected occurrences, often accompanied by considerable loss of life, which cause a society, or part of it, suffering and distress, temporary disruption of normal life, substantial material damage and difficulties for the functioning of society and the economy.[1]

Thus defined, disasters can be divided into two main groups according to their origin: natural disasters and man-made disasters. The main natural phenomena, by descending order of frequency at the global level over a recent 20-year period, are as follows floods; typhoons, hurricanes and cyclones; earthquakes; tornadoes, gales and thunderstorms; snowstorms; heat waves and cold waves, volcanic eruptions; mud slides and landslides; rainstorms, avalanches, tidal waves, fogs, frosts; droughts; and earth, sand and dust storms

The commonest man-made disasters are those caused by explosions, fires, air crashes and collisions, land and water transport, and collapses of dams and dikes. There is also a growing list of "quasi-natural" disasters, such as air pollution and deforestation, and "social" disasters, such as epidemics, famines, pogroms, massacres, terrorist acts and wars Most of these fall outside the scope of this Manual, which focuses mainly on the first group —natural disasters Tables 1 and 2 show the most frequent economic and social effects by type of natural disaster.

Natural phenomena of meteorological and geological origin frequently cause disasters in the countries of Latin America and the Caribbean. On the one hand, tropical storms sweep the Caribbean each year and similar events affect countries situated in the tropical belt of the Pacific coast Changes in air currents over the Pacific alter the sea's characteristics and cause floods and droughts on the Pacific slope of the continent. On the other hand, the presence of the "ring of fire" along the continent's Pacific coast and other lines of contact between tectonic plates cause frequent, intense earthquakes and volcanic eruptions in the region.[2]

It is customary to divide the post-disaster period into different phases, the most common division being the following: a) the emergency phase; b) the rehabilitation and recovery phase, also called the transitional phase; and c) the reconstruction phase.

[1] There are also natural disasters —droughts— which may go on for a long time before society feels their effects

[2] J. Roberto Jovel, op. cit.

The emergency phase is the period in which action is taken to save lives. It includes such activities as search and rescue, evacuation, first aid, building of shelters, emergency relief and medical assistance, temporary restoration of transport and communications networks, preliminary repairs to critical public utilities and a preliminary census of the victims and a record of the damage to public and private property.

The rehabilitation or transitional phase covers all activities designed to restore the situation in affected areas and communities to normal It includes the temporary repair of dwellings and buildings, transport infrastructures and public utilities. It is also the phase in which the problem of the emotional and psychological recovery of the inhabitants of regions affected by the disaster must be tackled Getting people back to work, creating new jobs, providing credit and financial resources and launching immediate projects to deal with the aftermath of the disaster are some of the most helpful recovery measures for victims and affected communities.

Lastly, the reconstruction phase covers all activities related to the reordering of the physical environment so that resources can be allocated according to the new social priorities arising from the effects of the disaster.

From the standpoint of this Manual, although the analyst must carry out his evaluation work primarily during the emergency phase, his calculations and conclusions must essentially serve the needs of the rehabilitation and reconstruction phases

Table 1

EFFECTS OF NATURAL DISASTERS ON LAND SURFACE, STRUCTURES AND AGRICULTURE

Type of disaster	Effects on land surface	Effects on structures	Effects on agriculture
Earthquakes	Tremors and fissures	Damages buildings, roads, dams and bridges	None
	Landslides	Buries structures; dams rivers, causing localized flooding	Some localized losses in affected areas
	Liquefaction of soils	Damages buildings which sink	None
	Underground collapses	May damage buildings; rupture underground conducts and cables; alter course of underground streams	Temporary losses of irrigation
	Avalanches	Damages buildings, roads, dams and bridges	Localized crop and timber losses
Hurricanes, typhoons (cyclones)	High winds	Damages buildings, power lines, towers	Loss of trees; damage to standing crops, especially grains
	Flooding (from rain)	Damages buildings, bridges, causes mud slides and landslides	Damage to standing crops, especially tubers; erosion
	Flooding (storms)	Damages buildings, roads and bridges	Extensive damage to crops and irrigation systems, leaves salt deposits and contaminates soil and wells; causes erosion
Droughts	Dry soils	No major damage	Kills crops and trees
	Windstorms	Minor damage	Erosion and minor tree damage
	Desertification	No major damage	Covers land with sand; alters cropping patterns; kills trees; increases scrub growth

Table 1 (continuation)

Type of disaster	Effects on land surface	Effects on structures	Effects on agriculture
Floods	Erosion	Undercuts foundations	Destroys crops; changes cropping patterns
	Soil saturation and landslides	Buries buildings and damages other structures	Localized crop and timber losses
	Silting	No major effect	Improves soils
Tsunamis	Flooding	Destroys or damages buildings, bridges, irrigation systems, contaminates soil and wells	Localized destruction of crops; leaves salt deposits; destroys trees along shoreline
Volcanic eruption	Eruption	Destroys or damages buildings and other structures	Extensive defoliation near eruption; deforestation
		Damages and buries buildings; sets fires	Buries crops and renders land unusable; starts forest fires
		No major effect	Destroys crops, makes land temporarily unusable; causes pollution, kills trees
		Damages buildings, dams and bridges	Little or no effect

Source: Adapted from Frederick C. Cuny, Disasters and development, Oxford University Press, New York, 1983

Table 2
MORE IMMEDIATE SOCIAL AND ECONOMIC CONSEQUENCES OF A NATURAL DISASTER

Type of disaster	Short-term migrations	Permanent migration	Loss of housing	Loss of industrial trial production	Loss of business production	Loss of crops	Damage to infra-structure	Disruption of marketing systems	Disruption of transport systems	Disruption of communications	Panic	Break-down of social order
Earthquake			x	x	x		x	x	x	x		x
Cyclone			x	x	x	x	x	x		x		x
Flood	x		x	x	x	x	x		x	x		
Tsunami			x	x	x	x	x			x		
Volcanic eruption	x		x			x		x				
Fire	x		x	x	x	x	x			x	x	x
Drought/ Famine	x	x				x						

Source: Adapted from Frederick C. Cuny, Disasters and development, Oxford University Press, New York, 1983.

II. GENERAL METHODOLOGICAL CONSIDERATIONS

The chapters that follow detail the methodology and the information sources recommended for each sector and for assessing a disaster's overall impact. This chapter enunciates some general criteria applicable to these issues

The evaluation must begin with an exhaustive compilation of quantitative information and of any background information that will permit an assessment both of the conditions prevailing before the disaster and of the scope and magnitude of the damage and secondary effects. It will be necessary to consult governmental sources and professional associations (engineers' or architects' associations), chambers of commerce and industry, farmers' associations and experts of international agencies or bilateral missions who happen to be in the country at the time.

The reliability of the information obtained from the above sources will have to be verified in situ. Such verification, which of necessity will sometimes be limited to spot checks, will determine both the number of affected units and the magnitude and extent of the damage, using appropriate evaluation criteria as indicated in the following paragraphs.

It must not be forgotten that the evaluation exercise for which this Manual is intended is an essential tool for the adoption of decisions on the direction and priorities of rehabilitation and reconstruction plans and programmes. As a result, the various options must be properly weighed in order to balance the need for accurate estimates with the need to expedite the evaluation so that programmes can be launched as soon as possible At the least, the results should give an accurate idea of the magnitude of the disaster's effects and of its geographical and sectoral impact. more precise calculations can always be made at a later stage when specific investment projects have to be drawn up

III. CLASSIFICATION AND DEFINITION OF DAMAGE AND EFFECTS

Natural disasters do not only have readily perceptible effects, such as those caused by earthquakes, storms and floods They also have consequences that develop slowly or appear only long after the event, for instance, crop destruction by pests arriving in the wake of the disaster or shortages of essential products arising several months after it.

This Manual describes and suggests a way of classifying the damage and effects brought about by natural disasters, applying two criteria: the methodology to be followed should permit a full assessment of the disaster's socio-economic impact at the time it occurs, and also of its subsequent effects; and it should be appropriate to the various levels (sectors and regions) at which an evaluation is required

Bearing in mind that any set of definitions is governed to a large extent by convention, since there are cases that fall on the borderline between two concepts, the definitions used in this Manual are based, for the most part, on agreed elements deriving from the various evaluation exercises carried out to date.

In schematic terms, the effects of a natural disaster have been classified as follows: effects on property (direct damage), effects on goods and services production flows (indirect damage); and effects on the behaviour of the main macroeconomic aggregates (secondary effects). The first effects more or less coincide with the disaster or occur within hours of it, while the others occur over a period of time which practical experience has shown to be as much as five years, depending on the magnitude of the disaster.

If a rapid damage assessment is to be made, the damage caused by direct effects is relatively easy to identify and evaluate. The opposite is true of damage caused by indirect effects, as these arise at different intervals after the disaster and are therefore more difficult to identify rapidly. Most indirect effects do not show up in a rapid assessment and, while it may be possible to identify them when damage is assessed, they cannot always be measured in monetary terms.

Another point to be made here is that the first two categories of effects (direct and indirect damage) can be combined, with the necessary exceptions since one concerns property and the other concerns production flows, to ascertain the overall magnitude of the damage Secondary effects, on the other hand, are considered to measure the impact from a different point of view They measure the disaster's effects on the functioning of the economy, and the resulting macroeconomic imbalances. As a result, they cannot be added to the other two categories without causing duplication.

Wherever possible, the starting point for damage estimates should be physical units (number, square meters of built-up land, hectares, tons, etc.). This will make it easier to adopt the valuation criteria most appropriate to each case. We shall now describe more precisely the kinds of damage to be included in each of these three categories of effects

A. DIRECT DAMAGE

Direct damage is all damage sustained by immovable assets and inventories (of finished and semi-finished products, raw materials, other materials and spare parts).[3] It essentially involves damage to property occurring more or less simultaneously with the disaster itself and comprises, inter alia, total or partial destruction of physical infrastructure, buildings, installations, machinery, equipment, means of transport and storage and furniture, and damage to cropland, irrigation works and dams. In the particular case of agriculture, the destruction of crops ready for harvesting must also be valued and included as direct damage.

It has also been customary to include as "direct damage" the estimated cost of demolishing and clearing areas where there has been destruction, since this comes under the budget for repairs and reconstruction and is easy to factor into the cost per square meter of construction work.

As will be seen in the sections on individual sectors, for calculation purposes it is appropriate to distinguish between: i) damage to the public sector and ii) damage to the private sector, and between i) repairs,[4] ii) structures that have been totally destroyed, iii) equipment; and iv) inventories. Where possible, it is also very useful, in quantifying direct damage, to estimate what goods will have to be imported in order to restore or replace damaged or destroyed assets.

[3] Businessmen or business owners also tend to treat as losses those affecting realizable assets, such as unpaid liabilities which cannot be collected because the corresponding documentation has been destroyed. However, it seems inadvisable from the macroeconomic standpoint to include these losses as direct damage since, if the liability is not collected, it would be accounted as an inter-sectoral transfer of income and its inclusion as direct damage would result in duplication in the accounts.

[4] In practice, sectoral evaluators often value repairs as a percentage of the replacement value of the partially destroyed asset. Although this method is expeditious, an attempt must be made to improve it by using estimation techniques that reflect more closely the actual value of the repairs.

B. INDIRECT DAMAGE

This is basically damage to the flows of goods that cease to be produced or the services that cease to be provided during a period of time beginning almost immediately after the disaster and possibly extending into the rehabilitation and reconstruction phase, which has been set at a maximum of five years although the greatest losses occur in the first two years. Any calculation of its effects should, in any case, extend to the period needed to restore all or part of production capacity.

Indirect damage is caused by direct damage to production capacity and social and economic infrastructure.

Indirect damage also includes the costs or increased costs of providing services as a result of the disaster, and losses of income as a result of the impossibility or difficulty of providing such services (which will, in turn, be reflected in the secondary effects). Some examples of indirect damage are losses of future harvests as a result of flooding of farmland;[5] losses of industrial output as a result of damage to factories or lack of raw materials; increased transport costs because of the need to use alternative routes or means of transport that are longer or cost more; loss of income for service companies because of the interruption of services; loss of taxes because of reduced economic activity; etc. These all constitute indirect damage for the sectors concerned and are also computed as secondary effects when an attempt is made to measure the disaster's effects on the principal macroeconomic aggregates.

The evaluator must be alert to the possibility that the indirect effects of a disaster may yield society net benefits instead of damage, costs or losses. Indirect effects sometimes yield major, quantifiable benefits which must be deducted from the overall estimates of the damage.[6]

Disasters also have major indirect effects that are difficult to identify and impossible to quantify. These are effects which cause "intangible" damage (or benefits) such as human suffering, insecurity, feelings of pride or aversion at the way in which the authorities have dealt with the consequences of the disaster, solidarity, altruistic involvement, effects on national security and many other similar factors which have an impact on well-being and quality of life. The analyst will not have time to try to put a monetary value on these important effects of disasters, but he must be aware that a comprehensive assessment of the effects of a disaster should include an evaluation or at least a

[5] However, if the disaster destroys crops that are about to be harvested, this loss should be treated as direct damage, as shall be seen in the chapter on the agricultural sector in Part 2 of the Manual.

[6] For instance, prolonged, widespread flooding in a South American country made fertile a large amount of land on the shoreline which prior to the disaster had not been suitable for cultivation. This land was sown by the owners and the net benefits expected from the first harvest were deducted, as an indirect benefit, from the estimate of the damage.

thorough discussion of intangible damage or benefits that have a major impact on living conditions or standards.

Lastly, disasters have indirect effects which could be measured in monetary terms were it not for the time pressures on the analyst. These include opportunities lost because of the impact of the disaster on the structure and functioning of economic activities; distributive and redistribution effects, environmental changes, losses of human capital in the person of the victims; etc.

To sum up, disasters have one or more of the following kinds of indirect effects which are measurable in monetary terms:

i. Increased overheads in the sector as a result of the destruction of physical infrastructure or inventories by direct effects, or losses of production and income: for instance, losses of non-storable or perishable products which were not marketed; additional costs to the health system of reconstituting an appreciable quantity of statistics (health centres clinical records).

ii. Production or service cuts as a result of the total or partial interruption of activities; for instance, the damage caused by the loss of an entire semester of instruction in the formal education system; the cost of failing to meet export contracts, etc.

iii. Additional costs in the sector because of the need to use alternative means of production or provision of services; for instance, increased costs because of having to use diversions and build emergency roads

iv Cost increases as a result of the reorientation or reallocation of budgets.

v Loss of income as a result of non-provision of services; for instance, income lost by public utilities such as electric companies because they cannot charge for normal service that has not been supplied; loss of income for employees who have lost their jobs or must work part-time

vi. Additional costs of dealing with new situations arising from a disaster; for instance, the cost of a health campaign to prevent epidemics

vii. Production or income losses caused by a chain reaction similar to that occurring in a recession. Such losses may occur "upstream" or "downstream"; for instance, the destruction of an industry can cut back the activities of suppliers who have no alternative markets or customers who have no other suppliers

viii Costs or benefits deriving from external factors, in other words, from any indirect repercussion or side-effect of the disaster whose costs (or benefits) are absorbed by third parties not directly hit by (or benefiting from) it. This concept is excessively broad, for it includes effects such as the benefit of training brigades and workers in the emergency, certain costs of environmental pollution, increased traffic congestion and other similar repercussions of a disaster. The analyst must

consider only those external factors that significantly modify the quantification of the damage.

Since not all kinds of effects are mutually exclusive, the analyst must be careful to avoid duplicate accounting in identifying and evaluating them. For instance, if he computes effects on the production side he must not compute them again on the income side; if he identifies the effects of reallocating budgetary resources to cover the costs of the rehabilitation phase, he must not then factor in as an indirect cost the expenditures financed by that reallocation, etc.

As a result, it will be essential to estimate indirect damage in close consultation with the relevant authorities or with experts. For instance, it will be necessary to determine how long it will take to restore services, how much output has been lost, what further costs will have to be incurred in order to provide services and what corresponding reductions will occur in factor incomes. It will also be necessary to analyze the performance record of service companies in order to estimate what their losses might be during the rehabilitation phase, and the prices and returns that lost agricultural and industrial output would have brought in. This Manual provides a step-by-step procedure for making these estimates in each of the sectors considered.

Because the concept outlined above is very broad, it would be advisable to delimit it so that the evaluator does not spend his time on laborious calculations which, taken as a whole, are not significant; for instance, estimates of the disaster's intangible effects on people's productive capacities, or the indirect effects of the approach taken to the emergency process or even the effects of certain drastic economic measures that may have been taken as part of that process. The evaluation must measure only the most important indirect effects, which could also be called primary or first-hand effects.

Combining the two categories of damage just described gives an idea of the overall material losses attributable to the disaster.

C. SECONDARY EFFECTS

Secondary effects reflect the disaster's impact on the behaviour of the main macroeconomic variables. Their measurement complements the measurement of direct and indirect damage, since it is carried out from a different standpoint. Secondary effects reflect the impact of direct and indirect damage and must not be added to it. Although it makes absolute sense to quantify these effects for the economy as a whole, it is essential that sectoral evaluators provide, on the basis of their specialized knowledge, the information the overall evaluator needs to integrate these effects into the main economic aggregates.

It also makes sense to present a disaster's secondary effects in such way as to allow to predict how each of the variables evaluated would have behaved if the disaster had not

occurred This is where we must start in order to determine the extent to which the disaster has frustrated the goals that would have been reached and the extent to which the deterioration in the main variables is affecting the country's ability to tackle the rehabilitation and reconstruction phases, making it necessary to obtain further international cooperation

The disaster's main secondary effects are those which have an impact on the level and growth rate of the overall and sectoral gross domestic product; on the balance of trade, because of projected changes in exports, tourism and services and also in imports and payments for external services, etc.; on the level of indebtedness and of foreign reserves; and on public finances and gross investment. Depending on the nature of the disaster, it is also usually relevant to estimate the secondary effects on inflation, employment levels and household incomes.

Domestic product can be reduced by the anticipated decline in the output of sectors that have sustained damage and, at the same time, increased by a surge in activity as a result of reconstruction efforts. In some cases, exports shrink because of reduced output, or import requirements increase to meet internal demand, and this has an impact on the trade balance and the balance of payments. Public sector spending will increase to meet the needs of the emergency and rehabilitation phases, and tax revenues may shrink because reduced output and fewer exports mean the levying of fewer taxes or even the abolition of certain taxes to ease the pressure on sectors seriously affected by the disaster. This, in turn, can increase the fiscal deficit.

At the same time, prices of goods may go up because of shortages created by the disaster or because of speculation, thereby adding to inflationary pressures Moreover, depending on the economic situation predicted before the disaster and if the latter was sufficiently large-scale and serious, it is possible that the country's international reserves or its ability to meet its external commitments will be threatened.

Secondary effects also include the decline in the living conditions of the affected population as a result of difficulties in gaining access to its sources of supply, reduced availability of essential services and, above all, loss of sources of employment and resulting loss of income. Although a reduction in quality of life cannot be measured in monetary terms, it is possible to quantify the secondary effects of a disaster on a population as a result of the loss of income caused by the partial, temporary or total interruption of its activities.

To facilitate the calculation of total secondary effects, sectoral evaluators will have to make estimates of foreseeable losses of output (of goods or services) during the time it will take to rehabilitate croplands, production equipment or physical and social infrastructure. They will also have to obtain information enabling them to evaluate the impact on the other aggregates mentioned (employment, income, exports, imports, gross investment, taxation, etc.). Lastly, as background, they will have to estimate what trends could have been predicted in the sector, given recent trends in its behaviour, before the disaster occurred.

The period of time for which secondary effects are to be projected will have to be flexible, according to the magnitude of the disaster. Experience has shown that, normally, a "reasonable time" would be the rest of the year in which the disaster occurs (short term), plus one or two years or, in exceptional cases, five years (medium term).

Part 5 of the Manual deals with this issue at greater length. However, the following are some methodological aspects common to estimates of some of the most important aggregates.

a) Gross domestic product. Loss of production of goods and services per sector as a result of the disaster and during the rehabilitation period must be measured by the overall or macroeconomic evaluator, using the information provided by sectoral evaluators. Data are needed that make it possible to estimate at constant prices the GDP lost, particularly the volume of the reductions in GDP predicted for the period it will take to repair the damage to production capacity. The sectoral evaluator will also have to estimate what trends in GDP could have been expected in his sector in the year in which the disaster occurred had the latter not taken place. This estimate will provide the basis for projecting losses by comparing results "before" and "after" the disaster.

b) Net investment. Losses of capital stock, calculated as direct damage, will not be reflected in gross investment for the year, since the destroyed assets were in existence before that year. As assets are gradually restored and depending on available resources and the country's capacity for building engineering works, gross investment for the following year will have to be increased. In any case, the magnitude of this variable in the disaster year will reflect two kinds of effects: i) ongoing projects which are suspended because of the disaster; and ii) inventory losses Data on these effects and an assessment of sectoral investment requirements to repair the damage during the next five years[7] will have to be provided by the corresponding sectoral evaluator for use by the overall evaluator.

c) Balance of payments The macroeconomic evaluator will have to calculate the balance-of-payments current account during the disaster year on the basis of sectoral reports for the following main headings. i) reduced exports of goods and services (if the country has experienced losses which inhibit its tourist activity or affect its shipping fleet or the production capacity of firms that export services such as engineering, etc.); ii) increased imports essential during the rehabilitation phase (fuel, food to replace lost harvests) For the following years (which may range between two and five), imports related to the reconstruction process would have to be estimated by sectoral evaluators on the basis of the imported component of each of the main headings; iii) donations in cash or in kind received because of the emergency; and iv) a possible reduction in interest payments on the external debt under emergency agreements concluded with creditors To complete the picture of

[7] Or another period whose duration can be established by the sectoral evaluator and the macroeconomic evaluator as the most appropriate for completing reconstruction

the disaster's effects on the balance-of-payments current account, compensation paid to the country under policies concluded with foreign insurers must be treated as a credit.

The balance-of-payments capital account will have to be estimated basically according to the medium- and long-term external financing requirements for the priority investment projects that will form part of the reconstruction process during the five years following the disaster[8] and also according to the additional external financing that may be needed because of the possible deterioration of the current account balance deduced from the above projections.

d) Public finances. This is another macroeconomic aggregate that will have to be quantified, since it usually fluctuates significantly during the disaster year and the years immediately following it. The following possible secondary effects will have to be included: i) lower tax revenues because of the drop in production of goods and services, loss of earnings and reduced consumer spending, and reduced earnings for public service companies, ii) increased current expenditures because of the emergency, especially to meet the needs of the affected population and repair damaged public services; and iii) increased investment spending for the reconstruction phase. The macroeconomic evaluator will have to try to reconcile possibly conflicting information from different sources. He will then estimate the deficit in the Government's accounts for the disaster year and subsequent years in order to determine the financial requirements the public sector will have to face during that period

e) Prices and inflation. Although it is not always feasible or necessary to measure the overall inflation levels existing before and after a disaster, assessments should at least be made, on the basis of sectoral reports, of the effect that supply restrictions resulting from the destruction of harvests, manufactures, marketing channels, transport networks, etc. may have on the price of certain goods and services which, in such cases, will be supplied by alternative means.[9] The influence of these variables on the overall level of inflation and on relative prices will have to be estimated and included as a secondary effect of the disaster.

f) Employment. Sectoral estimates have to be made in order to assess the overall effects on employment levels as a result of: i) the destruction of productive capacity or social infrastructure, and ii) new demands for manpower during the emergency and the rehabilitation process.

[8] See previous footnote.

[9] In some cases, the effect may even be to reduce prices, if the substitute product that is imported or obtained from another source is bought at a lower price.

Lastly, the experience of evaluations made by both national and international institutions over the past two decades points to the existence of certain relationships between the type of disaster and the kind of damage sustained, the main ones being [10]

- natural disasters of meteorological origin —such as floods, hurricanes and droughts— usually affect a wider geographical area than those of geological origin;
- because of population density, the number of victims resulting from natural disasters of geological origin —such as earthquakes— is likely to be higher than in the case of disasters caused by meteorological phenomena;
- losses of capital stock in the physical and social infrastructure caused by earthquakes are usually much higher than those caused by floods;
- production losses and other indirect damage, on the other hand, are likely to be much higher in the case of floods and droughts; and
- when a geological phenomenon gives rise to floods or mud flows, production losses and other indirect losses are generally much higher than in other kinds of geological disasters

The following general effects are common to all types of natural disaster:

- a variable number of victims;
- a substantial reduction in the availability of housing and health and education facilities and a corresponding increase in already high underemployment and unemployment rates;
- temporary interruptions of water supply and sanitation services, electricity, transport and communications,
- temporary shortages of food and raw materials for agricultural and industrial production;
- regardless of the damage sustained, the activities that can be expected to recover fastest are small commercial businesses and personal services,
- in countries with predominantly dual structures, the problem of disaster-related loss of employment is more serious and more lasting in the modern sector than in traditional sectors, and is worse in industry than in agriculture, commerce or services.
- in the recovery and reconstruction phases, the structure of employment changes as activities related to housing construction and public works increase,

[10] J. Roberto Jovel, op. cit.

- a reduction in the volume of exports and an increase in imports can normally be expected; and
- public finances will also evolve towards a deficit situation, since increases in all kinds of social spending, the reallocation of spending over time and increases in investment will generally be accompanied by lower tax revenues and other fiscal income.

Although the direct and indirect losses described are considerable, the social effects of natural disasters are usually more significant.

IV. CRITERIA FOR EVALUATING DAMAGE

The experience gained in this area advises against any attempt to use a single concept of costs and prices for evaluating damage However, as a general rule of thumb, the prices and costs most relevant to each situation must be estimated. Accordingly, damage will be estimated on the basis of the costs and prices prevailing as close as possible to the moment at which the disaster occurred, the purpose being to establish, to the extent possible, a single baseline in time for the calculation of all damage and to avoid including in the calculation any inflationary or deflationary effects that might be caused by the disaster.

However, it is advisable to value at equivalent replacement cost totally destroyed capital stock or buildings earmarked for demolition. This involves taking into account the functional equivalence of the destroyed capital asset, in other words, the cost of replacing it with other stock offering similar operating characteristics. This is a standard approach for avoiding the over-valuation that is likely to occur if the destroyed stock or equipment is simply replaced by the latest version of it (incorporating technological innovations) available on the market In any case, once the corresponding replacement value has been established, it will have to be adjusted for depreciation (based on the average working life and age of the goods). This will give the value of the direct loss or damage. However, it is advisable that the amounts included in the final evaluation should refer to the replacement value of the destroyed assets, since these are the amounts that the economy will have to pay and that will therefore affect its financial, foreign exchange and budgetary requirements, among others. It is clear from this ttat, in many cases, the value of the actual damage sustained by the destroyed property will not be the same as the amount the country needs to rehabilitate or rebuild it.

The evaluator will often have to take a decision that falls between two extremes, for instance, between the value per square meter of destroyed sub-standard housing and the kind of permanent housing that the country will provide for the people who used to live there (which would clearly mean a qualitative improvement in the kind of housing), or between the value of near-obsolescent machinery destroyed in a textile industry and the cost of its replacement, which will obviously be different because it will incorporate a considerable amount of technological change. This does not mean that the value of the most sophisticated equipment will always have to be taken into account; the replacement chosen will be the one functionally closest to the destroyed equipment and the one whose purchase and financing is considered feasible.

Given the acute inflation that have affected most countries of the region, book value will generally not be taken into account as an approximate indicator of the market value of goods or assets. Indirect damage to flows of goods or services will be evaluated at producer or market prices, as appropriate. (This issue is dealt with in detail in Part 3)

Costs and prices will be evaluated in "real terms" (use of productive resources, goods and services); in other words, the damage assessment will not include an estimate of financing costs. Such costs relate to: commissions, interest, discounts, insurance and reinsurance, subsidies and all the internal or external post-disaster systems of free, paid or subsidized financing. (As a result, the costs or prices of the real economy are treated as paid "in cash".) Transfers within the economy will also not be costs (or benefits) of the disaster, since they are transactions which do not use resources or produce goods and services.

In a rapid damage assessment, it seems unlikely that most sectors will be able to evaluate damage (pre- and post-disaster) in terms of social costs. In any case, we recommend weighing the appropriateness of using, in some situations, the approach characteristic of evaluations of social costs.

Calculations of direct and indirect damage will have to be made in the national currency of the country affected by the disaster. However, it is often essential to then convert these figures into United States dollars, using an appropriate exchange rate, to permit comparisons and a better grasp of their magnitude internationally. The prices of exports or of articles that must be imported will have to be expressed directly in dollars.

V. INFORMATION SOURCES

One common effect of natural disastes is that they obstruct normal information sources, especially if a country's capital city or other political and administrative centres have been severely hit Many public buildings will have been evacuated and some of their functions will be carried out in various other places. Civil servants and technical staff will be working in the field or will have joined special commissions to coordinate planning or relief activities, with the result that a number of customary sources of information will be inaccessible.

The analyst must quickly evaluate his possible information sources, which in all likelihood will be dispersed For instance, he will obtain population data from the national statistical office, but if the office cannot provide them he will have to turn to specialized centres or institutes; he will probably obtain background information on disaster victims from units of the ministries of health, government or the interior, information on damage to schools from departments such as the ministry of education or construction offices in charge of building educational establishments, and so on for each of his needs Moreover, in many cases he will not be able to obtain information from a central office but only in the places affected by the disaster

In the vast majority of cases, the analyst will have to make an independent assessment of the damage or review assessments already made by the authorities or by relief agencies. He will have only a short time to do this, in the circumstances characteristic of an emergency situation. Accordingly, the most advisable techniques for obtaining information would be the following.

A. STRATEGIC INFORMATION SOURCES

Regardless of whether emergency and rehabilitation efforts have been organized on a centralized or a decentralized basis, the evaluator will have to first locate a network of national bodies, national and international agencies, research centres and "key" people who can provide the necessary information and have sufficient authority to request and obtain documents and reports on the disaster Despite time pressures, the evaluator must use for his evaluation only documented facts and data, his own observations or those obtained from oral reports, or summaries of the situation prepared by various sources. There will almost certainly be no way for him to judge the validity and reliability of this information, or to reconcile conflicting opinions or information, other than to rely on these strategic information sources.

B. ANALYSIS OF PRESS COVERAGE

Starting on the day of the disaster, the press will publish written information that the analyst may find very useful. Press clippings must be sorted into categories that are easy to handle. The press archive will be kept up to date and may prove vitally important for four aspects of the evaluation process: i) as a reference source for identifying people who could become strategic information sources and for locating useful documents; ii) as an independent yardstick for verifying the consistency and coherence of the official and unofficial information available to the evaluator; iii) to draw attention to areas and types of damage not covered by existing analyses; and iv) to provide data and figures that supplement the information obtained from other sources.[11]

C. CARTOGRAPHY

Maps are an essential tool and the evaluator must try to obtain them at the outset. Maps made after the disaster and giving information on its effects are particularly useful. However, even if they exist, such maps are usually difficult to obtain since they are being constantly updated. Moreover, in most cases even basic maps are not available in institutions and the evaluator will often have to search for them

D. RECONNAISSANCE MISSIONS

These may be by land, sea or air. If, as often happens, the evaluator is able to make only one reconnaissance, it should be scheduled to enable him to first evaluate in his office the information sources already available to him. The reconnaissance mission will then gather additional information unavailable from those sources. In isolated or inaccessible areas, reconnaissance missions will often be the only feasible way of obtaining information. Local reconnaissance will always be useful for the evaluator, because it will provide a way for him to evaluate the quality of the information sources to be used throughout the damage assessment process, it will enable him to classify the effects of the disaster by order of magnitude on the basis of his own findings and, lastly, it is the only opportunity he will have to detect major damage not mentioned in any other documented source.[12]

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[11] The evaluator will have to take due care to identify, and treat with the necessary circumspection, information provided by the sensationalist press.

[12] This often happens in the evaluation of damage to social sectors and the affected population However, it is valid for all sectors. For instance, when the damage caused by a recent earthquake was evaluated, much of it centered on the destruction of several kilometres of oil pipeline The aerial reconnaissance mission, however, detected major damage to agriculture as a result of landslides, an aspect not considered initially.

E. SURVEYS

In-depth surveys are the best method of obtaining data for the rehabilitation and reconstruction phases. When the object is a rapid damage assessment —an activity normally carried out towards the end of the emergency phase— such surveys do not yet exist There are three kinds of surveys that may be very useful, however i) those made by departments or agencies who carry out rapid damage assessments involving, for instance, a visual inspection of the number and state of damaged or ruined dwellings or a survey of specific aspects of the damage, such as victims and morbidity structure, by a health area division; ii) more comprehensive surveys using more systematic procedures and providing comparable, valid data on the pre-disaster situation, such as employment and unemployment surveys in the main cities. These instruments are very valuable in several areas of the damage assessment process and are analyzed below as an integral part of the analysis of secondary data; and iii) the rapid assessment surveys that the evaluator (or his team) may make. especially during reconnaissance missions. These must be made whenever there are no better sources of information [13]

F. ANALYSIS OF SECONDARY DATA

This involves the analysis and use of publications, documents and reports containing background information provided by various institutions or individuals. For the evaluator, the data are "secondary" in the sense that he does not have to produce them himself, but their importance is usually fundamental Whatever the methodology used for evaluating damage, the evaluation must reflect values that contrast a post-disaster situation with a pre-disaster one. This is the best alternative available to the evaluator for ascertaining the relevant values and the situation prior to the disaster Moreover, information on the pre-disaster situation will be the starting point for evaluating the effects of the disaster. Without it, an accurate assessment of the damage will be impossible

[13] An overland reconnaissance mission drove through a dozen or 50 small villages of the South American plateau on which there was no information about the population affected or the homes damaged by an earthquake. The evaluator made the following rapid assessment: i) he established a three-tier scale of damage to dwellings: "ruined", "severely damaged" and "damaged but habitable"; ii) in each village, estimating a distance of 50 to 60 meters, he "surveyed", by slowly driving past them a line of dwellings in the centre of the village and two lines of streets, at two different cardinal points, chosen at random towards the outskirts of the village, estimating the number of damaged dwellings and classifying the damage in the corresponding categories, iii) in addition he inspected any major "buildings", such as churches, schools and public offices. At a later stage, he combined this information with population census data to estimate the size of the affected population and the damage caused to homes and buildings in the villages.

In the case of natural disasters, reliable, valid data both on the physical characteristics of the affected territory and on its population (size, distribution, density, economic, cultural and ethnic characteristics, etc.) must be obtained. When the evaluation is being made for government institutions or international agencies, the evaluator should wherever possible use official sources or documents giving data based on those sources, with figures published by the competent agencies.

Population, housing and sectoral (agriculture and livestock, manufacturing, mining, etc.) censuses are particularly useful, as are statistical yearbooks, journals of statistics and census departments, publications of research centres operating within the country and surveys made by official bodies, university centres and other centres of recognized expertise. In the period immediately following the disaster, documents will be scarce and of the kind described above: partial surveys made by public departments and international agencies and internal reports prepared by the institutions most involved in the emergency and rehabilitation phases.

G. LONG-DISTANCE INTERPERSONAL COMMUNICATION

The evaluator often has no choice but to use telephone, radio or telegraph to obtain information about remote, inaccessible disaster-stricken areas. Since one of the first activities after the disaster is the restoration of communications, one of these channels is very likely to be in operation. In any event, the evaluator must request very precise data through these channels and then carefully evaluate the information he obtains by comparing it with information available independently from other sources

H. AERIAL PHOTOGRAPHY

Aerial photography, if available, can be of considerable assistance. However, it is easy to exaggerate its importance Experience has shown that photographs taken in isolation and unsystematically by non-specialized staff will yield little information of any use to the evaluator. The opposite is true when aerial photography forms part of a system of aerial photometry, since in this case the evaluator will have all the information he needs to correctly interpret the nature and magnitude of much of the damage. In such cases, the investigator should make his estimates and calculations in close cooperation with staff specialized in the analysis of aerial photometry.

I. REMOTE SENSING IMAGES

Images obtained by remote sensors mounted on aircraft or satellites are a new technique for collecting data that could potentially assist in rapid damage assessment Remote sensing is able to provide complete resolutions over wide areas in a very short

time. However, it has two serious drawbacks: the cost of installing these systems for use in disaster evaluation is too high for most developing countries; and remote sensing images do not permit evaluation of aspects essential for a rapid assessment. For example, a building may look intact from the air and be scheduled for demolition because of internal structural damage· damage to underground pipes and conduits or internal damage to industrial and commercial establishments also cannot be detected

However, the use of remote sensing images could prove invaluable in the pre-disaster stage, especially for planning, early warning systems and vulnerability profiles. It could also prove useful in the reconstruction phase, when the mass of information gathered by sensors can be rigorously analyzed