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1818 H Street NW  
Room MC5-701  
Washington, DC 20433

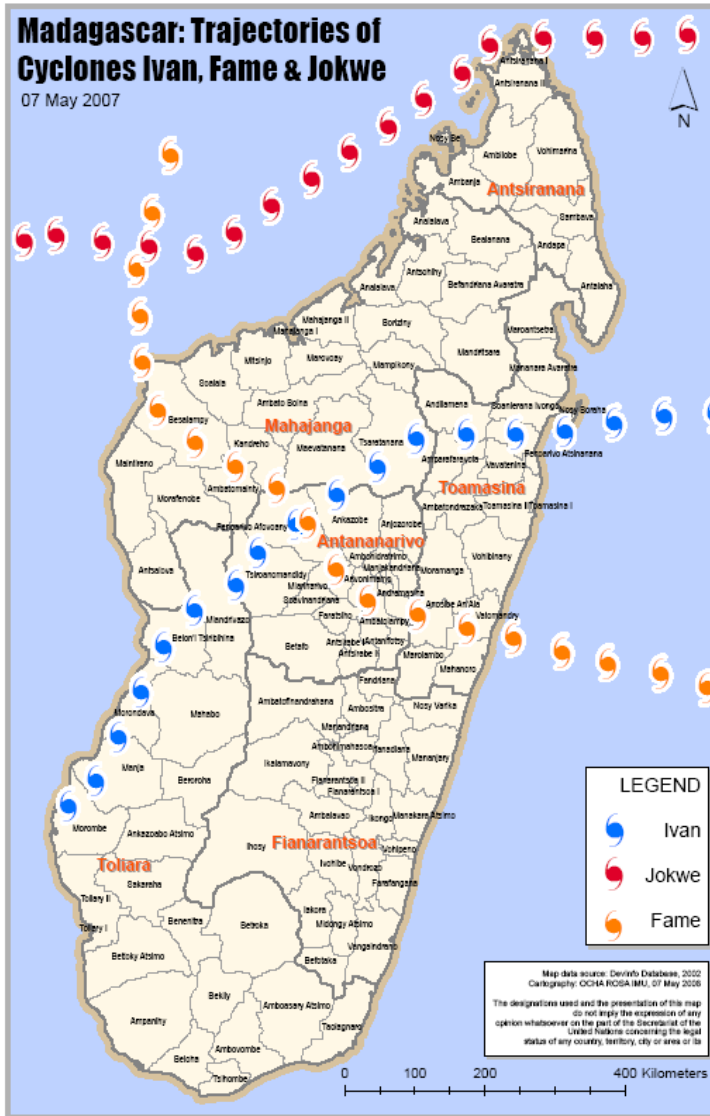
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**ESTIMATION OF DAMAGE AND LOSSES  
IN INDUSTRY AND COMMERCE,  
2008 CYCLONE SEASON IN MADAGASCAR**

**Exercise prepared by International Consultant J.Roberto Jovel, for use in training workshops on damage and loss assessment after disasters.**

## DESCRIPTION OF CASE STUDY

In the first few months of 2008, three consecutive cyclones struck Madagascar affecting 17 of 22 regions. The paths of Fame and Ivan crossed in the central plain around the capital of Antananarivo, while Jokwe grazed the northern tip of the island. These cyclones were accompanied by heavy rainfall, especially in the northeast and northwest.



These category three and four storms caused extensive physical destruction to infrastructure, and affected the livelihoods of an already struggling population.

Madagascar remains a country that is extremely vulnerable to natural disasters, and this problem stands to be exacerbated by issues of climate change in the future.

The conjunction of these events affected 342,000 people out of a total population estimated in 2008 at over 19 million. Among those affected, 191,404 lost their homes and over 100 people died.

In the wake of the disasters, the Government of Madagascar, together with an international team of experts, undertook a comprehensive damage and loss and needs assessment to ascertain the extent of the damages caused by the storms, and to define a comprehensive and feasible recovery plan.

The estimated total damage and losses caused by the cyclones to be Malagasy Ariary (Ar.) 549.4 billion (US\$ 333.0 million). Table 1 presents an overall summary of the damage and losses broken down by sector.

Table 1: Overall Summary of Damage and Losses (Ar. Millions and USD million)

## **DISASTER EFFECTS ON INDUSTRY AND COMMERCE**

The winds and rain of the cyclones and the subsequent flooding caused extensive damage in the industrial and commerce sectors of the affected Districts in the country. The strong winds usually destroyed roofs and windows of the shops. Rainfall entering through the broken roofs and through windows caused damage to the furniture, machinery and equipment, as well as destruction of inputs and goods stored within the affected buildings. Floodwaters that entered subsequently into the buildings further destroyed the contents in the shops.

Affected were micro-enterprises that are usually run from homes, as well as small to large industries and shops having separate facilities.

In addition to such damage to physical assets, production and sales were affected negatively as well. In fact, electricity supply was suspended for different time periods, due to the damage sustained by the transmission and distribution systems. Furthermore, in some cases, production and sales would not be re-initiated until the damage to sector facilities could be repaired, and until input flows could be re-established. In the commerce or trade sector, resumption of sales could be achieved sooner than in the case of industry, since the stocks and buildings could be repaired more promptly. In the industrial sector, machinery repairs or replacement usually took longer.

The assessment team took into consideration the fact that there exist hundreds if not thousands of individual industries and commerce shops, and the impossibility of visiting and assessing damage for each. While the field visit enabled to visit many of the affected shops for the estimation of damage and losses, a private enterprise was engaged in order to carry out a sample survey that would provide a relatively wide sample of factories and shops. The sample survey provided data on the extent and estimated value of damage to buildings, machinery, furniture and stocks, as well as details as to the period of stoppage of production and sales and the resulting losses.

The sample survey data and the information collected by the assessment team was used to extrapolate the damage and loss estimations to the entire affected areas, using as a basis data from the most recent industry and commerce survey for the country, provided by the Statistical Institute, and also a detailed survey of damage to housing conducted by the government. The report of the INSTAT provides information on the number of industrial and commerce shops existing in all districts of the country, as well as data on the average monthly turnover of production and sales. The survey of damage and destruction of housing units provided an overall picture and structure of damage that was applied to the industry and commerce sector as well.

The exercise to be carried out requires the estimation of the value of damage in the industry and commerce sectors, as well as the losses in production, in the affected districts.

### **AVAILABLE INFORMATION**

Data on the number of existing industries and commercial shops and their monthly average production and sales were provided by INSTAT, as shown in the following table.

Table 2  
Number of Industries and Commerces, by Size, and Average Monthly Turnover

District	Existing Number of Industries			Existing Number of Commerce			Average monthly sales per Shop, million Ariary		
	Micro	SME	Large	Micro	SME	Large	Micro	SME	Large
Melaky	64	2	3	644	13	2	0.357	1.491	212.630
Analanjirifo	476	11	1	4,817	55	0	1.005	7.128	139.935
Diana	1,304	56	7	13,182	297	6	0.537	10.010	28.034
Amoron	118	4	1	1,189	18	0	0.355	21.265	76.055
Vato	436	91	2	4,403	480	1	0.370	8.484	239.212
Alaoatra	607	10	0	6,136	53	0	0.720	64.323	0.000
Arsinana	962	91	9	9,728	480	8	0.791	84.857	322.011
Atsimo	61	2	0	612	13	0	0.735	3.047	0.000
Haute	599	36	0	6,053	192	0	0.416	8.664	0.000
Atsimo	443	46	1	4,481	239	0	1.897	8.953	19.994
Boeny	500	66	3	5,055	348	2	0.587	14.814	446.515
Sofia	280	50	0	2,832	264	0	0.251	1.594	0.000
Ihorombe	52	4	0	527	23	0	0.212	5.252	0.000
Menabe	180	2	0	1,822	8	0	0.617	219.855	0.000
Bongolava	124	1	0	1,254	3	0	0.722	5.000	0.000
Anamalanga	10,352	702	175	104,675	3,684	156	1.286	48.820	393.685
Betsiboka	74	6	0	753	30	0	0.286	4.247	0.000
<b>Total</b>	<b>16,632</b>	<b>1,180</b>	<b>202</b>	<b>168,163</b>	<b>6,200</b>	<b>175</b>	<b>11.144</b>	<b>517.804</b>	<b>1,878.100</b>

Source: Statistical Institute

Information obtained through the special sample survey for the two sectors yielded the average values for damage and for losses included in the following two tables.

Table 3  
Average Value of Damage in Industry and Commerce Shops

Damage Component	Damage, million Ariary			
	Industries	Commerce		
		Micro	SME	Large
Buildings	1.30	0.15	0.15	0.15
Machinery and Equipment	2.20			
Stocks	2.50	0.06	0.12	1.00

Table 4  
Average Value of Losses in Production and Sales in  
Industry and Commerce Establishments

Sector	Average Losses in Production/Sales	
	Period of Stoppage	Monthly Output Reduction, %
Industries	4 Weeks	50
Commerce	4 Weeks	25

Information from the survey conducted by the Housing Sector assessment team, combined with data from the most recent household survey, provides data for the destruction caused by the cyclones, and is included in the following table.

Table 5  
Destruction of Housing Units by Type of Construction Materials

District	Total Number of Houses	Units Destroyed		Destruction Factor	
		Local Materials	Durable Materials	Local Material	Durable Material
Melaky	38,437	386		0.0100	0.0000
Analanjirofo	189,678	99,575	4,230	0.5250	0.0223
Diana	105,411	664	70	0.0063	0.0007
Amoron	153,838			0.0000	0.0000
Vato	243,667	1,861	42	0.0076	0.0002
Alaotra	193,413	1,029	15	0.0053	0.0001
Arsinana	246,092	15,517	8,245	0.0631	0.0335
Atsimo	137,916	985	104	0.0071	0.0008
Haute	250,566	2,898	9	0.0116	0.0000
Atsimo	221,894			0.0000	0.0000
Boeny	118,964	438	37	0.0037	0.0003
Sofia	206,006	1,355	139	0.0066	0.0007
Ihorombe	42,029	3		0.0001	0.0000
Menabe	85,150	142	21	0.0017	0.0002
Bongolava	71,036			0.0000	0.0000
Anamalanga	531,485	499	200	0.0009	0.0004
Betsiboka	51,768			0.0000	0.0000
<b>Total</b>	<b>2,887,350</b>	<b>125,352</b>	<b>13,112</b>	<b>0.0434</b>	<b>0.0045</b>

## **SUGGESTED STEP-WISE PROCEDURE FOR ASSESSMENT OF DAMAGE AND LOSSES**

The following steps are suggested for the estimation of damage and losses in this exercise:

1. Estimate number of affected establishments, for the two sectors, breaking it down by micro, small to medium and large sizes
  - Obtain destruction rates from housing sector assessment data and apply as required to micro, SME and large establishments, as follows:
    - i. For micro enterprises, destruction rate from local-material houses
    - ii. For SMES and large enterprises, destruction rate for durable-material units
  - Combine with number of shops of each size and type taken from INSTAT data
  - Obtain number of affected shops for each sector and each size and type of establishment
2. Estimate value of damage for each sector, with breakdown by size of establishment
  - Using number of affected shops obtained under step 1
  - Multiply by average value of damage to buildings, machinery, stocks obtained in sample survey
  - Obtain value of damage for each sector, by type and size of shop
3. Estimate value of losses for each sector, with breakdown by size of establishment
  - Using number of affected shops obtained in step 1
  - Multiply by value of average losses estimated by combining period of stoppage obtained from sample survey and the value of average monthly output/sales per type and size of establishment taken from INSTAT data
  - Obtain value of losses for each sector, by type and size of shop
4. Estimate total values of damage and losses for each sector, by combining the estimates from steps 2 and 3, with breakdown by type and size of establishment.