

## APPENDIX X

### AGRICULTURAL LOSSES IN HONDURAS FOLLOWING HURRICANE MITCH

The following concepts were applied to estimate agricultural losses:

- A) **Loss of assets.** One of the most significant effects of the hurricane, in terms of both its short - and long-term repercussions, was the loss of assets, including physical facilities, investment in plantations and the production capacity of soils that lost their top layer. Floodwaters ruined agricultural land, covering it with a diverse range of materials.

Pending a detailed survey, it was estimated that soil loss was total on approximately 10 000 hectares, located mainly on floodplains. Stone deposits were the predominant factor in these areas. In one area of roughly 750 hectares, it was decided that the high cost of eliminating sand sediment might be justified by crop profitability. However, before land covered by sand and materials can be used productively, considerable expense must be incurred in cleaning and leveling works.

Mud deposits can be beneficial because they improve soil quality, but several agricultural seasons must pass before the site can be used. Soil losses due to mudslides were detected on approximately 7 000 hectares of mountain slopes used for growing coffee; recovery will take many years.

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Estimated total soil losses amounted to 5 200 million lempiras in lost net income (see Table 4). Losses in plantations and ancillary facilities amounted to 6 300 million lempiras. As a whole, they accounted for 50% of the total damage in the agricultural sector. In the case of some crops and regions, new seeds would be needed for planting.

Since agriculture in the valleys was significantly damaged, proper management of hillside agriculture became more important, not only as a source of supply and income for a sizable sector of the rural population, but also as an integral part of sustainable development for the forestry and agriculture sector.

- B) **Crops for domestic consumption.** The hurricane coincided with the end of the harvest of certain crops and the planting of others, so availability of those products would drop the following year. The deficit would be smaller if soil humidity conditions allowed for a second crop. The magnitude of production losses is shown in Table 4.

In the case of maize, data shows that approximately one - third of the first (and most important) harvest for the 1998-1999 farming year had already been collected, whereas in the area still to be harvested production would be reduced by 250 000 tons, worth 609 million lempiras (see Table A below). Excess water generated by the hurricane resulted in extraordinary costs by preventing the use of machinery for the harvest, which had to be done manually. That value is recorded as indirect damage. At the same time, the poor state of roads hindered transportation of the crop to collection and grain-drying centers, thereby undercutting quality.

The first harvest in the bean cycle had also been collected at the time of the disaster and the second crop, which provides 75% of national production, had already been sown. In the area planted, losses were estimated at 30%, which entails approximately 9,000 fewer tons of beans than were available in 1999. This shortfall would have to be compensated through additional imports. Replanting was possible, but not over the entire affected area. The direct damage of 67 million lempiras includes lost production in the first harvest, as well as investment in the planting of the damaged areas. Indirect damage represents the harvest that was not collected.

Table A

HONDURAS: ESTIMATE OF PRODUCTION LOSSES IN MAIN AGRICULTURAL CROPS  
AS A RESULT OF HURRICANE MITCH  
(Thousands of tons)

Source:

Product	Production forecast before the hurricane	Production estimated after the hurricane	Lost production	Loss over expected production (%)
<b>Basic grains</b>				
Uncleaned rice	64.8	56.1	8.8	14
Beans	95.1	89.9	5.2	6
Maize	607.1	252.2	354.9	58
Sorghum	94.2	71.8	22.4	24
<b>Industrial and export crops</b>				
Bananas	872	766 a/	739 b/	85
Sugarcane	3,397	1,360	2,037	60
Coffee	153	126	27	18
Melon	203	144	59	29
African palm	576	415	161	28

ECLAC estimates, based on information from official sources and productive sectors.

a/ In 1998.

b/ The last months of 1998 and the 1999 harvest.

A similar situation occurred in the case of rice, as adverse weather led to a production shortfall of 8 800 tons. Moreover, excess water hindered growth on around 700 hectares already planted that were to be harvested the following year. Direct damage of 30 million lempiras reflects lost production and investment. Indirect losses of 5.5 million lempiras represent future production that will not be obtained.

The volume of sorghum lost was greater than that of rice and beans, since barely a tenth of the harvest had been collected and almost a quarter of annual production was lost. Because a part of the planted area ready for the next cycle was damaged, supply was expected likely to fall by an estimated 10 000 tons.

Expectations of a considerable drop in the supply of basic grains led to uncertainty and a scarcity in markets that was aggravated by difficulties in the transportation of goods as a result of the deterioration of highways and access roads in production areas. To prevent price increases, the government reached an agreement with producers and wholesalers for a temporary price freeze. To meet the demands of industry and direct consumption, officials considered a zero tariff on the import of certain basic grains that are sold within a price range and with a variable tariff of approximately 35%. However, once communications were stabilized to some degree, it became obvious that available short-term stocks were sufficient and that imports (a total of 560 million lempiras) could be deferred until the following year.

Support programmes would have to be designed in line with producers' socioeconomic conditions to mitigate the harm they sustained. The priorities of a rehabilitation and reconstruction program for the whole sector should include the rehabilitation of damaged agricultural areas, the recovery and distribution of genetic material, plant and animal health surveillance, access to financial resources through preferential credits to facilitate reactivation and, more generally, the introduction of river basin management practices and infrastructure reconstruction.

Table B

HONDURAS: AREAS OF MAIN EXPORT CROPS  
AFFECTED BY HURRICANE MITCH  
(Hectares)

Export crops	Production area before the hurricane	Area affected by the hurricane	Percentages
Total	292,000	83,760	29
Bananas	22,000	16,000	73
Coffee	194,000	38,800	20
Sugarcane	44,300	22,000	50
African palm	32,000	8,960	28

Source: ECLAC estimates, based on information from official sources and productive.

- C) **Industrial and export crops.** As in the rest of agriculture, industrial and export crops sustained major direct damages, which were estimated at approximately 1 800 million lempiras. Moreover, since most losses refer to permanent crops that would have to be replanted in many areas, losses not only affected production during the current cycle, but would continue throughout the time required for new plantations to reach maturity (between two and seven years, depending on the crop). Total losses thus amounted to 6 000 million lempiras, including damage to assets and indirect losses of production over several years.

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Significant losses were reported for bananas, since almost all plantations are located in two of the areas most severely affected by floods. Large producers lost all or part of their plantations, as did many independent producers, particularly cooperatives. The Tela Railroad Company (Chiquita Brands) reported that between 50% and 60% of its plantations were damaged, while Standard Fruit Company (which normally hires about 10,000 workers) lost 80%. Independent producers had very high losses on some 6 000 hectares, of which only a small fraction can now be harvested to meet domestic demand and the needs of farmhands and cooperative members.

Floods affected current and future crops as many plants were destroyed. Although new plants could begin producing in one year, the time required to clean up and level fields should be taken into consideration. That year's crop losses (466 million lempiras) correspond to the November-December harvests, whereas indirect damage refers to production lost until the plantations would recover in two years' time. Infrastructure and plantation losses, totaling 3 500 million lempiras on approximately 16 000 hectares, are listed under the heading of assets.

Losses in coffee —the country's main export— amounted to 500 000 quintals, while a further 105 000 quintals of reserves were ruined when warehouses were flooded. Another 7 000 hectares were affected by landslides, as were many access roads to plantations. Over 100 coffee-processing facilities were either swept away by swollen rivers or rendered useless by flooding, which also caused significant damage to access roads and many bridges. Crop production losses were estimated at 629 million lempiras, while future production will be decreased due to the number of lost coffee plants. That loss is recorded under the heading of soils. The decrease in the next harvest and exports during the present and future cycles must also be taken into account, as the normal development of plantations was curtailed.

Sugar cane losses were high in areas rendered useless by flooding, silting, mud, sand and stones. Although sugar cane is relatively resistant to excess water, it is difficult or impossible to harvest, either mechanically or by hand, when it is covered by mud. Furthermore, the inevitable postponement of the harvest decreased sugar yield. If delays were prolonged, it would no longer be economically feasible to harvest the crop. Damage to some mills and industrial facilities (the machinery in one of them was covered by water and mud) made the delay even greater and the situation more critical. It was therefore estimated that 50 percent of the planted area had been lost and that the value of the crop that could not be harvested during the present cycle was 387 million lempiras. Extensive areas would have to be replanted to ensure the recovery of sugar cane plantations, which is why the investment lost in plantations was also taken into account. The following year the sugar cane harvest would also be lower, and foreign exchange earnings from sugar exports in the next two years would decrease by some 85 million lempiras.

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African palm losses have affected the cooperatives established following the agrarian reform, as well as independent producers and large enterprises. The most recently planted area sustained significant damage, since two to three year-old plants, which are the most vulnerable, were partially covered by mud. This affected the heart of the plants, which died as a result; adult plantations were better able to withstand the effects of the hurricane. Nurseries and other plantation-related facilities were also significantly affected. Damages sustained by plantations provide the basis to estimate present year production losses (143 million lempiras). This situation will continue over the next few years until the damaged plantations recover.

In melon production, which is concentrated in the department of Choluteca, 12 000 hectares had been set aside for planting to take advantage of market demand in the winter months. When the hurricane struck, 3 600 hectares had just been sown or were being prepared for sowing, and 80 percent were lost; the direct damage led to the loss of 32 million lempiras in investment. In contrast, indirect losses refer to the area that was not sown, resulting in lower exports in 1998 and 1999. Action was rapidly taken to recover the market, but only 7 000 hectares were set aside due to the total loss of fertile soil on farms that were covered with large amounts of sand and stones deposited by the river. These farms are included in the loss of agricultural assets, as are the substantial investments that would have to be made to recover some of the affected areas. Infrastructure was also significantly damaged, with more than 50 refrigerated transport containers destroyed; this item, however, is included in the transport section.

Citrus crops on the Atlantic coast were also seriously affected. Fortunately, grapefruit exports to Europe had concluded on October 15, so direct damage affected mainly the oranges and grapefruit for the domestic market. Production in the coming cycles would be lower because of the damage sustained by fruit trees; indirect losses were therefore estimated at 400 million lempiras. The greatest losses in assets occurred in the region of the Aguan valley, where an estimated 1 750 hectares of grapefruit were covered by sand and debris and were completely lost, and approximately 7 000 hectares of young orange groves were waterlogged for several days and would have to be replanted.

- D) **Livestock.** The beef and dairy herd was reduced by approximately 50 000 head, valued at some 225 million lempiras. Information on livestock-raising areas was incomplete, owing to difficulties in gaining access to such areas. Although livestock raising is carried out in the highlands, losses occurred among cattle grazing in the lowlands. Adverse weather conditions resulted in animal weight decrease, causing an estimated loss of 900 million lempiras.

On the Atlantic coast, where dairy production is concentrated, the supply of raw materials to industry dropped during the first week as a result of flooding on farms and adverse transport conditions. The losses sustained on those days would cause lower milk production for several months. Direct damage was estimated at 120 million lempiras, while the subsequent impact of lower production was expected to result in higher indirect losses in view of the time required for recovery.

Damage to poultry production amounted to approximately 740 million lempiras from the loss of 60% of poultry stocks. The damage to dairy farm facilities and fences, calculated at 500 million lempiras, would have to be repaired. Flooded grasslands would eventually recover, but investments would be required to improve pasturelands. According to information provided by the unions, 70 000 hectares were affected at a loss of 300 million lempiras.

The public sector lost animal health control facilities and laboratories that produce and record genetic material. Under the prevailing conditions, the sector's response and international support in preventing diseases were very timely. Reconstruction would have to include recovery of the lost installed capacity.

- E) **Forestry.** Timber production is an important activity in Honduras, generating export earnings of 20 million dollars. Sawmills suffered no major damage from the hurricane, although some machines were affected by water. Damage to roads was more of a problem, since it hindered access to logging camps. Lumber, however, was available for reconstruction purposes.

One of the most significant losses in the sector was timber from trees blown down by the hurricane, amounting to 100 000 cubic meters of pine. The most seriously affected areas were in the Sierra de Agalta of the eastern and western parts of Olancho and in Yoro. Losses, based on the average price per cubic meter, amounted to 27 million lempiras. If the sales price offset the cost of extraction, which was hindered by road conditions and remote locations, part of the losses could be recovered. Collecting this timber would have other benefits, such as eliminating potential sources of fire in the dry season and forest pollution.

In Atlantida, 25 000 additional cubic meters of timber from latifoliated trees were reportedly lost, and forestry plantations throughout the country were also damaged.

- F) **Fisheries.** Fishing on the Atlantic coast and shrimp production in ponds in the Gulf of Fonseca are very profitable in Honduras. The hurricane affected these two zones, causing damage to both artisan and industrial fishing fleets. Owing to the type of shrimp-farm investments in the south, it would seem that the economic impact was more significant in that area. A total of 13,700 hectares were flooded in Choluteca and Valle, and during the first few days after the hurricane, estimates indicated an almost total destruction of infrastructure and the loss of at least two of the 2.5 annual shrimp harvests. Once the water level dropped, it became apparent that damage was considerable but clearly not as great as originally feared. Pond and packaging facilities, as well as investment in larvae for the restocking of ponds, sustained damages amounting to 100 million lempiras. In production, direct damage was estimated at 300 million lempiras—a harvest of 3,200 tons of shrimp— plus indirect costs from the partial loss of the first 1999 harvest.

Coastal fishing sustained losses of 140 million lempiras, although information on losses in the 365-vessel fish, lobster and conch fishing fleet could not be confirmed.

## II. TRADE AND INDUSTRY

### A. INTRODUCTION

#### 1. General considerations

This chapter has four sections. The first describes conceptual aspects that are common to trade and industry and that must be taken into account when assessing damage due to natural phenomena. The next two sections refer to each of these productive sectors. The presentation includes an overview both of the characteristics of the natural phenomenon and of the magnitude of damage in the sector; a description of the methodology and information sources that must be used to quantify direct damage and estimate indirect effects or losses; an estimation of the impact of the phenomenon on macroeconomic indicators or the manner in which damage and losses affect the performance of the main economic variables of the affected country; and recommendations on the definition of priorities that the responsible authorities must establish to meet the needs arising in both sectors from disaster effects. Finally, the fourth section contains a methodological appendix with formats of basic tables that the sectoral specialist can use as a guide, to be filled out with the information obtained from different sources as mentioned throughout the text.

To illustrate the methodology proposed for the assessment of direct damages, indirect losses and the corresponding macroeconomic effects on a national economy, the text draws on information from field research and various sources used to assess the impact of the 1999 floods in Venezuela.<sup>1</sup>

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For each of the sectors, references are made both to the sources of statistical information most often available in Latin America and the Caribbean, and to complementary information that should be obtained from official sources, chambers of trade and industry and field work.

#### 2. Characteristics that are common to both sectors

When assessing damage caused by a natural phenomenon, specialists will find certain similar features that run through the trade and industry sectors. In both economic sectors, value - added is generated in establishments that are well defined by their physical extension and facilities into large, medium-sized, and small enterprise categories. The peculiarities of each of these sectors differentiate them from other areas of the economy in terms of specific disaster effects and the actions needed for both the rehabilitation and reconstruction of productive units and risk reduction.

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<sup>1</sup> ECLAC, *The Socioeconomic Effects of the Floods and Landslides in Venezuela in 1999*, Mexico City, 2000.

In both trade and industry, large establishments contribute the lion's share of production and are normally more modern than medium-sized and small businesses. Therefore, they proportionally concentrate more of the capital stock in both sectors. They also generally have more solid installations and frequently have insurance covering the risks of damage caused by disasters.

According to Latin American and Caribbean censuses, there has been a structural trend towards a decrease in the relative importance of small establishments in terms of numbers and value - added; however, they still account for a large share of employment in both trade and industry, a fact that has even tended to increase in recent decades. This has been due mainly to the low absorption of labor by the most highly productive units –which constantly incorporate technological advances– and the subsequent increase in informal activities, especially in trade in large urban agglomerations.

These small establishments operate under precarious conditions, which undoubtedly make them more vulnerable to natural phenomena. Their recovery tends to be quick, however, since their functioning is more directly related to the subsistence of the persons engaged in each enterprise and because proportionally less physical capital is prone to destruction than in larger establishments.

28 Both trade and industry concentrate most of their activity in big cities (although trade –especially the small and informal kind– is less polarized and can be found in medium-sized and small cities as well as in remote tourism centers). Therefore, they are relatively less affected by disasters occurring primarily in the countryside (droughts, floods, etc.), with the exception of agribusiness and those branches of manufacturing that have broad production chains extending all the way to mining, fishing, forestry, food processing and so forth.

Nevertheless, hurricane winds that strike coastal areas can have a significant impact on commercial and manufacturing activities when they are located in major cities on the coast or very near to it and when secondary and tertiary activities linked to tourism are significant.

These features, which are common to trade and industry, have an obvious influence not only on the type and magnitude of the damage a natural phenomenon can cause, but also on the support they might need for rehabilitation and reconstruction and for disaster mitigation.

There are other characteristics worth noting. Because of the large financial capital they handle and the scale of their investments in machinery, equipment, buildings, warehouses and stock, large establishments often have insurance against such types of risks, and their asset losses can be proportionally lower than those of small and medium-sized industrial and commercial establishments. On the other hand, micro-enterprises –which in many cases operate in their owners' homes and basically use domestic inputs– may react more flexibly and quickly to the effects of a natural phenomenon in order to safeguard their stocks of inputs and partially completed or finished goods, which are the bulk of their assets. In addition, as mentioned earlier, the urgent need to recover their only source of income requires small businessmen and artisans to quickly get their premises and workshops operating again, undoing the damage on their own.

The above reasons explain why accumulated assessment experience in the region shows that medium-sized industrial and commercial establishments require proportionally greater recovery assistance than small or large ones.

Breakingdown the impact on these sectors by sex is equally important. Although the aim is to determine the monetary value of the damage, both the impact and the required rehabilitation and reconstruction tasks take on different characteristics depending on the sex of the affected owners. The trade and industry specialist must work in close cooperation with the gender specialist for assessment purposes.

Finally, it is necessary to estimate the employment and personal income losses registered because of direct damage and production decreases in the trade and industry sectors. Such a calculation should be made in cooperation with the employment specialist, making use of known ratios of labor required for specific production volumes.

## B. MANUFACTURING SECTOR

### 1. General considerations

The assessment of damages caused by a natural disaster in the industrial sector can be undertaken following a procedure of successive approximations, as described below. The starting point is the collection of basic information that will provide the specialist with an overview of the sector in the disaster area. Next comes the most accurate calculation possible of the specific damages sustained. Finally, a precise diagnosis of the situation must be made. This process will enable one to set priorities for the recovery of productive activities by defining reconstruction projects and programmes. It is recommended that the steps described below be followed.

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#### a) Collection and sources of information

One of the sector specialist's first tasks is the collection of basic information. In this activity he/she must proceed selectively because of the limited time usually available for such work.

The main domestic sources of information that should be used include the following:

- The most recent industrial census;
- Information and time series on production available in statistics bureaus, central banks or sectoral planning offices;
- Periodic surveys carried out by trade and industry ministries or by central banks;
- Information in periodic bulletins published by industry associations;
- Economic and statistical information published or made available by industrial or manufacturers' groups, such as the chambers of the textile, clothing, food, electrical appliance and construction materials industries;

- Information prepared by other groups on micro and small enterprises or businesses, which are sometimes available from development banks, manufacturing workers' unions or social security institutions;
- Information available in patent and trademark offices; and
- Information available from industry promotion offices or in municipal records.

In addition to local and national sources, the trade and industry specialist should consult the information available in the Latin American Demography Center's Redatam, which should provide a very precise view of pre-disaster conditions. Such data are useful for making damage estimates, identifying those affected and defining the bases for reconstruction programmes and projects. The Redatam network brings together census or household survey information in a coherent and compatible way, and presents it broken down by state, province and even municipality. For example, Redatam provided analysts with remote access to a highly useful body of information on the state of Vargas in Venezuela (economically active and employed population, productive activities, number of establishments by size, etc.).

Likewise, Internet searches before and during the assessment may reveal information on special characteristics of the most important manufacturing enterprises, which that might not be available through other sources.

**30** The sector specialist should promptly trace all available sources in order to obtain as much quantitative information as possible on the sector both nationally and in the disaster area. This set of background information should then be complemented with the most important specific information obtained in the field. All of the above will be used for the assessment of direct damage, indirect losses and macroeconomic effects.

#### b) Description of the affected area and of general damages

Immediately after a disaster occurs, the national authorities responsible for the post-disaster emergency stage usually act very quickly and provide general information on the nature of the phenomenon, the affected area and the magnitude of damage. Sometimes they also carry out quick surveys that help the specialist obtain an overview of the number of industrial establishments damaged or completely destroyed.

Based on a knowledge of the characteristics of the affected geographical area and the availability of primary information either provided by local authorities or collected from other domestic sources, the sectoral specialist –taking into consideration information from the most recent industrial census available and information collected from the sources mentioned above– must ascertain the approximate number of establishments affected; the industries to which they belong; their size, grouped into small, medium, and large, in terms of personnel employed; the employment and value - added each one generates; and the degree of interdependence on the productive activities located within and outside the area. This information will help one perceive any domino effects that might arise owing to the destruction of a given subsector's productive structure.

The sector specialist must then use this information, complemented with periodic assessments usually carried out by ministries and planning offices, to arrive at a quantitative and qualitative estimate of the situation of industrial activity in the immediate aftermath of the disaster. This will be very important for the subsequent estimation of the effects on changes in given macroeconomic variables.

The sectoral specialist, either individually or in cooperation with national authorities, must also conduct an informal survey among owners or managers both of the main industrial establishments and of a representative sampling of small and medium-sized companies, so as to obtain a clearer idea of the magnitude and nature of damage, as well as of the sector's most urgent rehabilitation and reconstruction needs. The survey may include information on companies' production chains that is unlikely to be found in the sources mentioned earlier, as well as the source of inputs and the destination of intermediate or final goods processed by the affected companies.

## 2. Direct damages

As soon as the sector specialist has a general idea of the effects of the disaster on the manufacturing sector in the affected area, he/she must estimate the damage more accurately, beginning with the value of direct damages.

The assessment's final purpose is to define reconstruction programmes containing specific projects and profiles. To that end, the following three types of direct damage must be determined to the fullest possible extent :

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- The value of the assets lost by manufacturing establishments, in their pre-disaster condition (in other words, measured in terms of their depreciated value);
- The replacement cost of lost assets, with the same characteristics as their original design; and
- The cost of reconstruction, including vulnerability-reduction components. The concept of vulnerability refers to the probability that a set of manufacturing establishments exposed to a natural hazard will sustain damage, depending on how fragile their installations are. The magnitude of this damage is directly related to their degree of vulnerability.

The assets considered in this calculation should be grouped by the sector specialist under the headings of buildings and facilities; machinery and equipment; transportation equipment; furniture; stocks of goods under processing; finished goods; raw materials; and spare parts.

The sector specialist must make these estimates in close cooperation with government offices responsible for the sector, as well as with trade groups and producers' associations. The specialist should verify all available official estimates during his/her field visits.

To obtain updated replacement costs for valuing losses of assets, the specialist could adopt internationally valid unit costs, at unit import prices, as well as costs used in development projects that the country's development banks might have in their portfolios and that, whenever possible, are in similar industrial branches and on a similar scale.

When calculating direct damage, the sector specialist should distinguish among establishments of differing sizes. Large establishments are those that employ 200 workers or more; medium - sized establishment employ between 199 and 40 workers; and small establishments employ 39 or fewer workers. Large establishments usually have more accurate accounting records; in this case, estimates should be based to a greater degree on interviews with the executives of such establishments. In the case of small establishments, the weight of fixed assets among total assets is very small, which, together with the precarious nature of the accounting information these establishments have, requires that the specialist carry out rougher, less accurate estimates.

32 Special attention should be paid to those manufacturing enterprises involved in productive processes making goods for re-export, known as in-bond (maquila) enterprises. Some characteristics of such enterprises –such as the fact that they are normally subsidiaries of, or dependent on, international enterprises, that they are normally backed by insurance against damage, that they are labor intensive and that their assets are possibly prone to rapid depreciation– should be taken into consideration for the assessment of disaster-related damages. In any case, the sector specialist should collect as much information as possible on these companies (when affected), ideally obtaining it directly from their executives and defining their corresponding incentives with local authorities.

The main categories into which destroyed or affected assets should be grouped for the purposes of assessing direct damages are presented below.

#### a) Buildings and facilities

Losses under this heading are to be valued at their pre-disaster condition cost (that is, at their depreciated value); at replacement costs with the same characteristics as their original design; and at reconstruction costs including vulnerability-reduction components. This will entail determining the destroyed or damaged surface area, the age of the facility and the current value of a square meter of construction in industrial-type buildings. This last factor generally varies as a function of the enterprise's size, because large enterprises require facilities and constructions of higher quality and complexity than medium-sized and small enterprises because of the machinery and equipment they use and associated technologies.

In each case, a definition must be reached in cooperation with national authorities on the vulnerability-reduction components that should be introduced in the reconstruction process, which will likely increase their cost. Alternatively, such mitigation components might encompass works that are external to and independent of facilities, such as ditches, river protection works, retaining reservoirs and channels. In the first case, there are important elements to be considered in construction-design and land-use regulation. Reconstruction should only be carried out on the basis of a significant qualitative improvement over the previous situation as regards vulnerability to future phenomena.

#### b) Machinery and equipment

Under this heading, it is necessary to determine the corresponding replacement prices for assessing total or partial damage to machinery and equipment. The value of these items as they appear in industrial censuses refers to the value registered in enterprises' accounting records and does not take into consideration accumulated depreciation as a function of the number of years of useful life since acquisition. They also show acquisition prices, except in certain countries with high inflation where a periodic restatement of physical assets is advisable. Such limitations are especially significant in the case of machinery and equipment, where rapid technical change governs the replacement value.

As in the case of buildings and facilities, losses of machinery and equipment in large industrial enterprises must be estimated directly by their executives, in consultation with national authorities. These figures must then be examined and adjusted by the sector specialist to obtain the current value of destroyed equipment, using as a basis the unit values of recent imports.

When assessing direct damage sustained by medium-sized and small establishments, the varied nature of potentially affected industries and the inconsistencies typical of data obtained through direct surveys may require analysts to rely more on census parameters, which must be assessed and updated.

#### c) Furniture and vehicles

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Larger enterprises usually have a proportionally higher stock of these goods, both because their personnel work under better conditions and because they more frequently have such equipment as forklifts and a fleet of vehicles for the transportation of raw materials, intermediate products or finished goods. Intermediate and small enterprises usually outsource these services. For valuating widespread damages sustained under these headings, the analyst may need to obtain updated market values for furniture and vehicles similar to those destroyed or damaged.

If the disaster is deemed to have had a relatively minor impact on this type of fixed assets, indirect estimates should suffice. For example, investments in furniture and equipment are, to a certain extent, proportional to the value of buildings and facilities, although the validity of this relationship depends directly on the size of establishments. It is also necessary to make distinctions between specific industries; for example, the relative importance of vehicle fleets among total assets is greater in the soft drinks and cement industries.

#### d) Stocks or inventories

This heading includes finished goods produced by the company in question; goods being processed; raw materials; and other goods such as spare parts that are not directly related to production. This is one of the headings experiencing the most damage during a disaster because space limitations often mean that warehousing facilities are less protected than those that house machinery and equipment.

The specialist must consider that a portion of stocks might have been imported. Relevant information on large enterprises can be obtained from official sources and from the enterprises themselves. In the case of medium-sized and small enterprises, estimates can be based on the application of the ratio of stock to total fixed assets, which is normally slightly higher for medium-sized companies.

Total losses of fixed assets can be obtained by adding the four previous headings. The imported component of direct losses must be estimated by calculating the foreign currency that would be required to replace the fixed assets and destroyed or damaged stocks. Various sources can be used for this, such as the domestic and imported cost structure of investment projects that might be available from development banks, as well as macroeconomics statistics listing the imported content of gross investment. Finally, a breakdown of damage among private and public enterprises must be made, because different patterns may be followed in reconstruction.

### 3. Indirect losses or effects

34 Damage sustained by industrial establishments located in a disaster area will obviously have a negative effect on production flows because of both the temporary suspension of activities –for as long as the rehabilitation lasts and until the pre-disaster production level is recovered– and relative shortages of inputs caused by the temporary interruption of communications and sales channels.

The increased costs involved in choosing and using alternative (longer) transportation routes must also be added to indirect losses. These and can be especially important for certain sectors where the transportation of goods is a major cost factor, as in the case of the sugar and cement industries.

Losses due to an interruption of exports must be taken into account for the same reason, along with taxes the government stops receiving as a result of the interruption in production and sales. To complete the picture of indirect effects, emergency expenditures made by enterprises must be ascertained, as well.

Local associations of industrial entrepreneurs often carry out surveys aimed at estimating losses due to the suspension of production, whose results must be verified by the specialist by means of interviews with businessmen in the disaster area. In the case of small establishments, and whenever necessary, the specialist can even make calculations of production losses based on worker productivity coefficients obtained from census information or industrial surveys.

Trade associations also have information regarding which enterprises have been affected and which are mainly involved in export activities. The sector specialist must also take into account seasonal factors when calculating this type of damage because the impact on production flows rarely lasts for more than a year, judging by past experience in Latin America and the Caribbean.

For example, estimates of direct damage and indirect losses caused by the floods and mudslides that occurred in the Venezuelan states of Vargas and Miranda in 1999 were based on information provided by EDEINDUSTRIA for small and medium-sized activities and by CONINDUSTRIA for larger ones (Tables 7 and 8).

Table 7

DIRECT AND INDIRECT DAMAGE AND LOSSES SUSTAINED BY THE  
MANUFACTURING AND NON - RETAIL ENTERPRISES IN THE  
STATE VARGAS, VENEZUELA  
(Millions of bolivars)

Type of establishment (units)	Direct damage	Indirect losses	Total damage
Drugstores (57)	1,130	830	1,420
Medical equipment factories	300	300	600
Pasta factories	125	125	250
Ironworks (315)	2,700	1,880	4,580
Bakeries (40)	1,600	1,600	3,200
Clothing workshops (337)	405	400	805
Footwear workshops	625	625	1,250
Mechanical workshops (17)	595	600	1,195
Radio stations and concessionaires (2 and 25, respectively)	395	350	745
Others	725	690	1,415
<b>TOTAL</b>	<b>8,600</b>	<b>7,400</b>	<b>16,000</b>

Source: ECLAC, based on official sources and those available from chambers of commerce.

The volume of non-commercial industrial activities in Vargas, the state most affected by the phenomenon, is rather small, consisting of a less than 800 enterprises. These are small establishments such as ironworks, garment and footwear factories and mechanical workshops. The vast majority of these establishments sustained total losses.

The state of Miranda, on the other hand, incurred significant losses because of the presence of the Guarenas/Guatire industrial complex – which includes such manufactures as plastics, batteries, laboratories, textiles and clothing, and food. Direct damages and indirect losses to the manufacturing sector in the state of Miranda were estimated at 9.360 billion bolivars.

Table 8

ESTIMATED DAMAGE AND LOSSES IN THE MANUFACTURING SECTOR  
(Millions of bolivars)

State	Direct damage	Indirect losses	Total
VARGAS (includes drugstores)	8,600	7,400	16,000
MIRANDA and other affected States:	4,110	1,920	6,030
Car parts	960	400	1,360
Food	830	360	1,190
Metalworking	1,240	560	1,800
Plastics	380	200	580
Laboratories	200	100	300
Other industries	500	300	800
<b>TOTAL</b>	<b>12,710</b>	<b>9,320</b>	<b>22,030</b>

Source: ECLAC, based on official figures and those available from chambers of commerce

#### 4. Macroeconomic effects

This section of the assessment should include background information and quantifications that will enable the macroeconomics specialist to determine the future overall effects of the disaster on the performance of the main macroeconomic variables, such as gross domestic product, balance of payments and public finances.

The industrial sector specialist must try to obtain an overview of the conditions prevailing in the sector before the disaster and of its prospects. These reference points are essential for properly weighing the future consequences of the disaster.

The information directly obtained from the affected productive units will normally be in terms of the gross value of production. This must be converted into value - added units so that the total output for the sector may be estimated. The sectoral specialist must carry out this conversion using coefficients linking one item to the other, which can be obtained from industrial censuses, some statistics and the national accounts themselves.

#### 5. Priorities for recovery and rehabilitation

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The industrial sector assessment should include a list of priority actions that affected business owners want the government to undertake to facilitate recovery. When conducting surveys of affected industrialists, industrial chambers and associations, ask for opinions on the immediate support that the sector needs for rehabilitation, both from the public sector and from abroad. Ideally, these proposals should be presented in the form of project ideas or proposals.

### C. THE COMMERCIAL SECTOR

#### 1. General considerations

Only a brief methodological description for the assessment of the effects of a disaster on commercial activities will be presented in view of the considerable overlap with the industrial sector. However, some features of the sector are different from those of the industrial sector. Whereas commercial establishments are relatively smaller than industrial concerns on the level of personnel employed and the relative weight of machinery and equipment to personnel and to total physical assets, the opposite is true on the level of inventories.

The trend in the industrial sector toward an expansion of larger establishments to the detriment of smaller ones is even more evident in the commercial sector because of the special proliferation of supermarkets. Their rise has affected medium-sized businesses more than small ones, which have a greater chance of survival because they normally serve remote urban or rural areas.

On the other hand, information on the commerce sector is generally scarcer and less reliable than that available for industry, so the sector specialist must rely comparatively more on the opinion and judgment of the trade and professional associations of the country or region under study. For example, practically no country in Latin America has time series on the level of commercial activities, except in the case of GDP estimates, which are very broad and indirect.

In this subsection of the manual, we only make detailed references to the methodology and sources of information used when they differ from those previously described for the industrial sector.

## 2. Description of the affected area

Rough estimates must be obtained for the number of commercial establishments destroyed or damaged, grouped by size and type (such as supermarkets, grocery stores, fresh produce stands, footwear shops, general stores, gas stations and spare parts stores). These estimates should be based on information collected by national authorities in order to identify the area affected by the disaster.

Use of pre- and post-disaster digital aerial photographs can be extremely useful for defining the affected area and to obtaining an overview of damages sustained.

## 3. Direct damages

The information available on commerce is usually so limited that detailed estimates cannot be made of the various headings under which one might otherwise list enterprises' fixed assets. Therefore, direct damage should only be broken down into three categories: buildings and facilities; furniture and office machinery; and stocks.

### a) Buildings and facilities

To calculate this component, it is necessary to determine the affected surface area, whether the damage is total or partial and the replacement value as a function of the cost per square meter of construction. The latter should be adjusted to include the cost of demolition and of vulnerability-reduction components.

According to past experience, the surface area of small stores normally ranges between 50 and 500 square meters and averages around 100. These figures vary in the case of fruit stores or stalls in public markets, for example, which require approximately 12 square meters. Service stations and spare parts stores have an average of 500 and supermarkets require 1 500. The cost per square meter of the most solid constructions, such as service stations and spare parts stores, can be seven times greater than those of food stores or public markets.

### b) Furniture and equipment

This component usually has relatively less weight within total fixed commercial assets than in the industrial sector, so there is no reason for the sectoral specialist to conduct an exhaustive valuation study. In past assessments, estimates stated the value of furniture and equipment as a percentage of that of buildings and facilities; the best figure seems to be 20% for small businesses and 40% for all others.

### c) Stocks

The inventories of commercial establishments have a higher relative weight in total assets because these businesses are intermediaries between producers and consumers. Surveys have shown that for this specific case, stocks are usually equivalent to a maximum of two months' sales in the small-scale commercial sector. The sector specialist should compare this information to local conditions.

Furthermore, a more or less stable relationship of one to two has been observed between the value of buildings and facilities and that of stocks. This may be a function of the physical storage capacity of the facilities, although it does vary somewhat depending on the branch of commerce. Once again, the sector specialist must corroborate the local applicability of such average figures.

#### 4. Indirect losses or effects

38 Since commerce is an activity whose main function is the provision of services, production losses incurred during the interruption of activities should be estimated not on the basis of the amount of sales not made (it is not a question of goods that could not be produced, as in the case of industry), but on the basis of profits not made. In turn, these effects should be given as value - added. Therefore, an estimate should be made of the income (or product) generated on average by each worker (vendor or owner), broken down into small, medium-sized, or large commercial establishments. Based on annual sales, an estimate may be made of losses for one or several months' of interrupted activities.

Experience shows that with proper official support, small commercial establishments can restart activities in a month, while other establishments can do so in a period that rarely exceeds six months after a disaster has occurred.

Even when the trade sector of a country is not directly affected by the disaster, its activities may be affected to varying degrees if other productive activities with which they have intermediation ties or chains have experienced damage.

Summarized information on direct damage and indirect losses caused by the floods and mudflows that affected several states in Venezuela in 1999 is provided in Table 9. The trade sector in the country had considerably diminished its output in 1999 (by around 18%), a situation exacerbated by the disaster.<sup>2</sup> Losses were estimated for the affected coastal area (mainly for the states of Vargas, Miranda and Falcón), and attention was paid to what happened in the capital and other states, where the effects were less severe. Effects in the first of the states mentioned, however, accounted for most of the damage. The coastal area's high dependence on tourism-related commerce meant that its recovery was almost completely dependent on tourism's recovery. This explains the high weight of indirect losses in the estimation of total damages.

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<sup>2</sup> Consecomercio, *Basic Economic Policies to Stimulate Internal Demand*, Venezuela, 1999.

Most of the data came from the National Commerce and Services Council (Consejo Nacional de Comercio y Servicios – Consecomercio), the La Guaira Chamber of Commerce and the specialist's own estimates carried out in the field.

It was estimated that slightly over 6 000 establishments operating in the area were affected, including large and medium-sized supermarkets, formal and informal commercial establishments covering a wide range of commercial and services activities, and over 500 customs brokers. The effects on the restaurant and recreational club facilities were dealt with separately because of their large impact in the area analyzed. In most of the cases included, damage was severe and often implied total loss of stock and facilities.

Table 9

ESTIMATED DAMAGE AND LOSSES TO THE TRADE AND SERVICES SECTOR  
(Millions of bolivars)

Area and type of trade	Direct damage	Indirect losses	Total damages
<b>State of Vargas</b>			
<b>Supermarkets and similar</b>	<b>53,950</b>	<b>10,790</b>	<b>64,740</b>
Caraballeda (7)	4,550	910	5,460
Carayaca (5)	3,250	650	3,900
Catia la Mar (27)	17,550	3,510	21,060
Macuto (5)	3,250	650	3,900
Naiguata (2)	1,300	260	3,900
La Guaira (19)	12,350	2,470	14,820
Maiquetia (18)	11,700	2,340	14,040
<b>Other medium-sized commercial establishments (a)</b>	<b>132,000</b>	<b>33,000</b>	<b>164,000</b>
<b>Micro commerce (b)</b>	<b>15,000</b>	<b>3,000</b>	<b>18,000</b>
<b>Bank branches (44)</b>	<b>6,600</b>	<b>2,200</b>	<b>8,800</b>
<b>State of Miranda</b>			
2 Supermarkets and 55 goods and services businesses	3,050	1,340	4,390
<b>State of Falcon ( c )</b>	<b>3,000</b>	<b>1,500</b>	<b>4,500</b>
<b>States of Sucre, Táchira, Yaracuy, and Zulia (d)</b>	<b>5,100</b>	<b>2,400</b>	<b>7,500</b>
<b>GRAND TOTAL</b>	<b>218,800</b>	<b>54,280</b>	<b>265,580</b>

Source: ECLAC, based on official figures and those available from chambers of commerce.  
(a) Approximately 3,000 formal commercial establishments with direct losses of 48 million bolivars each.  
(b) Estimated at 3,000 premises or "Small stores" with average stocks of five million bolivars each.  
(c) Simply estimated.  
(d) Estimated losses based on the data for states of Miranda and Falcon, considering half the losses per inhabitant for damage to commercial establishments, coefficients applied to the population of the four states mentioned in the table.

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## 5. Macroeconomic effects

Under this heading, the sector specialist must estimate the effects of damage and losses sustained by affected commercial establishments on local (if this information is available) and national GDP.

Disasters affect a countries' development because of their economic ramifications, which are inversely proportional to the country's economic diversification and disaster vulnerability.

As noted in the example of the assessment of direct damage and indirect losses in Venezuela, the central coastal area had a huge number of restaurants, recreational clubs, hotels, condominiums and homes, in addition to well-developed commercial and service infrastructure, all of which were destroyed to a sizable degree. A summary of all damages to non-agricultural productive sectors is presented below (Table 10).

Table 10  
SUMMARY OF DIRECT DAMAGE AND INDIRECT LOSSES SUSTAINED BY  
NON-AGRICULTURAL PRODUCTIVE SECTORS

Activity	Direct damage	Indirect losses	Total damages	Imported component (mill. of dollars)
	(Millions of bolivars)			
Trade and services	218,800	54,280	273,080	426.7
Manufacturing industry	12,710	9,320	273,080	34.4
Construction enterprises	640	640	1,280	2.0
Tourism	124,150	66,120	190,270	297.3
<b>TOTAL</b>	<b>356,300</b>	<b>66,120</b>	<b>486,660</b>	<b>760.4</b>

Source: ECLAC, based on official figures and those available from chambers of commerce

## D. OTHER RELATED SUBJECTS

### 1. Employment and income

The cross-sectoral nature of loss of employment and income by workers and their families due to the temporary paralysis of productive activities after a disaster has been previously noted. The trade and industry sectors are no exception to this rule; indeed, some of their subsectors or activities can have a heavy negative impact on employment and family income.

40 The existing relation between the output of different goods and the associated labor requirements may be determined and then applied to estimate losses of employment and income. The figures required for such estimates are normally available from labor, industry and trade ministries.

The chapter on employment and income in Volume Four of this Handbook provides details on the methodology to be used in all sectors that might be affected by a disaster. To that effect, the trade and industry specialist must work in close coordination with the specialist on employment when making such estimates. Likewise, the same type of cooperation must exist with the gender specialist when breaking down employment and income lost by women.

### 2. The differential impact on women

A description of how women are affected differently by disasters and the methodology for estimating this differential impact are included in the appropriate chapter of Section Five of this handbook. Each sectoral specialist is reminded to work in close cooperation with the gender specialist in this regard. Both direct and indirect damage must be estimated for women in the trade and industry sectors.

A breakdown is needed of women's private - sector assets that were damaged or destroyed by the disaster in question. Information on women's share in the ownership of industrial and commercial establishments is usually available in public statistics. Information derived from any surveys or samplings carried out to ascertain the effects on women can also be used. Once again, estimates should be broken down into large, medium-sized, small, and micro industrial and commercial enterprises. Women generally own a large share of micro and small enterprises, both in the industrial and commercial sectors.

Women often operate micro and small enterprises out of their homes to increase and supplement family income. These production activities are not always duly considered in the system of national accounts, nor can they be identified in quick surveys carried out by the trade and industry specialist because these women-run enterprises are not necessarily members of trade associations. Therefore, it is necessary to estimate damage to women-owned assets and production as a percentage of the total for formal micro and small enterprises. These damages will be over and above those estimated by the trade and industry specialist.

The gender specialist will normally carry out a quick survey among affected women to obtain figures on losses of assets and production in these types of home-based micro and small enterprises. The results of this survey must be compared with the rough estimates described in the paragraph above.

Information that must be obtained by the trade and industry specialist in close cooperation and support with the gender specialist for estimating losses caused by the disaster, is described below.

In regard to direct damages, the following information must be estimated or determined by means of quick surveys or samplings:

- Losses of assets (infrastructure, machinery and equipment and stocks) in private industrial and commercial establishments, broken down into large; medium-sized, small and micro enterprises, that belong to women; and
- Losses of assets (machinery and equipment and stocks) of family micro enterprises run by women in their homes.

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with regard to indirect losses, the following information must be obtained through estimates or samplings:

- Losses of production in formal private enterprises –large, medium-sized, small and micro enterprises– owned by women; and
- Losses of production in informal, home-based enterprises run by women in their homes.

### 3. Environmental impacts

One of the very frequent effects of a disaster is the uncontrolled release of toxic substances to the environment (both to the air as toxic clouds and to the ground and bodies of water ).These effects are usually related to the industry and energy sectors. They are generally caused by anthropogenic activity and are considered a disaster in themselves, although they may also be a consequence of natural phenomena such as earthquakes and floods.

The environmental consequences caused by these events are quite varied and depend on the magnitude, location and type of disaster. Sometimes it will be difficult to identify the environmental impact, especially for the short term.<sup>3</sup> Consequences of these damages can reach, directly or through “chain-link” effects, assets and flows of goods and services in several sectors.

In general, these direct damages and indirect losses are accounted for in the respective sectors. The environmental assessment specialist should work in close coordination with other members of the assessment team to ensure that these damages are duly accounted for, especially those expenses required to restore the environment. In some cases, natural areas are affected by these events; the environmental specialist will likely estimate such damages.<sup>4</sup> The preferred method to assess these damages is the restoration cost method (as described in Volume Four).

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<sup>3</sup> In some cases, the interaction of certain substances with the environment is not sufficiently known, involving effects that may only occur in the very long term. In the case of floods, for example, in spite of the fact that dilution capacity of substances in water bodies increases significantly, containers of toxic substances are carried away and their contents may be released later.

<sup>4</sup> Regardless of whether the sectoral specialist estimated direct and indirect damages, restoration measures may fall under the jurisdiction of institutions not directly related to the sector. In such a case, especially when environmental authorities must decide what solutions to adopt, it is likely that these expenses will not have been accounted for in the sector.