सत्यमेव जयते

MANUAL

POST DISASTER NEEDS ASSESSMENT INDIA

(VOLUME - II)

nidm

Resilient India - Disaster free India

National Institute of Disaster Management (NIDM)
(Ministry of Home Affairs, Government of India)

सत्यमेव जयते

MANUAL

POST DISASTER NEEDS ASSESSMENT INDIA

(Volume - II)

Resilient India - Disaster free India

National Institute of Disaster Management (NIDM)
(Ministry of Home Affairs, Government of India)
A-wing, 4th Floor, NDCC-II Building, Jai Singh Road, New Delhi -110001
Website : www.nidm.gov.in

MANUAL
POST DISASTER NEEDS ASSESSMENT INDIA
(Volume - II)

ISBN 978-93-82571-29-2

Co-ordinated by

Prof. Santosh Kumar
Shekher Chaturvedi

Published by

National Institute of Disaster Management, Ministry of Home Affairs,
New Delhi - 110 001

Disclaimer

We welcome receiving information and suggestions on its adaptation or use in actual training situations. The content of this document are solely those of the author(s).

The document can be downloaded from https://www.nidm.gov.in

Design and Printing

Kam Photo Types : 5/56-57, Old Rajinder Nagar, Shanker Road,
New Delhi - 110060, Ph.: 011 25851765, 25852810 M: 9811013290

नित्यानन्द राय
NITYANAND RAI

सत्यमेव जयते

गृह राज्य मंत्री
भारत सरकार
नार्थ ब्लाक, नई दिल्ली–110001
MINISTER OF STATE FOR HOME AFFAIRS
GOVERNMENT OF INDIA
NORTH BLOCK,
NEW DELHI - 110001

संदेश

मुझे यह जानकर अत्यंत हर्ष हो रहा है कि राष्ट्रीय आपदा प्रबंधन संस्थान, गृह मंत्रालय ने आपदा से हुए नुकसान का वैज्ञानिक तरीकों से आकलन सम्बन्धी अंतर्राष्ट्रीय स्तर का साधन विकसित किया है।

भारत विश्व में प्राकृतिक आपदाओं से सबसे अधिक प्रभावित होने वाले देशों में से एक है। हमारी भौगोलिक स्थिति कुछ इस प्रकार की है कि आपदाओं का प्रकोप और इसका प्रभाव तीव्र एवं अत्याधिक होता है। हमारे देश में आपदा के पश्चात इससे होने वाले नुकसान का आकलन पारम्परिक तरीके से होता रहा है। इसका सही आकलन वैज्ञानिक तरीके से होना चाहिए।

माननीय प्रधानमंत्री, श्री नरेन्द्र मोदी जी ने एशियन मंत्रीगण सम्मेलन में आपदा प्रबंधन को वैज्ञानिक आधार पर करने हेतु 10 बिंदुओं को चिन्हित किया। अभी हाल ही में राष्ट्रीय आपदा विमोचन दल द्वारा आयोजित कार्यशाला में माननीय गृह मंत्री, श्री अमित शाह जी, ने उन्हें दोहराते हुए सभी प्रतिभागियों से उसे सुनिश्चित करने तथा इन नीतियों पर कार्य करने को कहा।

मुझे विश्वास है कि वर्तमान प्रकाशन, जो चार भागों में प्रकाशित हो रहा है, का लाभ प्रत्येक राज्य और केंद्र के मंत्रालयों को मिल सकेगा। इस प्रकाशन को आकलन हेतु संदर्भ स्वरूप प्रयोग में लाया जा सकता है। वर्तमान में देश के कुछ राज्यों में इस विधि को आपदा के पश्चात होने वाले प्रभावों का आकलन किया है और इसके आधार पर दीर्घकालीन पुनर्निमाण की नीति विकसित करके आगे बढ़े है। इस ओर राष्ट्रीय प्रबंध संस्थान का यह प्रयास सराहनीय है।

मै एक बार पुन: इस अतंराष्ट्रीय स्तर का कार्य करने हेतु राष्ट्रीय आपदा प्रबंधन संस्थान को हार्दिक बधाई देता हूँ।

दिनांक : 16 सितम्बर, 2019
स्थान : नई दिल्ली।

(नित्यानन्द राय)

Office Tel.: 011-23092870, 23092595, Fax No.: 011-23094896

कमल किशोर
सदस्य

Kamal Kishore
Member

सत्यमेव जयते

राष्ट्रीय आपदा प्रबंधन प्राधिकरण
National Disaster Management Authority
भारत सरकार
Government of India
एन.डी.एम.ए. भवन
ए–1, सफदरजंग एन्कलेव, नई दिल्ली–110 029
NDMA Bhawan
A-1, Safdarjung Enclave, New Delhi - 110 029

3rd September, 2019

Message

Over the last twenty years, the practice of post-disaster recovery has undergone significant transformation. This change is characterized by three features: first, there is much greater focus on multi-sectoral, comprehensive recovery; second, there is much greater focus on "building back better," not only in physical terms but also in terms of better socio-economic conditions; and third, there is much greater focus on recovery outcomes rather than on inputs. For example, in the education sector, we measure success in terms of enabling access to a safe and healthy learning environment as opposed to the number of classrooms built.

This transformation in the practice of post-disaster recovery is underpinned by the development of post-disaster assessment methodologies. We have come a long way from assessing only the damages and losses from disasters to assessing the needs of the affected communities. In this context, I congratulate NIDM in systematizing the practice of post-disaster assessments in the form of this volume. This is an important contribution to the practice of disaster risk assessment and ultimately post-disaster recovery.

I am sure this will go a long way in meeting the needs of multiple stakeholders – local governments, non-governmental organizations, academic institutions – who are supporting post-disaster recovery in the country.

Kamal Kishore

Resilient India - Disaster free India

Maj Gen Manoj Kumar Bindal
VSM

Executive Director

सत्यमेव जयते

राष्ट्रीय आपदा प्रबंधन संस्थान
(गृह मंत्रालय, भारत सरकार)

National Institute of Disaster Management
Ministry of Home Affairs, Govt. of India
A-Wing, 4th Floor, NDCC-II, Jai Singh Road, New Delhi - 110001

Foreword

Disaster disrupts development and the dividends of development get seized. For regaining the growth gaps, created due to disasters, long term recovery becomes the only choice. In the light of understanding the disaster impact on economy Post Disaster Need Assessment is required to be done. PDNA also facilitates in understanding the impact of disaster in terms of direct and indirect loss. In resource gap scenario, PNDA is a good tool to be adopted by the states.

National Institute of Disaster Management has developed PDNA tool customized to Indian conditions under the National Cyclone Risk Mitigation Project of Government of India which was implemented by National Disaster Management Authority and funded by The World Bank. I would like to mention that it's a very pragmatic and easy to use tool. NIDM has also developed a user manual and professional development Modules for using the PNDA tool.

This is going to be the new beginning in the area of disaster management impact assessment for understanding the real impact of disaster event holistically. It will not be an exaggeration in saying that this process would help in setting new era of development environment of the disaster affected states in the post disaster scenario and in development planning by the sector.

I complement Prof. Santosh Kumar and Shri Shekher Chaturvedi, NIDM and other team members who have facilitated the process.

MKBindal

Manoj Kumar Bindal

Acknowledgement

Indian states are submitting their memorandum of loss assessment in the post disaster scenario. The assessments are done with a conventional tool while applying across the sectors. The memorandum of the states are based on the direct loss basis which is largely calculated on the replacement cost basis on current price. The memorandum does not cover the indirect loss i.e loss in flow or revenue loss basis (indirect cost). NIDM has completed the tools for calculating indirect loss, opportunity cost loss and its impact on the macro economy of the affected state. The current tool is an improvisation on the international tool initially developed by UNECLAC (United Nation Economic Commission of Latin American Countries). It has been customized to Indian system and procedure and been made easy to use by the officials at the local levels. The study was proposed by NIDM to National Disaster Management Authority and subsequently examined and proposed by NDMA to DM Division of MHA and the World Bank for its approval and the funding support. The World Bank funded the study and NIDM hired the services of Asian Disaster Preparedness, Bangkok. I got the opportunity of leading and coordinating the study and Shri P. G. Dhar Chakrabarti, the then Executive Director of NIDM guided the team extensively. I am also grateful to subsequent executive directors of NIDM Dr. Satendra, Mr. Bipin Mallick, Mr. Sanjeev Jindal, Mr. B. H. Anil Kumar, Ms. Rajini Sekhari Sibal and Maj. Gen. Manoj Kumar Bindal for continuously supporting for its implementation and its institutionalization.

NIDM acknowledges the support by all the former members of NDMA – Gen. N. C. Vij, Vice Chairman, NDMA, Mr. K. M. Singh, Mr. Vinod C. Menon, Mr. V. K. Duggal, for approving the proposal. We extend our thanks to Shri Bramha, the then Additional Secretary of NDMA. NIDM also acknowledges the support provided by Shri S. Vasudeva, Ms. Mamta Kundra, Mr. Pradeep Kumar, Shri Pradhan and Shri S. S. Jain. NIDM also acknowledges the support of Shri R. K. Jain, Shri Kamal Kishore, Gen. N. C. Marwah and Shri D. N. Sharma members of NDMA.

NIDM also acknowledges the support and guidance provided by Ministry of Home Affairs especially Shri R. K. Singh, the then Union Home Secretary and subsequent home secretaries Mr. L. C. Goyal, Mr. Rajiv Goswami Mr. Rajiv Mahrishi. NIDM also acknowledges Mr. Rajiv Guaba for his support.

NIDM is thankful to the team of The World Bank Shri Saurabh Dani, Shri Deepak Singh, and Shri Anup Karanth for their continued support in the completion of the study.

Mr. Aslam Parvez, ADPC, and his team members who were engaged for the study and contributed.

NIDM acknowledges Dr. K. J. Ananda Kumar, Capt. Vandana Srivastava, Ms. Rubal Saroha, Mr. Shekher Chaturvedi, Ms. Priyanka Chowdhary, Shri Priyank Jindal and Mr. Rajesh Kumar Singh who supported for the completion process of the study. NIDM extends thanks to our Secretarial support from Ms. Rani Dhakad, Mr. Ramesh Kumar, and Mr. S. S. Bisht, Mr. A. K. Pandey, Shri Santosh K. Tiwari, Shri Rajiv Kumar and administrative support staff. NIDM also acknowledges support of state governments for supporting the endeavor of NIDM.

NIDM acknowledges the support and suggestions provided by Members of Technical Steering committee Mr. M. P. Sethy, Mr. Govindrajan, Mr. T. N. Gupta.

CONTENTS

4

Standard Sector Assessment Procedures

Agriculture, Livestock, Fisheries and Forestry Sector

This section contains the following contents – specific to this sector – in order to guide the user to successfully conduct post-disaster needs assessment in India:

1. **The Introduction to the Sector**
   a. Baseline Information
   b. Post-disaster Situation and Performance
   c. Estimation of Disaster Effects
   d. Estimation of Disaster Impact
   e. Estimation of Post-Disaster Recovery and Reconstruction Requirements
2. **The Standard Procedure for the Sector Assessment**
   a. Recommended Assessment Team
   b. Steps in conducting a PDNA in the agriculture, livestock, fisheries and forestry sector
      - Collect baseline information on sector assets and production flows
      - Estimate value of damage and production flow changes
      - Analyze the impacts of the damages and losses to affected population
      - Identify the recovery strategies and estimate recovery and reconstruction needs
      - Draft the post-disaster damages, losses and needs (PDNA) report of the sector

The user is advised to refer to:

a. *The "Introduction of the PDNA Manual" for a complete information of the concepts and definitions on the post-disaster needs assessment (PDNA);*
b. *The section on "Disaster Effects, Impact Assessment, Needs Estimation" for a more detailed discussion in identifying the possible impacts within and across sectors; and*
c. *The section on "Estimation of Post-Disaster Recovery and Reconstruction Needs" for a more detailed discussion on identifying and prioritizing post-disaster needs.*

Introduction

Almost 60% of the population in India (about 70 crore) lives in the rural areas and depends on agriculture for their livelihood. India has one of the largest agricultural sectors in the world. The purpose of this section is to provide an overview of the status and performance as well as vulnerabilities of the agricultural sector in India. The original agricultural statistics reported in this paper draws heavily from the State of Indian Agriculture, 2011/12 and 2012/13 by the Ministry of Agriculture (Government of India, 2013 and 2014).

The agricultural sector[1] accounts for about 14% of GDP, 10% of exports and 50% of the work force (employment). About 30% of the population is below the poverty level and almost 75% of all the poor in India are in the agricultural sector. Agriculture growth is 2-3 times more effective in reducing poverty than growth in the non-agriculture sectors. On an average, food accounts for about 50% of the household expenditure. Clearly, agricultural sector is critical to promote economic growth, enhance food security, improve nutrition, increase employment, enhance household farm income and reduce rural poverty in India. The annual average growth target for the 12th Five Year Plan (2012-17) is 8% for GDP and 4% for agriculture.

However, as per the development experience around the world, the relative contribution of the agricultural sector in India's GDP has declined over time from almost 52% in 1950/51 to 14.5% in 2010/11 (see Table 1).

Table 1. Percent Share of Agriculture in GDP over Time in India

Year	% Share of Agriculture in GDP
1950/51	51.9
1960/61	47.6
1970/71	41.7
1980/81	35.7
1990/91	29.5
2000/01	22.3
2010/11	14.5

The declining share does not mean that the role of the agricultural sector in absolute terms has declined. This only means that the industry and service sectors have been growing faster over time than agriculture. The share of agriculture is composed of four sub-sectors: crops, livestock, fisheries and forestry. The relative share of all the sub-sectors has also declined over time. However, crops and livestock agriculture sub-sectors account for almost 85% of the total share of agriculture in GDP. The composition of agricultural output over time is given in Table 2.

[1]According to the India System of National Accounts, this sector falls under *"Agriculture, forestry and fisheries"*.

Table 2. Composition of Agricultural Output (%)

Sub-sector	Crops	Triennium ending 1990/91 (%)	Triennium ending 2009/10 (%)
Crops		65	61
	Cereals	23	18
	Pulses	4	3
	Oil seeds	7	6
	Sugar	4	4
	Fiber	2	3
	Other Crops	9	7
	Horticulture	16	20
Livestock		20	25
Fisheries		3	5
Forestry		12	9
Total		**100**	**100**

In 1990/91, cereals, livestock and horticulture accounted for the first, second and third largest shares in the agricultural output, respectively. In 2009/10, cereals share dropped to number three whereas the livestock and horticulture shares increased to number one and two, respectively. The demand for livestock, horticulture and fisheries has been expanding faster than the demand for cereals as well as they are relatively more profitable. These high value agriculture activities accounted for 50% of agriculture GDP in 2009/10. The share of fiber crops has also increased due to an increase in cotton production, partly attributed to the use of genetically modified seed of Bt cotton. The production of food grains (cereals and pulses) increased from about 8.2 crore ton in 1960/61 to 25.9 crore ton in 2011/12. In 2012/13, however, food grain production declined to 25 crore ton. The production increased in 2013/14 to 26.5 crore ton due to good weather conditions but then decreased again in 2014/15 to 25.1 crore ton (record decrease) due to bad weather i.e. drought, floods and hail storm. Within the production of horticulture crops (25.7 crore ton in 2010/11), vegetables, fruits and plantations + spices + other crops account for 60%, 30% and 10%, respectively. The annual agricultural GDP growth rate (%) over time, at 2004/05 prices, is reported in Table 3.

Table 3. Annual Agricultural GDP Growth Rate (%)

Year	Growth (%)	Year	Growth (%)	Year	Growth (%)
1992/93	6.7	1999/00	2.7	2006/07	4.2
1993/94	3.3	2000/01	0.0	2007/08	5.8
1994/95	4.7	2001/02	5.5	2008/09	0.1

1995/96	-0.5	2002/03	-6.6	2009/10	1.0
1996/97	9.9	2003/04	9.0	2010/11	7.0
1997/98	-2.6	2004/05	0.2	2011/12	3.6
1998/99	6.3	2005/06	5.1	2012/13	1.8

The results clearly indicate a large year-to-year variability in growth rate in agriculture GDP. The primary reason for this variability has been fluctuations in weather indicators, climatic conditions and monsoon rains that have been responsible for natural disasters, floods and droughts. Almost 55% of Indian agriculture is rain-fed and its production depends on timely and adequate monsoon rainfalls. Out of 21 years reported in Table 3, growth rate was either negative or below 1% in 7 years. On the other hand, 10 out of 21 years (about 50% of the time), the growth rate of agricultural GDP was equal to or above 4% (the target of 12th Five Year Plan, 2012-17).

Increasing Vulnerability and Declining Farm Size

The average size of operational holdings in India (based on various agricultural censuses) is very small and it has been declining even further over time, as reported in Table 4. Table 4. Average Size of Operational Holdings over Time in India

Year	Farm Size (ha)	Year	Farm Size (ha)
1970/71	2.28	1995/96	1.41
1976/77	2.00	2000/01	1.33
1980/81	1.84	2005/06	1.23
1985/86	1.69	2010/11	1.16
1990/91	1.55		

The results clearly indicate that the farm size has been declining over time. The average farm size in 2010/11 was almost half of the average farm size in 1970/71, which was very small to begin with. Furthermore, the fragmentation has also been increasing over time. Indian agriculture is dominated by small farmers who are very vulnerable to natural disasters as well as disasters caused by the outbreaks of pests and diseases (e.g. avian flu and swine flu). The farm size is so small that it is very difficult to achieve the economies of scale. This explains why majority of those who are involved in agriculture in India are poor and vulnerable. Agriculture is a very risky business and the small farmers have limited capacity to bear the potential risks in agriculture. Since the current post-disaster assessment and assistance to agriculture is relief-centric, it does not promote recovery and resilience. This partly explains the desperate economic situation of marginal and small farmers after disasters and even farmer suicides. The details of the distribution of the number of operational holdings and area operated are reported in Table 5 for 2010/11.

Table 5. Distribution of the Number of Operational Holdings and Area Operated, 2010/11

Group	Size (ha)	Number of Holdings (lakh)	Area Operated (lakh ha)	Average Area per Holding(ha)	% of all Holdings	% of Area Operated
Marginal	< 1.0 ha	924	354	0.38	67.05	22.25
Small	1-2 ha	247	351	1.42	17.93	22.07

Semi-med	2-4 ha	138	375	2.71	10.05	23.59
Medium	4-10 ha	59	337	5.76	4.25	21.18
Large	>10 ha	10	174	17.38	0.73	10.92
All		1,378	1,592	1.16	100.00	100.00

It is important to note that two-third of all operational holdings are below 1 ha. The average size is only 0.38 ha. These 67% of the operational holdings account for a total of only 22% of all the area operated. These numbers clearly indicate that the marginal and small farmers, who are relatively poor and have limited capacity to bear agricultural risks and the effects of disasters, dominate Indian agriculture. The marginal farmers are extremely vulnerable to disasters, pest and disease outbreaks and market failures in agriculture.

Agriculture in Vulnerable States in India

Ten States in India are considered most vulnerable to disasters such as cyclones, floods, droughts and earthquakes. As reported in Table 6 (minus Assam and J&K), the growth rate in State agricultural GDP for the vulnerable states varies a great deal from one state to another.

Table 6. Growth rates in State Agriculture GDP and Indian Agriculture GDP

State	1994/95 to 1999/2000 (at 1993/94 prices)	2000/01 to 2008/09 (at 1999/2000 prices)
Bihar	8.7	7.1
Gujrat	5.2	7.7
West Bengal	4.1	2.4
Maharashtra	3.1	2.2
Andhra Pradesh	2.8	5.9
Uttarakhand	2.4	1.9
Tamil Nadu	1.8	1.4
Odisha	-0.9	1.5
India	3.0	2.6

Bihar and Gujarat have performed consistently better than all the other states. Tamil Nadu, Uttarakhand and Odisha have performed poorly, with the growth rates even lower than the growth rate for agricultural GDP in India. The performance in Andhra Pradesh, West Bengal and Maharashtra is mixed and varies over time. Clearly, vulnerability to disasters and climate change is one important factor that affects the performance in all these states.

a) Baseline Information

Pre-Disaster Situation in the Sub-Sectors

In order to properly estimate the value of destruction of physical asset and production flow changes in the sub-sectors, it is very important to first develop the baseline information (including the year before the disaster) as well as expected (forecast) information (for the year of disaster) related to production of each

of the sub-sectors. This statistical information is not only essential for estimating production losses caused by the disaster but also important to validate information received from various sources. In addition, there is a need to have a complete inventory of all the physical assets used in the sub-sectors by States. In the absence of appropriate baseline information on physical assets, it may not be possible to accurately estimate the damage to physical assets.

Information Requirements

The information requirements for making an assessment of disaster effects can be grouped into three categories. These are:

- (i) baseline information (possibly up to 5 years, including the most recent year prior to the disaster) on all the physical assets and production activities for all the agricultural sub-sectors;
- (ii) any existing damage and production loss information (however partial or preliminary) for each of the agricultural sub-sectors and related activities following the disaster; and
- (iii) information related to the forecasts for agricultural production and the physical assets for the future, including the year of the disaster.

All this information must be at the national level as well as disaggregated to the lowest administrative unit possible, District and State. This information should deal with, but not be limited to, the following activities:

- **Crops:** Area, yield and production of various crops (annual and perennial), use of agricultural inputs, availability of physical assets and agricultural infrastructure, including irrigation system;
- **Livestock:** Number, yield and production of livestock, use of livestock inputs, availability of physical assets and livestock infrastructure;
- **Fisheries:** Area, yield and production of various types of fisheries, use of fisheries inputs, availability of physical assets and fisheries infrastructure;
- **Forestry:** Area, yield and production of exploited forestry, production of forest non-timber goods and services, availability of physical assets and infrastructure area;
- **Macroeconomics:** Agricultural GDP, overall GDP, value added coefficients, balance of payments in agriculture, revenue and expenditure in agriculture and inflation;
- **Socio-economics:** Population, labor supply, wage rates, employment, livelihood opportunities, level of rural household income and role of women in agriculture;
- **Food Security:** Production, imports, exports, stocks, social safety net, food for work programs, nutrition, hunger, role of dairy, poultry, fisheries;
- **Rural Poverty:** National and regional poverty levels over time and by rural and urban sectors as well as the criteria for poverty;
- **Environment:** Status of environmental assets over time and location, levels of land degradation, desertification and deforestation;
- **Agricultural Inputs:** Production, consumption, distribution, imports and exports by type of inputs and location, levels of productivity of various inputs;
- **Agricultural Prices:** Farm gate, procurement, guaranteed, wholesale, retail, export and import prices for all agricultural inputs and outputs as well as marketing; and

- **Agricultural Trade:** Exports and imports of agricultural inputs, outputs and related products by country and mode of transport.

Every effort must be made to make sure that there is no double accounting, no gaps in critical information and that information is cross checked to ensure its quality. Information on macro-economic and socio-economic variables related to agriculture is generally collected by the agriculture team and given to the respective macro-economic and socio-economic teams.

Sources of Information

The sources of information may vary by agricultural sub-sector, sector, region and country. However, the critical list of the likely sources of information is provided below.

- National, State and regional economic and statistical agencies;
- Census data (e.g. agriculture, population, credit);
- Household or household income and expenditure surveys;
- Specialized post-disaster field surveys;
- Satellite photographs (before and after the disaster);
- Field visits to the affected areas;
- Government reports on the disaster;
- Reports by CBOs and NGOs;
- Interviews with affected stakeholders; and
- Newspaper articles (mainly for qualitative information).

b) Post-Disaster Situation and Sector Performance

Initial Analysis of the Agricultural Sub-sectors

In order to provide a broad socio-economic perspective and accurately estimate the value of destroyed assets and production losses caused by a disaster, it is very important to first undertake an initial analysis of the agricultural sub-sectors (crops, livestock, fisheries and forestry). The importance of these sub-sectors may vary from one State to another. The initial analysis of the sub-sectors should deal with, but not be limited to, the following aspects:

- **Socio-economic importance of sub-sector and sector**
  - Contribution to GDP;
  - Contribution to employment;
  - Contribution to food security; and
  - Contribution to exports.
- **Type of production**
  - Subsistence or commercial;

- Irrigated or rain-fed;
- Labour intensive or mechanized;
- Specialized or diversified;
- Cropping pattern;
- Role of animals as draft power; and
- Type of fisheries (aquaculture, artisanal, commercial).

- **Calendar of crop production**
  - Annual crops (planting to harvesting); and
  - Perennial crops (flowering to harvesting).

However, one must keep in mind that the importance of agricultural sub-sectors may vary by States and hence the nature of disaster effects. By superimposing disaster time on the crop calendar, it would be possible to visualize whether the crop has been fully lost or only partially lost due to decline in crop yield. In addition, there is also a need to analyze:

- farm size and agricultural land distribution and the relative share of the landless and the small and marginal farmers in order to get a sense of equity; and
- the quantity and quality of physical assets and their distribution by farm size groups and regions or States.

Post-disaster Analysis for the Agricultural Sub-sectors

Crops: Following the disaster, it is important to determine the post-disaster situation in the crop sub-sector i.e. for both the annual and perennial crops. This would require the determination of the extent and severity of disaster effects in terms of area and yield in the regions or States affected by the disaster.

Physical Assets: In addition, there is a need to take an inventory of all the physical assets used in the crop sub-sector that have been affected by the disaster, including soil (land); agricultural infrastructure such as buildings, farm access roads, irrigation system; farm machinery and equipment, including irrigation equipment; perennial crops; and agricultural stocks (such as seeds, other inputs and produce) stored at the farm.

Livestock: Following a disaster, it is important to take an inventory of the livestock sub-sector and the likely disaster effects in the affected areas. This of course depends on the type, extent and severity of the disaster. Cyclone surges in the coastal areas and flash floods are likely to kill animals through drowning and long droughts are likely to kill animals through starvation or to cause animals to lose weight and yield less milk or meat because of stress. In addition to the likely production loss, there is a need to take an inventory of the damage to physical assets, including livestock infrastructure, equipment and machinery and stored input, feed and fodder stocks.

Fisheries: In order to estimate the value of damage and loss of production, it is important that the post-disaster information on the physical assets and production in the fisheries sub-sector, particularly in the disaster-affected area, is accurate and complete. Unlike the other sub-sectors, the fisheries sub-sector faces

a unique situation with respect to fish fries and fingerlings. For example, during heavy floods, individual fish farmers and hatchery owners may lose fish fry and fingerlings and thereby experience financial loss. However, most of the fish fries and fingerlings may merely swim to other parts of the State or India (and some may go to the sea). As a result, the country may suffer only a minimum financial loss in the form of fries and fingerlings.

Forestry: Forestry sub-sector is further divided into two parts: exploited forestry and natural forestry. As part of agriculture, the forestry sub-sector deals only with the part that is exploited for timber production and non-timber forest goods and services. The natural forestry is considered part of the environment sector. In order to estimate the value of damage and loss of production, it is important to collect all the pre-disaster information on the physical assets and production under the exploited forestry. The nature and type of non-timber forest goods and services depends on the type of forest (tropical or non-tropical) and the type of trees used for timber.

Supplementary Sources of Post-Disaster Information

Information related to post-disaster situation for each of the agricultural sub-sectors needs to be supplemented by other available sources of disaster related information. This includes field visits to the disaster areas, satellite pictures before and after the disaster, focus group discussions at the local levels with representatives of the communities that have been affected by the disaster, as well as rapid agricultural surveys of the affected areas, if need be.

c) Estimation of Disaster Effects

Estimating the Value of Destroyed Physical Durable Assets for Crops

The value of destroyed physical durable assets in the crop sub-sector can be estimated by taking an inventory of the destroyed assets and determining the extent of their damage. These physical assets can be classified into six broad categories:

- Soil (agricultural land);
- Irrigation system;
- Agricultural infrastructure;
- Agricultural machinery and equipment;
- Agricultural stocks; and
- Perennial crops.

With the exception of perennial crops, the destruction of physical assets can be estimated by multiplying the number of units of fully destroyed by the replacement value (for soil, irrigation system and infrastructure) or the prevailing market price (for agricultural machinery, equipment and stocks). On the other hand, damage to partially destroyed but repairable physical assets can be estimated by multiplying the number of units of partially destroyed by the prevailing average cost of repair. The estimated value of damage to individual physical assets (across regions or States) can then be aggregated to obtain the estimated value of total damage to physical assets.

Estimating Production Flow Changes in Annual Crops

a. **Criteria for Determining the Magnitude of Production Flow Changes**

If disaster occurs at the end of the season and the annual crop is affected by the disaster, the production loss is equal to:

- Full production loss if the crop is fully destroyed; or
- Partial production loss if only crop yield declines.

On the other hand, if the disaster occurs at the beginning of the season and total production is not obtained, depending on whether the crop can be replanted without affecting the next crop, the production loss is equal to

- Full loss if the crop cannot be replanted and harvested in the same calendar year; and
- Partial loss equal to the value of investments that were made before the crop was destroyed (i.e. cost of production).

There is a need to apply these criteria to each of the annual crop that is affected by the disaster.

b. **Procedure A for Estimating Full Crop Production Loss**

This procedure involves the following steps for the individual annual crops that have been fully destroyed:

- Determine baseline (historical) data for
  - Crop area;
  - Average crop yield;
  - Crop production; and
  - Farm gate price for crop produce.
- Obtain pre-disaster forecast for
  - Crop area;
  - Crop yield; and
  - Crop production.
- Develop post-disaster forecast for
  - Crop area;
  - Crop yield;
  - Crop production; and
  - Current farm gate price of crop produce.

Crop production loss is the difference between the value of post-disaster crop production and the corresponding value of pre-disaster forecasted crop production. However, if neither the historical data for crop area, yield and production nor the corresponding forecasts are available at the level of States or Districts that are affected by the disaster, this procedure is not applicable.

c. **Procedure B for Estimating Full Crop Production Loss**

This procedure involves the following steps for the affected individual annual crops:

- Determine post-disaster values for

- Affected crop area;
- Expected or forecasted average crop yield in the absence of a disaster; and
- Current farm gate price of crop produce.

Production loss is equal to the value (using current farm gate price) of lost production as determined by the affected crop area and the expected average crop yield for the crop.

d. **Procedure for Estimating Production Loss due to Decline in Crop Yields**

For a particular individual crop that has experienced only partial production loss due to a decline in crop yield caused by the disaster, the production loss can be estimated as follows:

- Determine disaster affected crop area (say, A);
- Expected/forecasted average crop yield in the absence of a disaster (say, Y);
- Estimate crop production in the absence of a disaster (A*Y);
- Determine % decline in average crop yield (say, p);
- Determine likely crop production loss (p*A*Y);
- Determine current farm gate price (P);
- Determine value of likely crop production loss (P*p*A*Y).

Estimating Production Loss in Perennial Crops (Plantations or Trees)

As far as perennial crops (plantations or trees) are concerned, following a disaster, there are likely to be three scenarios i.e. full destruction of the perennial crops; full loss of production; and partial loss of production due to a decline in yield.

a. **Full Destruction of Perennial Crops**

Under this scenario the following should be noted:

- The value of damage may be estimated as equal to the cost of replanting the destroyed perennial crop. The replacement trees must be equal quality as the destroyed ones; and
- The value of production losses is equal to the sum of the value of the full standing crop production at the time of disaster plus the value of production losses over time that is required for the new trees to fully mature and start production or bearing fruit.

b. **Full Production Loss**

Under this scenario, there is no destruction of trees due to a disaster and the production loss is equal to the value of production of the full standing crop.

c. **Partial Production Loss due to a Decline in Yield**

Under this scenario, the production loss is determined by following the same procedure as has been outlined above for a decline in yield in the case of annual crops. However, there is one difference- depending on the nature and intensity of the disaster, the yield for perennial crops may remain below normal for several years. For example, if the perennial crop in the coastal areas is affected by the intrusion of brackish water (due to water surge caused by a cyclone, as in the case of Odisha), yield may remain below normal for several years. When that occurs, estimations are made of the average annual yields that may be obtained after the disaster, using data obtained from past experience and similar cases.

Estimating Damage to Physical Durable Assets for Livestock

The physical assets in the livestock sub-sector can be classified into 5 broad categories:

- Animal deaths;
- Livestock sheds;
- Storage buildings;
- Stored feed and fodder; and
- Livestock equipment and machinery.

The damage to these physical assets can be estimated by multiplying the number of fully destroyed units with their replacement cost (e.g. sheds and buildings) or current market price (e.g. dead animals, poultry and honey bees, feed and fodder). On the other hand, damage to partially destroyed physical assets can be estimated by multiplying the number of affected units by their average cost of repair. The estimated value of damage to individual physical assets must be aggregated to obtain the value of total damage for each District, State and for the country.

Estimating Production Loss for Livestock

For estimating production loss in the livestock sub-sector, there are likely to be three scenarios i.e. full production loss due to death of animals, birds or bees; partial production losses due to a decline in yield and/or an increase in production costs.

a. **Full Production Loss due to Death of Animals, Birds or Bees**

   Death of male animals used for meat and broilers will be included only in the damage part of the livestock sub-sector. However, production loss will be estimated for the male animals used for draft purposes, cows and buffaloes used for milk, poultry layers for eggs and honey bees for honey. Production loss is equal to the value of lost draft services, milk, eggs or honey over a period of time till the young replacements are mature and start producing. The lost value for milk production, for example, can be estimated by multiplying the number of dead cows with annual average milk yield and current market price for milk. Same can be done for estimating the value of production loss for eggs, honey or draft power. However, in order to accurately estimate the value of production loss, it is important that only the number of cows that were being used for actual production should be used in calculations. It holds true for poultry layers and draft animals also.

b. **Partial Production Loss due to a Decline in Yield**

   Under this scenario, the production loss is determined by following the same procedure as has been outlined for estimating production loss from decline in yield for perennial crops. After disasters, the livestock may come under stress, lose weight due to lack of water, feed or fodder or may become sick. Hence, depending on the nature of the problem or the manner to restore the animal stock to pre-disaster levels and numbers, the decline in yield can be only for one year or it can last for several years. Generally, over time, yield will improve as the conditions for livestock become normal.

c. **Higher Production Costs**

   In addition to losses in production, the production costs may also increase due to disasters. The higher production costs could be attributed to higher costs involved in feeding animals, providing veterinary treatments and costs associated with possible transporting animals to other areas where they may find food and water.

Estimating Destruction of Physical Assets for Fisheries

It is important to estimate the number of different type of physical assets (such as ponds, hatcheries, fries, fingerlings, stores, stocked fish or feed, and fishing equipment) that have been fully or partially destroyed by the disaster. The damage to these physical assets can be estimated by:

- Multiplying the number of fully destroyed units by their replacement value (e.g. infrastructure) and current market price (fishing equipment).
- Multiplying the number of partially destroyed units (of assets) by the average cost of repair.

The value of the total damage due to disaster can then be estimated by aggregating the value of fully and partially destroyed physical assets.

Estimating Changes in Production Flows for Fisheries

For estimating production loss in the fisheries sub-sector, there are likely to be four scenarios i.e. partial to full production loss in aquaculture ponds; full production loss in inland capture fisheries; full production loss in marine capture fisheries; and higher production costs.

a. **Partial to full production loss in aquaculture ponds**

   Depending upon the damage to the pond, contamination of pond water and loss of fries and fingerlings, fish yield per pond may decline between zero and 100%. The yield decline may vary from one pond to another. Hence it is important to estimate average yield decline. The value of the production loss can be estimated by multiplying decline in yield with area under aquaculture and prevailing market prices for fish.

b. **Full production loss in inland capture fisheries**

   Depending on the loss in the number of fishing days caused by either disaster or damage to the fishing equipment, there will be full production loss for certain number of days or partial loss in terms of annual loss. Similarly, the value of the lost production can be determined by multiplying production with the prevailing market prices for the particular type of fish that has been lost.

c. **Full production loss in marine capture fisheries**

   The methodology is same as above except that it is applied to production loss in marine capture fisheries production.

d. **Higher production costs**

   Higher production costs can be due to many factors such as higher cost of aquaculture or capture fisheries due to increased cost of inputs, increased cost of equipment rental, higher cost of fuel to reach fish that may have migrated far away, cost of temporary rental of boats while they are being repaired.

Estimating Destruction of Physical Assets for Forestry

It is important to estimate the number and the extent of damage to physical assets such as standing timber, forestry equipment and machinery, fire management equipment, firebreaks, houses, watch towers and access roads that have been fully or partially destroyed by the disaster. The value of damage can be estimated by:

- Multiplying the fully destroyed assets by the replacement cost (infrastructure) or the prevailing market price (equipment).
- Multiplying the number of partially destroyed units (of assets) by the average cost of repair.

The total value of damage to physical assets can be estimated by aggregating the value of fully and partially destroyed physical assets in forestry.

Estimating Changes in Production Flow of Forestry

For estimating production loss in forestry sub-sector, there are likely to be four scenarios i.e. partial production loss due to decline in timber yield; partial production loss due to decline in yield of non-timber goods; partial production loss due to loss of carbon sequestration; and higher input cost due to cost of removing the dead trees and cost of replanting.

Public and Private Sector Breakdown of Disaster Effects

As has been indicated earlier, most of the agricultural sector is in the domain of the private sector. However, substantial amount of agricultural infrastructure (such as irrigation, drainage, research, extension, veterinary hospitals, fish landing facilities, forestry infrastructure) are in the public sector. The main logic for dividing the disaster effects into the public and private sectors is to determine their relative shares on the public and private sectors and to assign the primary responsibility for recovery and reconstruction following the disaster. Even when most of the disaster effects are in the private sector, the governments should generally play a very active role in facilitating appropriate arrangements for financing recovery and reconstruction.

Geographical Breakdown of Disaster Effects

The extent of geographical coverage by a disaster depends on the type and intensity of the disaster. More importantly, however, it also depends on the size of the country. For example, cyclones may cover only a part of India. In order to develop an appropriate recovery and reconstruction strategy, however, it is very important to determine the location-specific impact of the disaster in terms of damage, production loss and secondary impact. It may also be important to divide the recovery and reconstruction responsibilities by the State and Central governments. Furthermore, it is important to allocate recovery and reconstruction resources based on quantitative estimation of the disaster effects rather than on political considerations. Estimating damage and production losses by geographical areas provides an objective criterion for developing a financing strategy and allocating resources following a disaster, irrespective who is providing the financial resources.

d) Estimation of Disaster Impact

In addition to causing destruction of assets, and changes in production flows, a disaster may also have secondary impacts, some of which may last for several years. The secondary impacts would, of course, depend on the type and severity of the disaster. These secondary impacts include, but are not limited to (a) macroeconomic impact; (b) socio-economic impact; and (c) impact on strategic agricultural indicators. In addition, disasters do cause stress and thus have a major psychological effect on rural households as well as on human health, nutrition and productivity.

Macroeconomic Impacts

The macroeconomic impacts fall into four broad categories: gross domestic product (GDP), balance of payments, fiscal balance and inflation.

a. **Gross Domestic Product**

   Since GDP and production losses due to disaster are flow concepts, the estimated magnitude of loss in agriculture (by sub-sectors or an aggregate) are used by the macro-economic team to determine the likely

reduction in agriculture GDP (as well as for GDP in general) during the year of disaster and over several years after the disaster in some cases. However, in order to undertake this type of analysis, production losses in individual agricultural sub-sectors must be multiplied by the value added coefficients in order to estimate the value added losses. These value added coefficients capture the effect of linkages between the different sectors. In addition to the direct impact of production losses on the level and growth of GDP, the likely secondary impacts of a disaster will also affect the level and growth rate of GDP.

b. **Balance of Payments**

As a result of a disaster, India may have to either import more of certain type of foods or other agricultural commodities, agricultural inputs and equipment and/or reduce exports of agricultural commodities that the country generally exports. This will adversely affect the balance of trade (and hence the balance of payments).

c. **Fiscal Balance**

Following any disaster, the government may have to allocate additional budgetary resources to finance emergency relief, recovery and reconstruction work in the affected agricultural rural areas of the country. In order to finance activities due to a disaster, India may either have to increase budget deficits and/or divert scarce financial resources from public investment for agricultural development to finance post-disaster needs in the agricultural sector. In either case, it will have serious consequences for the annual budget.

d. **Inflation**

Depending on the disaster and its impact on both the demand and supply of agricultural goods and services, it is likely to have consequences on the prices of essential commodities and services and hence inflation. An increase in prices for affected food commodities, following a disaster, is such an example. Similarly, prices for the reconstruction material may also increase during the reconstruction period. The actual impact on inflation would, however, depend on the relative share of affected goods and services in the consumption basket that is used to determine the consumer price index. However, any price impact of the disaster is likely to be temporary.

Socio-economic Impacts

The socio-economic impact of a disaster may have consequences on employment, livelihood, household income and gender in the agricultural sector. In order to estimate the socio-economic impact there is a need to supplement the relevant secondary information from the disaster areas with appropriate randomly selected sample surveys; focus group discussions; and discussions with the local, state and national NGOs actively operating in the affected area.

a. **Rural Employment**

The direct and indirect production losses caused by a disaster may result in decline in employment in the short and medium-term. This decline in employment (in person months) in each of the agricultural sub-sectors can be estimated by multiplying the value of production loss with a corresponding labour coefficient that relates the value of production with the number of people employed. The decline in employment in the agricultural sector can be estimated by adding decline in employment in each of the sub-sectors. This decline in employment will affect both family labour and hired labour. India has initiated a national program called NREGA that provides guarantee for a maximum of 100 days per year to the unemployed.

b. **Rural Livelihood Opportunities**

The livelihood opportunities in rural areas depend primarily on the agricultural and rural non-farm (which

depend directly or indirectly on agriculture) activities. The disaster triggered damage to physical assets and production losses will have significant implications on rural livelihood opportunities for the marginal and small farmers and the landless rural households in the short and medium-term. The assessment of the impact on rural livelihood opportunities, however, would require both qualitative and quantitative analysis based on focus group discussions and survey based on randomly selected farming and rural landless households.

c. **Rural Household Income**

Depending on the type and severity of the disaster, the average income for the farming as well as landless rural households will decline as a result of agricultural production losses, reduction in employment and decline in livelihood opportunities in the agricultural and rural non-farm sectors. Again, an accurate assessment of the decline in household income would require focus group discussions and appropriate household surveys.

d. **Rural Women**

The likely impact of a disaster on rural women would vary by State and depends on the nature and degree of involvement of women in carrying out agricultural operations. In India, women in the rural areas are actively involved in agricultural and rural non-farm activities such as household gardens, dairy, poultry, harvesting, post-harvest management and marketing. Women are also very active in cash earning backyard economic activities. The information based on secondary data does not always give an accurate picture of the role of women. Hence, this information must be supplemented by focus group discussions and special field surveys.

Impact on Strategic Agricultural Indicators

The effects of disasters in the agriculture sector will impact on the following indicators:

a. **Impact on Food Balance, Food Security and Nutrition**

Disasters that have major effects on the agricultural sector may also have serious consequences on the food balance and food security at the national as well as household level. Until the international food crisis of 2007, most food-deficit countries were gradually increasing their dependence on trade to meet their national food security needs. However, most of them now would like to increase domestic food self-sufficiency and/or food stocks to improve their food security and thereby minimize exposure of their population on the uncertain international market for critical food commodities, particularly rice and wheat. Hence, it is very important to analyze the impact of a disaster on the food balance and food security at the national, state and household levels. However, at present, India is in a position to export both wheat and rice but is net importer of pulses.

This analysis would require a careful examination of food requirements and elements of food supply, including domestic production, stocks (both public and private), and net imports. Requirements for increased food imports have direct implications for foreign exchange needs and balance of payments as well as impacts on the fiscal budget. In addition to the adequacy of food supply in physical terms, it is very important to analyze the implications for access to food by the poor segments of the society that have been affected by the disaster. In this context, food is also an important component of national social safety net and food for work programs that may follow or become even more important after a major disaster. In this context, India has passed the National Food Security Act (NFSA) in 2013 that provides minimum food to qualified citizens at low prices.

b. **Impact on Rural Poverty**

While there are many poor households in the urban areas, the existence of poverty in India is generally a rural phenomenon. For example, at the national level, approximately 75% of the poor in India live in the rural areas and mostly depend on agriculture for their livelihood. Any disaster that negatively affects agriculture and rural population may seriously increase rural poverty. The small and marginal farming and landless rural households are generally part of the poor households. Disasters have serious consequences for these households. The existence of poverty, however, varies a great deal from one region to another, from one State to another, from one productive sector to another and from rural to urban. With the increasing frequency and intensity of floods and cyclones in India, the likely impact of these disasters on rural poverty would be high.

c. **Impact on Agricultural Natural Resources**

Some of the environmental and natural resource assets that are either an important part of agriculture or have significant impact on agricultural production are biodiversity, soil, water, forestry and fisheries. Disasters can either damage these natural assets and/or increase production losses. The magnitude of damage and production losses, however, would depend on the type and severity of the disaster. Since most of the environmental and domestic natural resource assets are not tradable, it is difficult to determine their market value. Hence different methods of assessment will be used to estimate the value of damage and losses on environment and natural resources. In order to avoid double accounting, any of the items under this category that are included in the agricultural sector (i.e. agricultural land, fisheries or flood protection) should not be included here. In case of serious damage to agricultural land (soil), the value of the damage can be calculated by using the market value for a comparable land quality. On the other hand, loss can be estimated from the value of lost production until such time that the land quality is fully recovered.

d. **Impact on the Availability of Agricultural Inputs**

A disaster may affect the quality and quantity of agricultural inputs, including destruction of agricultural land; death of draft animals; damage to the irrigation system and equipment; damage to stored seeds, feed, fodder and fertilizer; agricultural equipment and machinery. Unless transferred from other parts of the country (which will not be possible in case of damage to land or the irrigation system anyway), the availability of most of the affected agricultural inputs will decline and market prices will go up. Since most of the rice crop is transplanted, depending on when the flood came, either the whole crop production is lost (if there is no time to replant) or agricultural inputs used for the crop are lost and have to be replanted (if crop is affected at the early stages). Under these circumstances, disaster may cause lower farmer revenues from crop production due to production loss (loss of crop or decline in crop yield) and/or higher production costs. Again, one must be very careful in making sure that there is no double accounting.

e) Estimation of Post-Disaster Recovery and Reconstruction Requirements

Estimating Recovery Needs

The total agricultural recovery needs in the agricultural sector are determined as follows:

*Agricultural Recovery Needs = A *Production Flow Losses*

Depending on the sub-sector or activity, the value of coefficient A varies between 0.2 and 0.5 or 20% and

50% of the production loss estimates. In other words, the financial needs for agricultural recovery are much lower than the estimated changes in production flows for crops, livestock, fisheries and forestry sub-sectors.

a. Agricultural Recovery Activities

The agricultural recovery activities can be broadly divided into four categories. These are:

(i) agricultural production recovery;

(ii) recovery of critical agricultural services;

(iii) livelihood recovery; and

(iv) recovery of food security.

All the recovery activities are important but there is a need to prioritize these categories and as well as activities within each of the categories. This is critical since budgetary resources are generally limited. Also there is a need to add time dimension to each activity since some activities need to be completed immediately, others in the short-term and some may be in the medium term.

b. Agricultural Recovery Programs

First, the agricultural production recovery programs may consist of (i) provision of agricultural inputs; provision of animal feed and fodder; prevention and control of animal diseases; restocking of young animals; and restocking of aquaculture ponds with fries and fingerlings.

Second, the critical agricultural service recovery programs consist of agricultural custom-hiring services; veterinary services; marketing services; transport services; nurseries; and service to supply fries and fingerlings. However, the list may vary depending on the nature and extent of the disaster.

Third, the livelihood recovery programs primarily include public works programs (both food for work and cash for work) and employment programs. In India, the National Rural Employment Guarantee Act (NREGA) program provides employment guarantee for a maximum of 100 days per year for the qualified rural unemployed.

Finally, the food security recovery program deals with food balance in the disaster areas at the State and household levels. In case there is a deficit of food (or certain kind of food), there may be a need to either import food or transfer food from the food surplus areas to the food deficit areas. Again, the specific nature of the agricultural recovery programs depends of the extent of production losses and the intensity and nature of the disaster.

Financing Agricultural Recovery Programs

The likely manners of financing for agricultural recovery programs are in-kind or cash grants, targeted to small and marginal farmers, lines of credit at low interest rates, write-off or restructuring of agricultural loans, micro-credit, food safety net and temporary tax relief. The private farmers would also use their savings, borrowings and insurance receipts, in case they have an insurance policy. Since most of the farmers are small or marginal, their capacity to finance post-disaster agricultural recovery activities is limited. The public sector or public good programs can be financed by the government through its own budget, either by diverting resources from the existing agricultural programs or through reallocation of additional budget by the Ministry of Finance.

Estimating Reconstruction Needs

The total agricultural reconstruction needs in the agricultural sector are determined as follows:

*Agricultural Reconstruction Needs = B *Destruction of Physical Durable Assets*

Depending on the activity, the value of coefficient B may vary between 1.2 and 1.5 or 120% and 150% of the damage estimates. In other words, the financial needs for reconstruction are higher than the damage estimates for crops, livestock and fisheries due to building back better.

a. Agricultural Reconstruction Activities

The agricultural reconstruction activities can be broadly divided into three categories. These are

(i) agricultural physical assets;

(ii) agricultural infrastructure; and

(iii) agricultural perennial crops (plantations and trees).

Again, all the reconstruction activities are important but there is a need to prioritize these categories as well as activities within each of the categories. This is critical since financial resources are generally limited. Also, there is a need to add time dimension to each of the reconstruction activities since some activities need immediate attention where as others may be able to wait for certain amount of time in the short and medium-term.

b. Agricultural Reconstruction Programs

First, the replacement of agricultural physical assets mainly consists of acquisition and replacement of agricultural equipment and machinery, stock replacement of draft and milk animals, and replacement of boats, engines and fishing equipment.

Second, reconstruction of agricultural infrastructure consists of irrigation systems, drainage systems, farm roads, storage facilities, animal sheds, fish-landing sites, aquaculture ponds and hatcheries.

Finally, replacement of perennial crops includes fruit trees, coffee and tea plantations, date trees and oil palm trees. Again, the actual nature of the agricultural reconstruction and replacement program depends of the extent of damages and the intensity and nature of the natural event that caused the disaster.

Financing Agricultural Reconstruction Programs

As indicated earlier, all the public programs can be financed by the government either by diverting resources from the existing agricultural programs or through new budgetary allocations by the Ministry of Finance. The private sources of funding for the private reconstruction or replacement programs are private savings, borrowings and insurance proceeds. However, the small and marginal farmers may not have the capacity to finance these programs on their own. Government can facilitate financing through write-off or restructuring of existing agricultural loans, provision of lines of credit at low rates of interest, temporary tax relief, and targeted government subsidies for small and marginal farmers. Government needs to carefully and passionately evaluate various options for financing the critical programs. Otherwise, a large number of affected farmers and landless labourers may fall below the poverty line.

Agriculture, Livestock, Fisheries and Forestry Sector

STANDARD PROCEDURES FOR SECTOR ASSESSMENT

Recommended Assessment Team

The composition of the sector assessment team may vary by the type of disaster and the extent of the likely damage and production flow changes. The table below gives the recommendation for members of the assessment team. Others areas of expertise like sericulture or apiculture can be added, depending on the sector coverage in the district to be assessed.

Organization and Personnel	Role in the Sector Assessment

Personnel from
• **State Department of Agriculture**
• **Agricultural Research and Education; and other related offices in the disaster-affected area:**
  • Agricultural Economist
  • Civil and Agricultural Engineer
  • Agricultural Extension Specialist
  • Agronomist
  • Husbandry / Livestock Specialist
  • Veterinarian
  • Fisheries Specialist
  • Forestry Specialist
• **Representative from the Office of Revenue Collector**
	Lead and coordinate

Personnel from:
• **Ministry of Agriculture**
• **Department of Agricultural Research and Education (DARE)**
• **Department of Agriculture and Co-operation**
• **Directorate of Extension, New Delhi**
  • Agricultural Economist
  • Civil and Agricultural Engineer
  • Agricultural Extension Specialist
  • Agronomist
  • Husbandry / Livestock Specialist
  • Veterinarian
  • Fisheries Specialist
  • Forestry Specialist
	Provide baseline information and facilitate the field assessment of damages and losses

Development partners (if active in the sector)	Participate and provide technical advice

Steps in conducting a PDNA in the agriculture, livestock, fisheries and forestry sector

Step 1. Collect baseline information on sector assets and production flows

Baseline information must be compiled before the field assessment or, if possible, prior to the occurrence of disaster. The baseline data should be validated before the field visit to serve as the basis for the estimation of damages and losses for the disaster-affected area/s. This data can be compiled at the State/Region office or at the District levels. The tables below can be used for the baseline information.

A. Crops, Permanent Crops and Forestry

Table 1. Baseline information on agricultural crops and forest products

Name of District:								
Sub-sector	**Area planted**	**Average yield for the year**	**Farm gate price**	**MSP**	**Production cost**	**Number of farmers or growers**		
	(Hectares)	**(Kg/Hectare/Yr)**	**(Rs/unit)**	**(Rs/unit)**	**(Rs/Hectare)**	**Families**	**M**	**F**
Crops								
Rice								
Millet								
Maize								
Wheat								
Barley								
Lentil								
Oilseed crops								
Culinary crops								
Vegetables								
Others								
Permanent Crops								
Coconut								
Coffee								
Rubber								
Sugarcane								
Cotton								
Tea								
Mango								
Cashew								
Dates								
Fruit tree crops								
Others								
Forestry								
Timber								
Rattan								
Charcoal								
Others								

B. Fisheries

Table 2. Baseline information on fisheries

Name of District:							
Sub-sector	**Area**	**Average yield/ catch for the year**	**Average price paid to fisher**	**Production cost**	**Number of farmers or fishers**		
Fisheries	**(Hectares)**	**(Kg/ Hectare/Yr)**	**(Rs/Kg)**	**(Rs/ Hectare)**	**Families**	**M**	**F**
Inland fisheries							
a. Commercial							
b. Artisan							
Aquaculture							
a. Commercial							
b. Artisan							
Others							
Marine / Open-sea fishing	**N.A.**	**Average yield/catch for the year**	**Average price paid to fisher**	**Production cost (Rs)**	**Number of fishermen**		
					Families	**M**	**F**
a. Commercial							
b. Artisan							

C. Livestock and poultry

Table 3. Baseline information on livestock and poultry

Name of District:							
Sub-sector	**Number**	**Average yield for the year**	**Farm gate price**	**Production cost**	**Number of farmers or growers**		
Livestock for meat	**Heads**	**(Kg/Yr)**	**(Rs/Kg)**	**(Rs/Unit)**	**Families**	**M**	**F**
Goats							
Pigs							
Others							
Livestock for milk	**Heads**	**Offspring/Yr**	**Rs/ Head**	**Rs/Head**	**Families**	**M**	**F**
Dairy cattle, local							
Dairy cattle, imported							
Draft animals	**Heads**	**Offspring/Yr**	**Rs/ Head**	**Rs/Head**	**Families**	**M**	**F**
Bullocks							

Horses							
Camels							
Others							
Breeding stock							
Others							
Poultry	**Heads**	**(Kg/Yr)**	**(Rs/Kg)**	**(Rs/Unit)**	**Families**	**M**	**F**
Chicken							
Ducks							
Others							

D. Other agricultural products

Table 4. Baseline information on other agricultural products

Name of District:						
Sub-sector	**Average yield for the year**	**Farm gate price**	**Production cost**	**Number of farmers or growers**		
Agricultural Products	**(Units/Yr)**	**(Rs/Unit)**	**(Rs/Unit)**	**Families**	**M**	**F**
Milled Rice						
Processed Vegetables						
Fruit Syrup, Jam, Cordial						
Eggs						
Milk						
Honey						
Value-added products						
a. Wool						
b. Leather						
c. Others						
Other products						

Notes for filling Tables 1 to 4

- *Agricultural products are those that are produced in the farm, by the farmers. Those that are produced by formal manufacturers should be included in the industry sector to avoid double counting.*
- *Major vegetables or other value-added cash crops grown should be enumerated.*
- *The major types of fisheries should be enumerated.*
- *Estimated average yield per hectare per year should be based on past-established productivity and farm gate prices.*
- *The assessment team must be aware which types of products are exported.*

E. Irrigation Assets

Irrigation is one of the major components in agriculture that is vital for the sector's performance, which must be accounted for before a disaster to facilitate a post-disaster assessment in the future. The quantity, total construction costs as well as cost per unit should be included as in the following table.

Table 5. Irrigation Facilities

Name of District:								
Name of Irrigation Facility	Type of Irrigation	Areas Irrigated	Length	Cost Per Meter	Monthly Income From Fees	Ownership		Number of Beneficiaries
		Hectares	Meters	(Rs/ m)	(Rs)	Public	Private	Farmers
TOTAL								

F. Other Agricultural Assets

On the other hand, the information on equipment and machineries used in agriculture can assist in assessment and the recovery of the sector should a disaster occur.

Table 6. Agricultural Assets

Name of District:						
Assets	Quantity	Average Replacement Value	Ownership		Number of Private Owners	
		Rs	Private	Public	M	F
Physical Assets						
Agriculture Land (Hectares)						
Storage Buildings (Warehouse / Silos)						
Livestock Sheds						
Poultry Sheds						
Milking Sheds for Dairy Cattle						
Rice Mills						
Fencing (km)						
In-farm Roads (km)						
Others						
Equipment and Machinery						

Tractor						
Hand Tractor						
Thresher						
Inter-cultivator						
Reaper						
Plow						
Combine Harvesters						
Dryers						
Seed Processing Plants						
Others						
Inputs and Raw Materials						
Seeds						
Fertilizer						
Pesticides						
Veterinary Supplies						
Stored Production (Enumerate)						
Others						
Forestry and Plantations						
Trees (enumerate)						
Orchards						
Others						
Other Equipment						
Honey Production						
Milk Production						
Egg Production						
Others						
Fisheries						
Boats						
Engines						
Nets						
Fishing Tools and Supporting Materials						
Traps and Cages						
Ponds						
Fish Feed						
Fries						
Fingerlings						
Others						

Note for filling Table 6

- *The first column of the table includes the type of agricultural assets in the area.*
- *The average replacement value refers to the average pre-disaster market price, in Rs. of the concerned asset.*

Sources of Information

The sources of information may vary by state. However, the critical list of the likely sources of information is provided below.

Ministry of Statistics and Programme Implementation	http://www.mospi.gov.in
Indian Council of Agricultural Research	http://www.icar.org.in
The Registrar General & Census Commissioner, India	http://censusindia.gov.in
Agriculture Census Commissioner	
Department of Agriculture, Cooperation and Farmers Welfare	http://agcensus.nic.in
Department of Agriculture Cooperation & Farmers Welfare	http://agricoop.nic.in
National Bank for Agriculture and Rural Development	https://www.nabard.org
Department of Animal Husbandry, Dairying & Fisheries	http://dahd.nic.in
Fishery Survey of India	http://fsi.gov.in
National Fisheries Development Board	http://nfdb.gov.in
Ministry of Finance	http://finmin.nic.in
National Institution for Transforming India	http://niti.gov.in
National Dairy Development Board	http://www.nddb.org/information/stats
National Horticulture Board	http://nhb.gov.in
India Brand Equity Foundation	http://www.ibef.org/
Open Government Data (OGD) Platform India	https://data.gov.in
Bhuvan, Indian Geo-Platform of ISRO	http://bhuvan.nrsc.gov.in

Note 1: Please use similar institutions at State level for baseline Information

Note 2: For Non-Government information sources, please search suitably

Step 2. Estimate value of damage and production flow changes

With the baseline information, field assessment should be undertaken in the affected Districts after a disaster. The assessment team from the State must work with their local counterparts in the Districts to ensure that the estimates for the damages and losses in the sector are accurate to the extent possible. Direct interviews with private contractors or government officials involved in the construction and repair of facilities can

also be conducted during the field trip in order to validate unit costs of repair and reconstruction (which is already contained in the baseline data).

Step 2.1. Estimate the damages in the year the disaster occurred

A. Agricultural Assets

The post disaster assessments can be done per District. The assessment team can use the following table in assessing the damages in a given District.

Table 7. Damages to Agricultural Assets

Name of District:					
Assets	**Number of Totally Destroyed (Rs.)**	**Average Replacement Cost Per Unit (Rs.)**	**Number of Partially Damaged (Rs.)**	**Average Repair Cost Per Unit (Rs.)**	**Total Value of Damages**
	A	**B**	**C**	**D**	**E**
Physical Assets					
Agriculture Land (Hectares)					
Storage Buildings (Warehouse/Silos)					
Livestock Sheds					
Poultry Sheds					
Milking Sheds for Dairy Cattle					
Rice Mills					
Fencing (km)					
In-farm Roads (km)					
Others					
Equipment and Machinery					
Tractor					
Hand Tractor					
Thresher					
Inter-cultivator					
Reaper					
Plow					
Combine Hharvesters					
Dryers					
Seed Processing Plants					
Others					
Forestry and Plantations					
Trees (Enumerate)					
Orchards					

Others						
Other Equipment						
Honey Production						
Milk Production						
Egg Production						
Others						
Fisheries						
	Co.	Ar.				
Boats						
Engines						
Nets						
Fishing Tools and Supporting Materials						
Traps and Cages						
Ponds						
Fish Feed						
Fries						
Fingerlings						
Others						
TOTAL						

Notes for filling Table 7

- *Agricultural lands can be totally damaged like when they become permanently submerged in water after a disaster making them unavailable for farming. Land can also be partially damaged by landslides, which may need "repair" to be restored to its original productivity. They should be measured in hectares.*
- *For fisheries, "Co." means commercial fisheries and "Ar." refers to artisan fishing.*
- *Column A is for the number or quantity of totally destroyed assets. Land is in hectares, fencing and in-farm roads in kilometers.*
- *Column B refers to the estimated average cost of replacement of each of the totally destroyed assets.*
- *Column C is for the number or quantity of partially damaged assets.*
- *Column D refers to the estimated average cost of repair of each the partially damaged assets.*
- *The total value of damages in Column E will be the quantity of totally destroyed assets multiplied by their average cost of replacement plus the quantity of partially damaged assets multiplied by their average cost of repair.*
- *In formula, Column E = (Column A x Column B) + (Column C x Column D)*
- *The table can be expanded if there are other important assets that were damaged, as may be determined by the assessment team.*
- *The above concept will be applied to the succeeding tables.*

B. Damages to Crops, Permanent Crops and Forest Products

The assessment must be able to account for all the permanent crops that have been destroyed or uprooted.

Table 8. Damages to Crops, Permanent Crops and Forest Products

Name of District:				
Permanent Crops	**Quantity of Affected Areas**	**Number of Totally Destroyed**	**Average Replacement Cost**	**Total Value of Damages**
	A	**B**	**C**	**D**
Crops	**Hectares**	**Kilograms**	**Rs.**	**Rs.**
Rice				
Millet				
Maize				
Wheat				
Barley				
Lentil				
Oilseed crops				
Culinary crops				
Vegetables				
Others				
Permanent Crops	**Hectares**	**Trees**	**Rs.**	**Rs.**
Coconut				
Coffee				
Rubber				
Sugarcane				
Cotton				
Tea				
Cocoa				
Cashew				
Dates				
Fruit tree crops				
Others				
Forestry	**Hectares**	**Trees**	**Rs.**	**Rs.**
Timber				
Rattan				
Charcoal				
Others				
TOTAL				

Notes for filling Table 8

- *Damaged crops are those that are to be harvested just before the disaster occurred.*
- *The "total value of damages" (Column D) is (column B) multiplied by the "average replacement cost" (Column C). Column D = Column B x Column C.*
- *The average replacement cost will be the amount required to replant each of the totally destroyed crops, permanent crops and trees due to the disaster.*
- *The number of trees can also be estimated by the average number of trees per hectare.*

C. Damages to Irrigation

The damages to irrigation systems can be estimated using the following table.

Table 9. Damages to Irrigation Systems

Name of District:					
Name of the Irrigation Facility	Partially Damaged	Totally Destroyed	Repair Cost	Replacement Cost	Value of Damages
	Meters	Meters	(Rs.)	(Rs.)	(Rs.)
	A	B	C	D	E
TOTAL					

Note for filling Table 9

- *An irrigation facility can either be partially damaged or totally destroyed and should be indicated in the number of meters.*
- *The value of damage is equal to the repair cost if partially damaged or the replacement cost of the asset if totally destroyed. The repair cost can be estimated by visiting the irrigation system after the disaster. In formula, the value of damages is either Column E = Column A x Column C or Column E = Column B x Column D.*

D. Damages to Livestock and Poultry

The damages to livestock and poultry can be estimated using the following table.

Table 10. Damages to Livestock and Related Products

Name of District:			
Livestock and Others	**Quantity of Dead Animals**	**Average Replacement Cost**	**Total Value of Damages**
	Heads	**(Rs.)**	**(Rs.)**
	A	**B**	**C**
Livestock for Meat			
Goats			
Pigs			
Others			
Livestock for Milk			
Dairy Cattle, Local			
Dairy Cattle, Imported			
Draft Animals			
Bullocks			
Horses			
Camels			
Others			
Breeding stock			
Others			
Poultry			
Chicken			
Ducks			
Others			
TOTAL			

Notes for filling Table 10

- *The value of damages will be the quantity of animals multiplied by the average replacement costs at current prices. In formula, Column C = Column A x Column B*

Step 2.2. Estimate the losses

A. Production Losses

The estimated losses in agriculture are the differences between the expected pre-disaster and post-disaster

production or income levels of various agricultural products within the year that the disaster occurred and the succeeding years. The following table below can show the estimated reduction in production and/or income levels for agricultural products.

Table 11. Production Losses

Name of District:						
Sub-sector	Estimated Reduction in the Value of Production					Total Estimated Losses
	Disaster Year			Year After the Disaster		
	Estimated Value of Production (Rs)		Estimated Losses	Year 1	Year 2	
	Pre-disaster	Post-disaster	Rs.	Rs.	Rs.	Rs.
	A	B	C	D	E	F
Crops						
Rice						
Millet						
Maize						
Wheat						
Barley						
Lentil						
Oilseed crops						
Culinary crops						
Vegetables						
Others						
Permanent Crops						
Coconut						
Coffee						
Rubber						
Sugarcane						
Cotton						
Tea						
Cocoa						
Cashew						
Dates						
Fruit tree crops						
Others						
Forestry						

Timber						
Others						
Fisheries						
Inland fisheries						
a. Commercial						
b. Artisan						
Aquaculture						
a. Commercial						
b. Artisan						
Others						
Livestock for Meat						
Goats						
Pigs						
Others						
Livestock for Milk						
Dairy Cattle, Local						
Dairy Cattle, Imported						
Draft Animals						
Bullocks						
Horses						
Camels						
Others						
Breeding stock						
Others						
Poultry						
Chicken						
Ducks						
Others						
Others Products						
Eggs						
Milk						
Honey						
Wool						
Leather						
Others						
TOTAL						

Notes for filling Table 11

- *The "Estimated Losses" for the year that the disaster occurred is the difference between the pre- and post-disaster estimated production levels. In formula, Column C = Column A – Column B.*
- *The "Estimated Reduction in the Value of Production" for Year 1 and Year 2 after the disaster year shall serve as the initial estimate of the assessment team. That can be calculated, based on the production estimates in the agricultural development plan less the new estimated production after the disaster.*

B. Losses from Irrigation Fees

If irrigation facilities charge fees, their destruction will result in the loss of income from fees. The table below can summarize the losses.

Table 12. Losses from Irrigation Fees

Name of District:						
Name of Irrigation	Estimated Income (Rs)					Total Losses
	Disaster Year			Year 1	Year 2	
	Pre-disaster	Post-disaster	Losses			
	A	B	C	D	E	F
TOTAL						

C. Other Losses

There are other unexpected expenditures that will add to the losses in agriculture like clearing of land, investment losses (higher production costs), etc. As previously mentioned, an important type of loss is the investment loss of farmers when their standing crops or poultry are totally destroyed by a disaster. If this happens, and the farmers (or growers) are not able to replant (or replace the stocks) in time to harvest within the year, the value of investment put into the destroyed crops or plants (or poultry) will be considered as loss.

On the other hand, if the farmers (or growers) replant (or replace the stocks) in time to harvest within the year, it will be as if the farmers (or growers) incurred a higher production cost to produce the same volume of harvest within the year. The total cost of production for the same volume of output within the year will be the normal production cost plus the investment losses they incurred due to the disaster. The following table will summarize these other losses.

Table 13. Other Losses

Name of District:							
Sub-sector	Losses (Rs.)						
	Disaster Year				Year 1	Year 2	Total
	Investment Losses	Clearing Operations	Other Expenses	Total			
Crops							
Permanent Crops							
Forestry							
Fisheries							
a. Commercial							
b. Artisan							
Livestock							
Poultry							
Other products							
Irrigation							
TOTAL							

Note for filling Table 13

- *Other losses can include the cost of additional veterinary medicines if poultry suffered some forms of injuries, more fertilizer requirement, etc. Add losses for Year 1 and Year 2 if it is estimated that the other losses will go beyond the disaster that the disaster occurred.*

Step 2.3 Summarize the Damages and Losses in the District

Based on the information gathered in the previous tables, the summary table below can show the magnitude and scope of damages and losses due to disasters.

Table 14. Summary of Damages and Losses

Name of District:						
Agriculture	Disaster Year			Losses		Total
	Damages	Losses	Total	Year 1	Year 2	(Rs.)
	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)	
Crops						
Rice						
Millet						
Maize						
Wheat						
Barley						
Lentil						
Oilseed crops						
Culinary crops						
Vegetables						
Others						
Permanent Crops						
Coconut						
Coffee						
Rubber						
Sugarcane						
Cotton						
Tea						
Cocoa						
Cashew						
Dates						
Fruit tree crops						
Others						
Forestry and Timber						
Timber						
Rattan						
Charcoal						
Others						
Fisheries						
Inland fisheries						
a. Commercial						
b. Artisan						

Aquaculture						
a. Commercial						
b. Artisan						
Others						
Livestock for meat						
Goats						
Pigs						
Others						
Livestock for milk						
Dairy Cattle, Local						
Dairy Cattle, Imported						
Draft animals						
Bullocks						
Horses						
Camels						
Others						
Breeding stock						
Others						
Poultry						
Chicken						
Ducks						
Others						
Other products						
Eggs						
Milk						
Honey						
Wool						
Leather						
Others						
Irrigation						
TOTAL						

Step 2.4 Summarize the Estimated Damages and Losses in the State

The total estimated effects of the disaster in the district could be summarized by combining the values of damages and losses in the State. The following table can be used.

Table 15. Summary of Damages and Losses in Agriculture in the State

Name of State:						
Name of District	Disaster Year			Losses		Total
	Damages	Losses	Total	Year 1	Year 2	(Rs.)
	(Rs.)	(Rs.)	(Rs.)	(Rs.)	(Rs.)	
District A						
Crops						
Permanent Crops						
Forestry and Timber						
Fisheries						
a. Commercial						
b. Artisan						
Livestock						
Poultry						
Other products						
Irrigation						
District B						
Crops						
Permanent Crops						
Forestry and Timber						
Fisheries						
a. Commercial						
b. Artisan						
Livestock						
Poultry						
Other products						
Irrigation						
District N						

Crops						
Permanent Crops						
Forestry and Timber						
Fisheries						
a. Commercial						
b. Artisan						
Livestock						
Poultry						
Other Products						
Irrigation						
TOTAL						

On Drought

Droughts can cause more losses than damages. Structures and equipment are seldom affected by droughts but losses in production happen. In cases of drought, the following should be noted in the agriculture sector:

a. The damages that will occur due to drought are generally in the livestock, fisheries, and poultry sub-sector where animals can perish due to the lack of water supply.

b. Losses will be observable in the reduction in volume and/or value of production of crops, permanent crops, livestock, poultry, and fisheries.

c. If the disaster that will be assessed is due to drought, the assessment team should be more concerned of losses than damages.

However, since drought can be predicted and does not occur suddenly (slow-onset phenomenon), its effects can be mitigated by advising farmers and growers beforehand to: a) temporarily stop planting for the duration of the drought; b) use drought resistant variety of seeds; c) temporarily stop the growing of livestock; d) relocating livestock; and e) discontinue the operation of inland fisheries for the expected duration of the drought. Nevertheless, if and when drought occurs, the impacts to the people and the larger community and economy as enumerated and explained below, can be expected.

Step 3. Analyze the impacts of the damages and losses to affected population

The assessment team of each of the sub-sectors must be able to analyze the broad impacts of the damages and losses and must answer the following issues, among others:

- **Poverty**. More people are engaged in agriculture and the poorest groups are dependent on this sector. What will be the socio-economic impact on the people if there will be delays in assisting these groups?

- **Out migration**. In some instances, the diminished capacity of farmers to replant and recover their livelihoods can cause the farmers and their families to migrate to the cities and other areas where they can earn a living. This phenomenon is more pronounced in cases of severe and prolonged droughts where the absence of water renders the land unproductive for crops and livestock.

- **Indebtedness**. Poor farmers usually incur debts for their production inputs. What will be the impacts if the farmers will be unable to meet their financial obligations? Will they be more in debt?

- **Effects on other sectors**. There are agricultural products, which are major inputs for other sectors (industries, tourism, commerce, etc.). For instance, if corn is the basic ingredient for animal feed, its reduction in supply will also increase the priceof feed, which will eventually inflate the prices of poultry products affecting a greater number of people. Is there a possibility that other sectors will suffer if the agriculture sector is not rehabilitated immediately?

- **Disaster risk reduction**. There may be some hazards that may have been created by the past disaster. Are there hazards created like landslide threats caused by extensive rains? Or potential flooding of rice and corn lands brought about by destroyed irrigation systems or dikes?

- **Environment**. Some environmentally sensitive areas within the sector may have been affected. Are there sensitive areas' water sources that may have been put at risk by landslides or the destruction of the forest that sustains them?

- **Women**. The condition of women may be severely affected by a disaster event. What are the potential adverse impacts on women? (This should be looked into in consideration of their possible new roles as breadwinners for their families; double burden or additional work in the farms and in the house; potential abuse; health hazards; etc.)

- **Food supply**. The destruction of crops, livestock and other agricultural outputs due to the disaster may adversely affect the balance of food supply within and outside the areas affected. Without assistance, a planting season may be missed by the farmers which will result in the scarcity of basic food supply that can cause inflation not only in the disaster-affected areas but also in other districts or even nationwide. The assessment team must be able to assess the gaps in food supply within the disaster year and beyond to enable the government to stabilize the food supply and their prices. Will food supply be enough in the short and longer-term?

  If there are perceived supply shortfalls, the cost of stabilizing food supply should be estimated. The value of the supply gaps can be estimated by multiplying the unit costs of the respective food items over a specified period. It should be noted, however, that in estimating the food requirements, the donations of food aid donors should be factored in including those that are integrated with food-for-work schemes. The overall food requirements, needed to stabilize food supply, can be shown in the following table.

Table 16. Pre- and Post-Disaster Estimated Food Requirements Per Year in the Area, in Kilograms

Food items	Pre-disaster (Quantity)			Disaster Year (Quantity)		Year 1 (Quantity)		Year 2 (Quantity)	
	Output	Consumption	Gap	Output	Gap	Output	Gap	Output	Gap
	A	B	C	D	E	F	G	H	I
a. Rice									
b. Corn									
c. Beef									
d. Pork									
e. Poultry									
f. Fish									
g. Vegetables									
h. Root crops									
i. Others									

Notes for filling Table 16:

- *Column 1 is for the food items normally consumed in the area under consideration.*
- *Columns A, B and C are for the pre-disaster (without disaster scenario) output (production) and consumption of the foods items by the population in the area.*
- *"Gap" in column C refers to the difference between production and consumption of food items. The gap must come from outside the country to augment or fill the food requirements of the population. In formula, Column C = Column A – Column B.*
- *Columns D and E are for the post-disaster estimated output or production of the food items for the year that the disaster occurred. The 'Gap" refers to the difference between the pre- and post-disaster gaps. The post-disaster gap will be the post-disaster output (Column D) less the pre-disaster consumption (Column B). In formula, Column E = Column D - Column B.*
- *The same will apply for the years after the disaster. Year 1 gap, Column G = Column F – Column B while year 2 gap, Column I = Column H – Column B.*
- *The above table assumes that pre-disaster consumption will not change and that no mass out-migration will occur.*
- *The estimated food supply gaps will enable recovery planners to design measures, like food importation, to maintain the food requirements and health conditions of the affected population.*
- *The cost of stabilizing food supply will be the value of the supply gaps multiplied by the unit costs of the respective food items over a specified time period.*

The potential impacts of the damages and losses in the agriculture can be placed in a matrix, which can be used in drafting the impact assessment part. The following matrix can be used to express the social impacts of the damages and losses to the agriculture sector.

Matrix 1. Social Impacts of the Damages and Losses to the Agriculture Sector

Area of Impacts	Expected Impacts						Brief Description of Impacts
	General Population			Women and Children			
	S	M	L	S	M	L	
Increased Poverty of Farmers							
Increase in Food Pprices							
Hunger and Malnutrition							
Increase Indebtedness							
Employment Losses in other Sectors							
Others (Specify)							

Notes for filling Matrix 1

- *The expected impacts are separated into a) the impacts on the general population; and b) the impacts on women and children measured as severe (S), moderate (M) or low (L). The assessment team should mark under the column whether the impacts are S, M or L.*
- *The impacts can be briefly described under the column "Brief Description of Impacts". For example, a brief description of a severe "impact on hunger and malnutrition" can be due to the loss of food supplies produced by farmers; the "increase in indebtedness" can happen if farmers are dependent on loans for their planting needs; while the impact on "employment on other sectors" can be due to the inability of agriculture to provide raw materials to other industries.*
- *The impacts on women and children may be different from the general population. For instance, women and children may suffer more from malnutrition than the men.*

Step 4. Identify the recovery strategies and estimate recovery and reconstruction needs

The post-disaster needs must be based on a framework where policies and strategies are likewise integrated. After analyzing the potential effects and impacts if no assistance will be provided to the agriculture sector, the aggregate needs of the sector must be estimated.

Step 4.1 Identify recovery and reconstruction strategies

After the consolidation of the field assessment, the assessment team must identify or recommend the policies and strategies for the recovery and reconstruction for the sector. The following are some of the general policies and strategies that could be considered for the sector.

A. Policy Measures

There are certain policies that can be adopted which can provide incentives to the private sector to reconstruct damaged facilities with higher standards of resilience over a limited period. Among them are:

1. Tax breaks for the private sector like real estate and other taxes;
2. Exemption from payment of building permits and other related fees;
3. Duty-free importation of construction materials and equipment during the recovery and reconstruction phase; and
4. Bank guarantees on loans given extension by the government to enable the private sector to rebuild immediately.

B. Strategies

Some of the general strategies that could be considered include the following:

1. **Rapid rebuilding of people's livelihoods and accelerate the revitalization of the local economy**. After a disaster, there is a critical need for an early revival of production, trade and the creation of income and employment opportunities in support of people's own initiatives. The immediate restoration of livelihoods will avert food shortage and lessen the dependency of the people from outside aid.
2. **Community Participation and Use of Local Knowledge and Skills**. The participation of the community in all processes (identification, planning, design and implementation) of recovery activities will help ensure the acceptability of projects and optimize the use of local initiatives, resources and capacities.
3. **Focus on the most vulnerable and socially disadvantaged groups such as children, women, and the disabled**. Recovery programming needs to give priority to the most vulnerable groups, including female-headed households, children and orphans, and the poor, and take into account those with special needs, to avoid their being overlooked.
4. **Building Back Better (BBB)**. Recovery activities based on BBB principles will promote longer-term disaster risk reduction and management. BBB principle should look at the how to make infrastructure and facilities safer from future disasters like stronger engineering design, the advantages of resettlement of facilities in disaster-safe areas instead of rebuilding in the same disaster-prone areas, etc.
5. **Secure development gains**. Recovery strategies, although may be a separate set of activities, must be supportive of existing development plans and must attempt to re-establish and secure previous development gains.
6. **Coordinated and coherent approaches to recovery**. Projects for disaster recovery must have the full and effective coordination among all involved agencies based on comprehensive information exchange, flexibility in administrative procedures, and uniformity of policies. In some instances, a special new agency may be needed to oversee, coordinate and monitor complex disaster recovery programs. Under this strategy, capacity building activities for the local public administration may be part of the recovery activities including a well-defined monitoring and evaluation system for the overall implementation of the recovery plan.

7. **Efficient use of financial resources.** The overall strategy should also include the identification of fund sources that are suited for the recovery activities. It should be clear how assistance to the recovery of the private sector would be delivered. Also, some cheaper source of funds from international donor partners should be initially identified for longer-term expensive projects.
8. **Transparency and accountability.** The overall plan and implementation of projects for recovery must be transparent, especially to those affected, through open and wide dissemination of information on all aspects of the recovery process. An effective monitoring system must be established.

Step 4.2 Estimate recovery needs

Recovery needs are intended to bring back normalcy to all affected areas and sectors as soon as possible and the agriculture sector is one of the very important sectors that will expedite a quick recovery.

Considering that a greater number of people, especially the poor, are engaged in agriculture, it is one of the sectors that should be prioritized. Some of the possible recovery related activities are:

1. Food-for-work or a combination of cash-for-work to rehabilitate/reconstruct damaged irrigation systems, town halls, public schools, health centers, and other off-farm sources of income that can provide temporary employment while farmers are waiting to plant and harvest.
2. Additional production credit to enable farmers to buy inputs and enable them to re-plant.
3. Direct subsidy on fertilizers, seeds and pesticides to farmers.
4. Dispersal of livestock and poultry to replace the depleted stocks of growers.
5. Urgent repairs of agriculture-related facilities such as irrigation, storage, markets, etc. and access to such facilities.

Step 4.3 Estimate reconstruction needs

Reconstruction needs are generally long-term in nature (3 years or more) and are intended to 'build back better' from the ruins of a disaster. The possible reconstruction related activities in the agriculture sector could include the following:

- Reconstruction and repair of irrigation systems, post-harvest facilities, markets and other structures under a building-back-better strategy to ensure future disaster resilience through the adoption and enforcement of improved construction standards.
- Structural retrofitting of undamaged or partially damaged farm facilities so that they are not affected by disaster event in the future.
- Relocation of vital agricultural facilities to safe areas, as necessary. In this case, the additional costs on land acquisition, and basic services provision (water, sanitation, electricity, etc.) should be included.
- Soft-term credit for reconstruction and repair of private businesses. Such schemes can be accompanied by technical assistance for improved disaster resilient standards of construction.
- Other mitigation measures such as construction of support infrastructure to prevent serious landslides and floods to farms; common storage facilities where farmers can stock their produce safely etc.

Step 4.4 Prioritize identified projects for recovery

Among the projects identified, relative priorities can be set in order to determine which among them are the more important. Based on the broad strategies for recovery, the assessment team should select the priority projects/activities among the identified needs.

The prioritization can be made by using a set of impact indicators and the level by which the projects can achieve said impacts. Examples of the criteria that can be used are the following, among others:

1. Economic impact, which can be evaluated in terms of the relative cost to the government of not undertaking reconstruction or rehabilitation.
2. Equity and social impact, which can be in terms of the number of beneficiaries who are poor and destitute and who could not afford to rebuild on their own without outside support.
3. Sustainability, which can be in terms of the reduction of risks and vulnerability of the people and other economic assets to future disasters.

The criteria above can be placed in a matrix like the one below where the impacts are ranked according to low, medium or high. This matrix can show the relative benefits of proposed projects to the people in the affected areas, which, in turn, will inform and assist the government in determining the priority projects within the sector.

Matrix 2. Impacts of identified post-disaster projects

Name of Proposed Project	Expected Impacts and Their Levels of Impact on Recovery								
	Economic Impact			Equity and Social Impact			Sustainability		
	High	Medium	Low	High	Medium	Low	High	Medium	Low

Step 4.5 Summarize the estimated recovery and reconstruction needs and draft the implementation schedule

Based on the prioritized recovery and reconstruction needs, a summary should be created by the assessment team enumerating the post-disaster projects for the recovery and reconstruction.

The identified needs should have a rough schedule of implementation outlining at the very least the activities, timing and budget required for all the programs and projects. The following techniques can be considered:

1. Identify the specific projects according to their relative urgency or priority in relation to recovery.
2. Plot the timeline of activities of all the projects, with the urgent ones on top, in a Gantt chart, with the corresponding funding requirement on an annual basis. This will assist the national government in programming the necessary funds over a certain time period, like on a quarterly or annual basis.

3. Identify and include in the list of projects that need further feasibility studies, which may be funded by foreign grants.
4. To the extent possible, a logical framework (log-frame) should be created for each of the project proposed for inclusion in the recovery plan. Log-frames are normally required by foreign donors to consider project proposals.

The recovery and reconstruction needs of the sector can be summarized in the table below showing the financing requirements over the years. Reconstruction needs mostly require long-term implementation periods. They normally require three or more years to complete.

Table 17. Summary of recovery and reconstruction projects in the agriculture sector.

Name of Specific Projects	Annual Needed Amount of Assistance (Rs.)			Total Needs (Rs.)
	Disaster Year	Year 1	Year 2	
Recovery Needs (Examples)				
a. Food-for-work				
b. Cash-for-work				
c. Production credit				
d. Food stabilization				
e. Dispersal of livestock and poultry				
f. Distribution of inputs				
g. Re-stocking of fingerlings				
h. Direct subsidy (specify)				
i. Urgent repairs / provision of machinery / equipment (specify)				
j. Others (Specify)				
Total				
Reconstruction Needs (Examples)				
a. Reconstruction of structures (specify)				
b. Structural retro-fitting				
c. Soft-term credit for reconstruction				
d. Mitigation measures (specify)				
e. Others (Specify)				
Total				
GRAND TOTAL				

Notes for filling Table 17

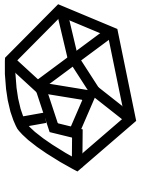
- *Project titles can be inserted under the column on recovery and reconstruction needs.*
- *Columns can be added to accommodate any additional reconstruction needs beyond Year 2.*

Step 5. Draft the post-disaster damages, losses and needs (PDNA) report of the sector

With all the information gathered using the previous steps, a report can be drafted by the assessment team,which will provide the inputs for a particular sector in the overall recovery and reconstruction plan. The following format may be considered:

1. Brief description of the sector in the disaster-affected areas.
2. Damages in the sector by areas and by types of assets affected.
3. Losses in the sector emphasizing the losses in income, increase in expenditures, estimated period before normalcy will be attained, etc.
4. Impact on the livelihood, individual households, vulnerable groups and the consequences to the greater community if no assistance for recovery will be provided.
5. Proposed strategies for recovery and reconstruction of the sector.
6. Needs of the sector, by priority, and the draft schedule of implementation with the estimated funds required for each project over time.

The draft sector report should be submitted to the State Disaster Management Office for consolidation.



Mining and Quarrying Sector

This section contains the following contents – specific to this sector – in order to guide the user to successfully conduct post-disaster needs assessment in India:

1. **The Introduction to the Sector**
    a. Baseline information
    b. Post-disaster Situation and Performance
    c. Estimation of Disaster Effects
    d. Estimation of Disaster Impact
    e. Estimation of Post-Disaster Recovery and Reconstruction Requirements

2. **The Standard Procedure for the Sector Assessment**
    a. Recommended Assessment Team
    b. Steps in conducting a PDNA in the mining and quarrying sector
        - Collect baseline information on sector assets and production flows
        - Estimate value of damage and production flow changes
        - Analyze the impacts of the damages and losses to affected population
        - Identify the recovery strategies and estimate recovery and reconstruction needs
        - Draft the post-disaster damages, losses and needs (PDNA) report of the sector

The user is advised to refer to:

a. *The "Introduction of the PDNA Manual" for a complete information of the concepts and definitions on the post-disaster needs assessment (PDNA);*
b. *The section on "Disaster Effects, Impact Assessment, Needs Estimation" for a more detailed discussion in identifying the possible impacts within and across sectors; and*
c. *The section on "Estimation of Post-Disaster Recovery and Reconstruction Needs" for a more detailed discussion on identifying and prioritizing post-disaster needs.*

Introduction

In India, the sector of mining and quarrying includes several subsectors or activities, including the following:[2]

- Major minerals, with the following subdivisions
  - Fuel minerals, including coal, lignite, petroleum and natural gas
  - Metallic minerals: iron ore, manganese ore, bauxite, copper ore, gold and others
  - Non-metallic minerals, including limestone, mica stone and others
- Minor minerals.

Data on the value of production for the sector in 2011-12 is shown in the following table.

Table 1. Value of production in mining and quarrying sector for 2011-12[3]

		Value, Rs Crore*	Percentage
Major minerals		**126,661**	**86.1**
Fuel Minerals		**111,198**	**75.6**
	Coal	52,138	35.4
	Lignite	3,014	2.0
	Petroleum and Natural Gas	56,047	38.1
Metallic Minerals		**11,198**	**7.6**
	Iron ore	7,886	5.4
	Manganese ore	619	0.4
	Bauxite	283	0.2
	Copper ore	208	0.1
	Gold	121	0.1
	Others	2,081	1.4
Non-metallic Minerals		**4,265**	**2.9**
	Limestone	2,826	1.9
	Mica stone	4	0.0
	Others	1,435	1.0
Minor Minerals		**20,464**	**13.9**
Total		**147,125**	**100.0**

*Value shown in constant 2004-05 Indian currency.

[2]According to the India System of National Accounts, this sector falls under "Mining and quarrying".See National Account Statistics, 2013, Central Statistical Office (CSO), Ministry of Statistics and Programme Implementation, New Delhi, 2013.

[3]Page 167, in National Account Statistics, 2013, Op. Cit.

Undoubtedly, the subsectors of petroleum and gas (38 per cent of the sector total) and of coal (35%) are the most relevant in terms of production value.

The Ministry of Mines is responsible for the survey and exploration of all minerals (except natural gas and petroleum), mining and metallurgy of non-ferrous metals, and for the administration of mines and minerals. The Geological Survey of India and the Indian Bureau of Mines are subordinate offices of the Ministry of Mines. There are several public-sector enterprises that operate in the sector, and produce about 85 per cent of the country´s mineral production, including the National Mineral Development Corporation, Kudremukh Iron Ore Company, Steel Authority of India and Orissa Mining Corporation, National Aluminum Company, Hindustan Copper Limited and others.

The Ministry of Petroleum and Natural Gas is responsible for exploration, production, refining, distribution, marketing, import/export, and conservation of petroleum, natural gas, petroleum products and liquefied natural gas. There are several public-sector institutions that operate in the sector, including inter alia Biecco Lawrie Limited, Bongaigaon Refinery and Petrochemicals Limited, Chennai Petroleum Corporation, Bharat Petroleum Corporation, Gas Authority of India, Hindustan Petroleum Corporation, Indian Oil Corporation, and others. Note should be taken that, according to the national accounting system, oil refining activities are to be included under the manufacturing sector and not under mining and quarrying.

Like any other productive sector, the mining and quarrying sector is vulnerable to the effects of disasters of any kind. Any destruction, however partial, to mines and equipment, used for extraction and processing of minerals and oil-related products, would result in the temporary decline of production activities and/or in higher costs of production, until recovery and reconstruction is achieved. In turn such reduction in production would affect other production processes that utilize minerals and fuels as input, thereby multiplying the effects of the disaster within the economy and society.

For the assessment of disaster effects, the composition of the mining and quarrying sector team should include different types of expertise: mining and petroleum engineers and geologist for the estimation of the value of destroyed assets, and economists with extensive experience in the sector to estimate the value of production losses and higher cost of production.

It is to be noted that there are no actual experiences of assessing disaster effects and impacts on the mining and quarrying sector in India, and that very limited experiences exist in other countries of the world. Some examples such as the recent experience of flood impact on the coal-mining sector of Serbia in 2014,[4] limited information on damage and impact of floods on oil fields and petroleum refineries in Nigeria in 2012,[5] and information on the earthquake impact in Ecuador in 1987,[6] do exist. In that context, the guidelines for assessment to be presented will be of limited nature and will have to be further developed later on, after actual assessments have been conducted in India; nevertheless, the procedures presented here do provide an overview of the required process for assessing disaster effects and impact for the sector.

[4]See Serbia Floods 2014, Government of Serbia, European Union (EU), United Nations and The World Bank, Belgrade, 2014.

[5]See Nigeria, Post-Disaster Needs Assessment, 2012 Floods, Federal Government of Nigeria, World Bank, European Union (EU), United Nations, June 2013.

[6]See The March 1987 Natural Disaster in Ecuador, and its Impact on Social and Economic Development, United Nations Economic Commission for Latin America and the Caribbean (ECLAC), Santiago de Chile, 1987.

a) Baseline Information

Data on the existing production infrastructure and output in the sector is to be collected as the first stage of the assessment to estimate the value of disaster effects, including the following:

- Location, capacities and ownership of each productive unit (both affected or unaffected, under operation and on stand-by mode) in the sector and its subsectors, such as inter alia:
  - Mines
  - Oil fields and wells
  - Refineries[7]
  - Storage facilities, and
  - Waste disposal facilities
- Information on the destination of mineral and fuel products, domestic and for export;
- Information on quantities and prices of imported and exported crude and refined products; and
- Information on skilled and non-skilled labour force in the sector, and their wages and salaries.

This kind of information is available in the Ministries of Mines and of Petroleum and Natural Gas, as well as in the Central and State Statistical Offices, and should be collected by the sector assessment team before starting any assessment.

b) Post-Disaster Sector Situation and Performance

The mining and quarrying sector assessment team needs to conduct field visits to the disaster-affected areas in order obtain first-hand information on the destruction sustained by the sector assets and to acquire a clear idea of the manner in which sectorial production would temporarily function until full recovery and reconstruction is attained. The sector team should include experts from the appropriate sectorial ministries and agencies, and collect any existing preliminary reports on damage assessments to the assets and on urgent temporary measures to re-establish production despite their partial coverage, to be used as the basis for defining the scope of the field visits that will be required to undertake.

In addition, the sector assessment team should collect all available information on unit costs to rebuild or replace damaged or destroyed assets, for which interviews are to be held with private contractors working in the field and with officials from the government agencies in the sector that may have recently constructed some of the destroyed assets. Furthermore, the team should visit local insurance companies that may have information on the availability of insurance on sector assets, and obtain from them the likely amounts of insurance proceeds on infrastructure and equipment that may be obtained.

During the field visits, the sector assessment team should ascertain whether there are undamaged idle capacities (such as standby oil wells) that may be used to partially offset production decline, or whether

[7]It is to be noted that the activity of oil refining is actually part of the manufacturing sector; not of mining and quarrying. Any disaster effects and impact on refining activities are to be referred to the manufacturing sector assessment team.

there are unaffected assets whose production levels may be increased to meet normal demands, the higher costs that may be involved in such operations, and the time periods that may be required to restore production in the affected mines, and oil and gas facilities.

With such information at hand, the sector assessment team should develop a calendar of activities required to ensure the reconstruction of destroyed assets and equipment and the recovery of production of minerals, oil and gas.

c) Estimation of Disaster Effects

The value of damage in the mining and quarrying sector is to be estimated as the cost that is required to rebuild all destroyed assets and to replace damaged equipment in the sector and its components, with the equipment with identical characteristics and the unit costs that prevailed at the time the disaster occurred.

In the mining sub-sector, this would normally involve the cost of draining by pumping of flooded underground mines and the removal of waste materials, which may have occurred in adjacent lands. In the oil and gas sub-sector it may involve the cost of drilling new wells and that of replacing equipment and machinery to replace the destroyed ones, together with the cost of rebuilding or repairing any storage facilities and pipelines. The replacement cost of destroyed vehicles and other specialized equipment should be included as well.

Very often after disasters any destruction of sector facilities and assets may bring about unwanted effects to the surrounding environment and adjacent areas. A clear example of this is the possible rupture of earth dams containing metallic mine tailings and their spilling over agriculture lands or contaminating water supplies[8], as well as the possible rupture of oil wells and pipelines and the spilled oil contaminating adjacent lands and other productive activities[9]. While t he damage sustained by the environment would be covered in the sectors of economic and social activity that have sustained these effects, the cost of environmental cleanup would have to be borne and included in the assessment of the mining and quarrying sector as part of the cost of reconstruction.

The value of the disruption of production flows may include the value of production that will not be obtained because of the interruption or slowdown of sector activities, and the higher costs of production which may be required until full recovery and reconstruction is achieved. As hinted at previously, it is possible that utilization of unaffected stand-by facilities and/or a more intensive operation of undamaged facilities may enable to partially offset production decline or interruption in the destroyed facilities and assets; but operational costs may have to be increased with respect to the normal level of operation.

The total value of changes in production flows may be estimated by aggregating the following:

– Value of production interruption which is not recovered by more intensive operation of unaffected sectorial facilities and assets within the same calendar year;

[8]As occurred in the recent floods in Serbia.
[9]As was the case in the 1987 earthquake in Ecuador and in the 2012 floods in Nigeria.

– Value of production losses arising from partial operation of sectorial facilities and assets that are only partially damaged, until they are repaired, rebuilt or replaced; and

– Higher operational costs involved in the more intensive utilization of standby or unaffected facilities over the recovery and reconstruction period.

The estimated values of damage and of production flow changes in the sector must be apportioned according to public and private ownership of the enterprises that operate in the sector, as such structure will have a bearing on the financing of post-disaster recovery and reconstruction activities.

d) Estimation of Disaster Impact

The mining and quarrying sector assessment team must make additional estimations, beyond the values of damage and changes in production flows for the sector, in order to provide inputs to the macro-economic assessment team to estimate disaster impact at the macro level and to the separate team in charge of estimating disaster impact at personal or household levels.

In that regard, note should be taken that disasters that have affected the mining and quarrying sector, have caused significant macro-economic impact due to the strategic importance of the sector. In the case of Ecuador in 1987, a net oil exporter country, overall GDP growth declined by nearly 5 per cent due to the losses in production and exports. The floods in Serbia in 2014 caused the national economy to recede because coal production, which is essential as an input for electricity generation, declined significantly, and the country had to import electricity from neighboring States in order to meet its energy demands during the winter. After the Nigeria floods in 2012, the country faced a slight decline in oil production but still maintained a positive overall GDP growth. The above is of importance for India since the country is a net importer of oil, and any negative disaster impact on this sector may bring about the need for importing larger amounts of oil and the corresponding impact on the balance of payments and trade.

Inputs for the macro-economic impact analysis would include, in addition to the estimation of gross production decline and of higher production costs (which are essentially higher values of intermediate consumption at the macro level), the following items:

– Estimations of the value of imported components for the reconstruction and replacement of physical assets and equipment and machinery that cannot be produced domestically in India and must be imported from abroad, as this will have a negative bearing on the balance of payments (BoP) and trade (BoT);

– Estimations of possible decrease in exports of mining and oil-related products and possible increase in imports of same, arising from the decline in production caused by the disaster, as this information will also be required for the analysis of disaster impact on BoP and BoT; and

– Estimations of possible lower revenues and higher expenditures in government-owned enterprises that operate in the sector, as this combination may have an impact on the fiscal position of the country.

The sector assessment team should also analyze possible disaster impact on the final sale prices of fuel and natural gas to consumers as a result of the disaster, and estimate the possible value of such price increases in order to provide elements to the government to decide on possible transference of such higher costs to the consumers via an increase in retail prices vis a vis the possibility of establishing temporary subsidies to the products involved. Whatever the decision on that issue is, it would cause either a further negative impact on the fiscal position or a negative impact on the quality of life of individual or household consumers, and the results of the analysis must be transferred opportunely to the macro-economic assessment team and to the team in charge of analyzing disaster impact at the personal/household level.

In addition to the above, the mining and quarrying assessment team must deliver the estimated values of sectorial production decline to the team in charge of estimating disaster impact at personal and household levels, so that they may use such values as input to estimate possible income decline of the labor force employed in the sector.

e) Estimation of Post-Disaster Recovery and Reconstruction Requirements

In the mining and quarrying sector, recovery needs refer to the amounts of financing required to restore normal production of the affected mines and of the extraction facilities for oil and gas, until such time as normal levels of production are achieved and the destroyed sector assets are rebuild or replaced, and to meet any higher costs of production which may have arisen after the disaster. These would usually involve the following activities and associated costs:

- The cost of pumping out flood waters from flooded mines (as happened in the Serbia floods in 2014) to enable restarting mining operations;
- The costs of shoring up tunnels and other parts of mines that have sustained destruction or flooding and ensure safety of the workers;
- The removal of destroyed equipment and materials from disaster affected areas in the oil and gas fields;
- The cost of starting up of alternative, stand-by oil and gas production units to take up the interrupted supply from destroyed units;
- Any higher costs of operation of undamaged oil and gas production units to supplement the interrupted supply of damaged units;
- Cleanup costs of spilled mine tailings and spilled oil in adjacent areas arising from the disaster until they are fit to return to their normal utilization; and
- Any cost of drilling emergency oil and gas wells to expedite recovery of supply, while the destroyed are repaired or rebuilt.

Note should be taken that in the temporary absence or insufficiency of coal, fuel and gas that may be used for industries and other consumer sectors, such consumers may incur in production losses or in higher costs to acquire such inputs from alternative sources. Such production losses and higher production costs

of the consumer sectors, and the corresponding recovery needs, are to be accounted for under their own institutional sectors, and not under the mining and quarrying sector.[10]

Should the mining and quarrying sector enterprises have insurance on losses in production and unearned revenues, the value of any due insurance proceeds (as reported by local insurance companies) should be deducted from the value of recovery needs.

The needs for reconstruction of sector assets and equipment are to be estimated by the mining and quarrying sector team by taking the estimated value of damage and increasing it by a certain percentage to include risk reduction features, as part of "build-back-better" strategy. Such an increase would arise from the combination of adopting better design standards to acquire resiliency against disasters (such as raising the base of oil and gas wells and storage facilities to avoid flooding), the possible relocation of certain sector activities such as the alignment of oil and gas pipelines to avoid seismic zones and flood areas), etcetera. There is no widespread experience in regard to the possible increase in unit costs to achieve such disaster risk reduction, and the sector assessment team would need to analyze each case as it comes to define such possible cost increases.

Again, the possible insurance proceeds for destroyed sector assets must be deducted from the estimated reconstruction needs to arrive at the net value of reconstruction requirements.

At the personal or family level, human recovery needs are the amounts of financing which may be necessary for disaster-affected households to meet any higher costs of living arising from resulting higher unit costs of goods produced in the sector, over and above their pre-disaster expenditure levels. These higher costs may be met through the setting up of temporary government subsidies or from special cash grants to affected households to cover the temporary price increases of fuel and other products arising from the disaster in the sector.

As pointed out before, the above human recovery needs are to be estimated by the mining and quarrying sector assessment team and delivered to the separate team in charge of estimating human recovery needs. Care must be exercised to ensure these needs are not included in both places, to avoid double accounting in the overall assessment.

[10]An example of this situation was the acquisition of electricity from nearby countries that had to be undertaken last year by the electrical companies of Serbia, in view of the production losses of coal that occurred in the mining sector which did not enable the electric utilities to have sufficient coal to generate electricity in their thermal power plants.

Mining and Quarrying Sector

STANDARD PROCEDURES FOR SECTOR ASSESSMENT

Recommended Assessment Team

The composition of the sector assessment team may vary by the type of disaster and the extent of the likely damage and production flow changes.

Organization and Personnel	Role in the Sector Assessment

Personnel from:
• **The State Department of Mines**
• **Indian Bureau of Mines (IBM)**
• **State Directorate General of Mine Safety (DGMS)**
• **State Directorate of Geology**
• **Local departments and offices in the disaster-affected area who are:**
  • Mining Engineer
  • Petroleum Engineer
  • Geologist
  • Mechanical Engineer
  • Electrical Engineer
  • Mining Economist
  • Mining Investment Specialist
  • Procurement Specialist
	Lead and Coordinate

Personnel from:
• **Ministry of Mines**
• **Geological Survey of India (GSI)**
• **Indian Bureau of Mines (IBM)**
• **Directorate General of Mine Safety (DGMS) who are:**
  • Mining Engineer
  • Petroleum Engineer
  • Geologist
  • Mechanical Engineer
  • Electrical Engineer
  • Mining Economist
  • Mining Investment Specialist
  • Goods/Equipment Buyer
	Provide baseline information and facilitate the field assessment of damages and losses

Development partners (if active in the sector)	Participate and provide technical advice

Steps in conducting a PDNA in the mining and quarrying sector

Step 1. Collect baseline information on sector assets and production flows

Baseline information must be compiled before the field assessment or, if possible, prior to the occurrence of disaster. The baseline data should be validated before the field visit to serve as the basis for the estimation of damages and losses for the disaster-affected area/s. This data can be compiled at the State/Region office or at the District levels.The tables below can be used for the baseline information.

Table 1: Baseline information for mining company/companies

District Name						
Company Name 1						
Ownership	Public ( ) Private ( )					
Employees	Male		Female			
Production	Average Output / Year (Tons)					
A. Fuel minerals	Coal	Lignite	Petroleum	Natural Gas	Others	
B. Metallic Minerals	Iron	Manganese	Bauxite	Copper	Gold	Others
C. Non-Metallic Minerals	Limestone	Mica Stone	Others			
Company Name 2						
Ownership	Public ( ) Private ( )					
Employees	Male		Female			
Production	Average Output / Year (Tons)					
A. Fuel minerals	Coal	Lignite	Petroleum	Natural Gas	Others	
B. Metallic Minerals	Iron	Manganese	Bauxite	Copper	Gold	Others
C. Non-Metallic Minerals	Limestone	Mica Stone	Others			
Company Name N						
Ownership	Public ( ) Private ( )					
Employees	Male		Female			
Production	Average Output / Year (Tons)					
A. Fuel minerals	Coal	Lignite	Petroleum	Natural Gas	Others	
B. Metallic Minerals	Iron	Manganese	Bauxite	Copper	Gold	Others
C. Non-Metallic Minerals	Limestone	Mica Stone	Others			

Notes for filling Table 1

- *Other minerals mined in the area like chromite, dolomite, granites, etc. should be specified, using the accepted units e.g. tons, cubic meters, kilograms.*
- *If a mining company is a joint venture between the government and a private corporation, it can be considered public for the purpose of PDNA.*

Sources of Information

The sources of baseline information may vary by state. However, the critical list of the likely sources of information is provided below.

Ministry of Statistics and Programme Implementation	http://www.mospi.gov.in
The Registrar General & Census Commissioner, India	http://censusindia.gov.in
National Institution for Transforming India	http://niti.gov.in
Ministry of Mines	http://mines.nic.in
Make in India Initiatives	http://www.makeinindia.com
Indian Bureau of Mines	http://ibm.nic.in
Ministry of Coal	http://www.coal.nic.in
Open Government Data (OGD) Platform India	https://data.gov.in
India Brand Equity Foundation	http://www.ibef.org/
Bhuvan, Indian Geo-Platform of ISRO	http://bhuvan.nrsc.gov.in

Note 1: Please use similar institutions at State level for baseline Information

Note 2: For Non-Government information sources, please search suitably

Step 2. Estimate value of damage and production flow changes

With the baseline information in hand, field assessment should be undertaken in the affected Districts after a disaster. The assessment team from the State must work with their local counterparts in the Districts to ensure that the estimates for the damages and losses in the sector are accurate to the maximum possible extent. Direct interviews with private contractors or government officials involved in the construction and repair of facilities can also be conducted during the field trip in order to validate unit costs of repair and reconstruction (which is already contained in the baseline data).

It should be noted that since there is a possibility that only one company operates or provides the service to a number of districts; caution should be exercised to avoid double counting. It is recommended that the assessment of damages and losses of the company should be accounted for in the district where the main office of the company is located. However, if the main office is located outside the disaster area, the assessment team must account for the damages and losses of the company with an indication as to where such damages and losses occurred.

Step 2.1. Estimate the damages and losses to companies or companies

Repair and replacement costs should be estimated for the damaged components of the company/s. The time needed to reconstruct the damages should also be estimated. Aside from field visits to the disaster sites, the assessment team should interview the officers of the company/s to ascertain the extent and value of the damages and the estimated period before operations can be fully restored to the pre-disaster level. The officials and experts in the company/s can estimate their respective damages more accurately. Moreover, considering that some of the damages may cover a wide area that may be inaccessible to the assessment team, the people in the company/s can get the data quicker from their colleagues in the field.

The value of totally damaged assets can be summarized in the following table, which should be used in interviewing the officials of the mining company/s as a questionnaire.

Table 2. Damages and losses of mining companies

District Name							
Company Name							
Ownership	**Public ( ) Private ( )**						
Employees	**Male**		**Female**				
Production	**Fuel minerals ( ), Metallic Minerals ( ), Non-Metallic Minerals ( )**						
ESTIMATED DAMAGES							
Damage to Structures and Assets	**Totally Destroyed**			**Partially Damaged**		**Total Damages (Rs.)**	**Average Time to Replace or Repair (Days)**
	Number of Totally Destroyed	**Average Replacement Cost (Rs.)**	**Number of Partially Damaged**	**Average Repair Cost (Rs.)**			
	A	**B**	**C**	**D**	**E**	**F**	
Structures							
Tunnels/Underground Mines							
Office Buildings							
Pipelines							
Drilling Rigs							
Storage Facilities							
Others (Specify)							
Equipment							
Trucks							
Computers							
Others (Specify)							

Machinery						
Generators						
Pumping Equipment						
Others (specify)						
Vehicles						
Others						
TOTAL						

ESTIMATED LOSSES				
Types of Losses	**Disaster Year**	**Year 1**	**Year 2**	**Total (Rs.)**
Foregone Income				
Cleaning up of Debris				
Higher Operating Costs				
Other Unexpected Expenses				
TOTAL				

Notes for filling Table 2

- *The company/ies should fill out information appropriate to their assets. There are various machineries and equipment in the sector, which should be assessed especially those that are vital to the operation.*
- *'Average Replacement Cost' will be the average pre-disaster value of the structures and assets that were totally destroyed.*
- *'Average Repair Cost' will be the average cost of repair of the structures and assets that were partially damaged.*
- *In formula, the total damages will be (Column E) = (Column A) x (Column B) + (Column C) x (Column D).*

A note on estimated losses:

Losses in the mining sector will include the following:

- *Foregone income or lower revenues from mining operations after the infrastructure if the sites (tunnels, etc.) and assets (equipment and machineries) were destroyed by disasters reducing the productive capacity of the company.*
- *Possible higher cost of operation that may arise after the disaster, such as higher rates of electricity from alternative sources, or acquiring goods and services from alternative sources, or renting temporary premises while repairing or rebuilding the original premises*
- *Other unexpected expenditure such as demolition and removal of debris and other rehabilitation works for the site after destruction.*

Losses can continue during the entire period of recovery and reconstruction. It is expressed in monetary values at current prices.

Step 2.2. Summarize the damages and losses in the sector in the District

Based on the survey of companies or companies, the damages and losses can be summarized in the following table.

Table 3. Summary of damages and losses in a District

Name of District:								
Number of Employees	Male		Female					
Name of mining companies	Within the Disaster Year				Losses Beyond Disaster Year			
	Damages		Losses		Year 1		Year 2	
	Public	Private	Public	Private	Public	Private	Public	Private
Company 1								
Company 2								
Company N								
TOTAL								

Notes for filling Table 3

- *Public' and 'private' refers to the ownership of the mining company.*
- *The damages and losses should be accounted for under the type of ownership of the company.*

Step 2.3. Summarize damages and losses of the sector in a State

Once the summary table for each affected District has been filled out, the information should be used to summarize the damages and losses at the State level. The summary table below can be used.

Table 4. Summary of damages and losses in the State

Name of State:								
Number of employees								
Number of Employees	Male		Female					
Name of mining companies	Within the Disaster Year				Losses Beyond Disaster Year			
	Damages		Losses		Year 1		Year 2	
	Public	Private	Public	Private	Public	Private	Public	Private
Name of District:								
Company 1								
Company 2								
Company N								
Company 1								

Name of District:								
Company 1								
Company 2								
Company N								
Name of District:								
Company 1								
Company 2								
Company N								
TOTAL								

Step 3. Analyze the impacts of the damages and losses to affected population

The assessment team should analyze all potential impacts of the damages and losses of the mining and quarrying sector and must answer the following questions:

- Did the companies lay off workers that have causes massive unemployment?
- Will there be substantial reduction in foreign currency earnings due to the reduction of output, which are exported?
- Are there potential adverse environmental impacts due to the damages in the sector?
- Are there additional vulnerabilities and risks created by the damages to the sector?

The following matrix can be used to express the social impacts of the damages and losses to the mining and quarrying sector.

Matrix 1. Social impacts of the damages and losses to the mining and quarrying sector

Area of Impacts	Expected Impacts						Brief Description of Impacts
	General Population			Women and Children			
	S	M	L	S	M	L	
Employment							
Environment							
Foreign currency earnings							
Vulnerabilities							
Others (Specify)							

Notes for filling Matrix 1

- *The expected impacts are segregated into a) the impacts on the general population; and b) the impacts on women and children measured as severe (S), moderate (M) or low (L). The assessment team should mark under the column whether the impacts are S, M or L.*
- *Severe impacts are very distinct and extensive change in the situation for more than 50% of the people in the sector, which will require outside assistance for more than 6 months to enable them to cope and recover.*
- *Moderate impacts are distinct changes in the situation affecting 20% to 50% of the people in the sector, which may require 3 to 6 months outside assistance to enable the people to cope and recover.*
- *Low impacts are distinct changes but less than 20% of the people are affected and may not be widespread or only in limited areas which may require less than 3 months of outside assistance before the people recover.*
- *The impacts can be briefly described under the column "Brief Description of Impacts". For example, a brief description of a severe "environment" can happen if toxic chemicals and materials used in mining are spilled due to the disaster; the "vulnerabilities" can be described as the natural hazards that may be caused by the damages to tunnels or open pit mines; while "employment" will refer to those who might lose employment in the sector.*
- *The impacts on women and children may be different from the general population. The assessment team must be able to observe any special issues or concerns that may affect women.*

Step 4. Identify the recovery strategies and estimate recovery and reconstruction needs

The post-disaster needs must be based on a framework where policies and strategies are likewise integrated. After analyzing the potential effects and impacts if no assistance will be provided to the sector, the aggregate needs of the sector must be estimated.

Step 4.1. Identify recovery and reconstruction strategies

After the consolidation of the field assessment, the assessment team must identify or recommend the policies and strategies for the recovery and reconstruction for the sector. The following are some of the general policies and strategies that could be considered.

A. Policy measures

There are certain policies that can be adopted over a limited period, which can provide incentives to the private sector to reconstruct damaged assets with higher standards of resilience. Among them are:

1. Income tax breaks for private companies such as:
   a. Temporary reduction or freeze or deferment in the collection of tax;
   b. Temporary freeze on basic service charges in the utilization of certain services over the time of the recovery phase;

c. Non-collection of property taxes for the duration of the recovery period;

d. Exemption from registration fees for replacements of the destroyed equipment and machinery over a certain period of time.

2. Subsidizing construction materials and equipment, to be imported by private companies during the recovery and reconstruction phase, through an exemption from paying customs duties and other levies.

3. Extending the bank guarantees on loans given by the government to enable the private sector to rebuild immediately.

B. Strategies

The following strategies can be adopted for the post-disaster recovery and reconstruction activities:

a. Building Back Better (BBB). Recovery activities based on BBB principles will promote longer-term disaster risk reduction and management. BBB principle should look at the how to make infrastructure and facilities safer from future disasters like stronger engineering design, the advantages of resettlement of facilities in disaster-safe areas instead of rebuilding in the same disaster-prone areas, etc.

b. Focus on the most vulnerable and socially disadvantaged groups such as children, women, and the disabled. Recovery programming needs to give priority to the most vulnerable groups, including female-headed households, children and orphans, and the poor, and take into account those with special needs.

c. Community Participation and Use of Local Knowledge and Skills. The participation of the community in all process (identification, planning, design and implementation) of recovery activities will help ensure the acceptability of projects and optimize the use of local initiatives, resources and capacities.

d. Secure development gains. Recovery strategies, although may be a separate set of activities, must be supportive of existing development plans and must attempt to re-establish and secure previous development gains.

e. Coordinated and coherent approaches to recovery. Projects for disaster recovery must have the full and effective coordination among all involved agencies based on comprehensive information exchange, flexibility in administrative procedures, and uniformity of policies. In some instances, a special new agency may be needed to oversee, coordinate and monitor complex disaster recovery programs. Under this strategy, capacity building activities for the local public administration may be part of the recovery activities including a well-defined monitoring and evaluation system for the overall implementation of the recovery plan.

f. Efficient use of financial resources. The overall strategy should also include the identification of funding sources that are suited for the recovery activities. It should be clear how assistance to the recovery of the private sector would be delivered. Also, some cheaper source of funds from international donor partners should be initially identified for longer-term expensive projects.

g. Transparency and accountability. The overall plan and implementation of projects for recovery must be transparent, especially to those affected, through open and wide dissemination of information on all aspects of the recovery process. An effective monitoring system must be established.

Step 4.2. Estimate recovery needs

Recovery needs are intended to bring back normalcy in the sector as quickly as possible. Recovery activities should include those that will enable companies to resume their normal operations. Some of the possible recovery-related activities in the sector can include:

- Repairs of the damages to structures, which are normally affected by strong winds and floods.
- Emergency procurement of vital equipment necessary to normalize operations.
- Clearing of debris that may have affected the sector.

Step 4.3. Estimate reconstruction needs

Reconstruction needs are generally long-term in nature (3 years and more) and are intended to 'build back better' from the ruins of a disaster. It is to be noted that reconstruction activities should include both public as well as private facilities and may require different types of financing strategies.

It is to be noted that since the companies in this sector are revenue-generating enterprises, financing their needs can come through soft-term credit schemes for the reconstruction and repair of their damaged assets. Such schemes can be accompanied by technical assistance for improved disaster resilient standards of construction. Some possible reconstruction related activities in the sector could include the following:

- Soft-term credit for the replacement or reconstruction of affected structures under a building-back-better strategy to ensure future disaster resilience through the adoption and enforcement of improved construction standards;
- Procurement of equipment and machinery;
- Structural retro-fitting of undamaged or partially damaged structures so that they are not affected by disaster event in the future;
- Relocation of facilities to safer areas; and
- Other mitigation measures such as construction of support infrastructure to prevent serious landslides and floods to energy facilities.

Step 4.4. Prioritize identified projects for recovery

Among the projects identified, relative priorities can be set in order to determine which among them are the more important. Based on the broad strategies for recovery, the assessment team should select the priority projects/activities among the identified needs.

The prioritization can be made by using a set of impact indicators and the level by which the projects can achieve said impacts. Examples of the criteria that can be used are the following, among others:

a. Economic impact, which can be evaluated in terms of the relative cost to the government of not undertaking reconstruction or rehabilitation.

b. Equity and social impact, which can be in terms of the number of beneficiaries who are poor and destitute and who could not afford to rebuild on their own without outside support.

c. Sustainability, which can be in terms of the reduction of risks and vulnerability of the people and other economic assets to future disasters.

The criteria above can be placed in a matrix like the one below where the impacts are ranked according to low, medium or high. This matrix can show the relative benefits of proposed projects to the people in the affected areas, which, in turn, will inform and assist the government in determining the priority projects within the sector.

Matrix 2. Impacts of identified post-disaster projects

Name of Proposed Project	Expected Impacts on Recovery								
	Economic Impact			Equity and Social Impact			Sustainability		
	High	Medium	Low	High	Medium	Low	High	Medium	Low

The projects identified by the assessment team must be included in the above matrix.

Step 4.5. Summarize the estimated recovery and reconstruction needs and draft the implementation schedule

Based on the prioritized recovery and reconstruction needs, a summary should be created by the assessment team enumerating the post-disaster projects for the recovery and reconstruction.

The identified needs should have a rough schedule of implementation outlining at the very least the activities, timing and budget required for all the programs and projects.

The following techniques can be considered:

1. Identify the specific projects according to their relative urgency or priority in relation to recovery.
2. Plot the timeline of activities of all the projects, with the urgent ones on top, in a Gantt chart with the corresponding funding requirement on an annual basis. This will assist the national government in programming the necessary funds over a certain time period, like on a quarterly or annual basis.
3. Identify and include in the list of projects that need further feasibility studies, which may be funded by foreign grants.
4. To the extent possible, a logical framework (log-frame) should be created for each of the project proposed for inclusion in the recovery plan. Log-frames are normally required by foreign donors to consider project proposals.

Reconstruction needs mostly require long-term implementation periods. They normally require three or more years to complete. The recovery and reconstruction needs of the sector can be summarized in the table below showing the financing requirements over the years.

Table 4. Summary of recovery and reconstruction needs of the mining sector

Name of Projects	Annual Needed Amount of Assistance (Rs)			Total Needs (Rs.)
	Disaster Year	Year 1	Year 2	
Recovery Projects				
a.				
b.				
c.				
Total				
Reconstruction Projects				
a.				
b.				
c.				
d.				
Total				
GRAND TOTAL				

Notes for filling Table 7

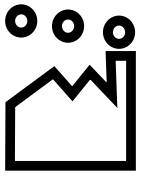
- *Project titles can be inserted under the column on recovery and reconstruction needs.*
- *Columns can be added to accommodate any additional reconstruction needs beyond Year 2.*

Step 5. Draft the post-disaster damages, losses and needs (PDNA) report of the sector

With all the information gathered using the previous steps, the assessment team can draft a report, including inputs from all the sectors, in the overall recovery and reconstruction plan. The following format may be considered:

1. Brief description of the sector in the disaster-affected areas.
2. Damages in the sector by areas and by types of assets affected.
3. Losses in the sector emphasizing the losses in income, increase in expenditures, estimated period before normalcy will be attained, etc.
4. Impact on the livelihood, individual households, vulnerable groups and the consequences to the greater community if no assistance for recovery will be provided.
5. Proposed strategies for recovery and reconstruction of the sector.
6. Needs of the sector, by priority, and the draft schedule of implementation with the estimated funds required for each project over time.

The draft sector report should be submitted to the State Disaster Management Office for consolidation.



Manufacturing Sector

This section contains the following contents – specific to this sector – in order to guide the user to successfully conduct post-disaster needs assessment in India:

1. **The Introduction to the Sector**
    a. Baseline information
    b. Post-disaster Situation and Performance
    c. Estimation of Disaster Effects
    d. Estimation of Disaster Impact
    e. Estimation of Post-Disaster Recovery and Reconstruction Requirements
2. **The Standard Procedure for the Sector Assessment**
    a. Recommended Assessment Team
    b. Steps in conducting a PDNA in the manufacturing sector
        - Collect baseline information on sector assets and production flows
        - Estimate value of damage and production flow changes
        - Analyze the impacts of the damages and losses to affected population
        - Identify the recovery strategies and estimate recovery and reconstruction needs
        - Draft the post-disaster damages, losses and needs (PDNA) report of the sector

The user is advised to refer to:

a. *The "Introduction of the PDNA Manual" for a complete information of the concepts and definitions on the post-disaster needs assessment (PDNA);*
b. *The section on "Disaster Effects and Impact Assessment"for a more detailed discussion in identifying the possible impacts within and across sectors; and*
c. *The section on "Estimation of Post-Disaster Recovery and Reconstruction Needs"for a more detailed discussion on identifying and prioritizing post-disaster needs*

Introduction

The manufacturing sector in India comprises the following industries, as per the System of National Accounts[11] :

- Food (Meat, Fish, Fruits, Vegetables and Oils)
- Dairy Products
- Grain Mills Products
- Other Food Products
- Beverages
- Tobacco Products
- Spinning, Weaving and Finishing of Textiles
- Wearing Apparel
- Leather and Fur Products
- Wood and Wood Products
- Furniture
- Paper and Printing
- Rubber, Petroleum Products
- Chemicals and Chemical Products
- Non-metallic Products
- Basic Metals
- Metal Products and Machinery
- Electrical Machinery
- Other Manufacturing, and
- Transport Equipment Manufacturing.

It must be noted that in India the manufacturing sector is not normally included in post-disaster impact and needs assessments. A review of existing reports on the subject indicates that: (i) for the purpose of estimating disaster relief assistance, the manufacturing sector is not included; and (ii) that even in more thorough assessments conducted in cases of major disasters with assistance from international organizations, the manufacturing sector was not assessed. A partial exception to the latter statement may be found in the case of the Gujarat earthquake in 2001, where numerous industrial enterprises sustained widespread destruction and significant disruption of production.[12] However, in the opinion of the ADPC team experts, the value of

[11]According to the India System of National Accounts, this sector falls under "Manufacturing".See National Account Statistics, 2013, Central Statistical Office, Ministry of Statistics and Programme Implementation, Government of India, New Delhi, 2013.

[12]See India, Gujarat Recovery Program, Assessment Report, Annex 13, Industry, pages 72 to 76, The World Bank and the Asian Development Bank, New Delhi, March 14, 2001.

industrial production losses arising from the disaster was significantly under-estimated, perhaps because of the fact that these industries were privately owned and because the anticipated higher demand for industrial products for reconstruction was expected to offset such losses.

The fact that manufacturing industries belong to the private sector does not warrant the assumption that they have insurance and thus they would need no post-disaster assistance for recovery and reconstruction is not valid. In fact, insurance penetration in India – as in other developing countries – is relatively low; and it is often found that those companies that are insured, coverage is normally restricted to physical assets (premises, machinery and equipment), but do not necessarily include production losses arising from disasters. That is more evident for the case of micro- and small-to-medium enterprises whose savings capacity and credit worthiness is limited. Such a limitation in post-disaster assistance makes such enterprises very vulnerable to the impact of disasters, and these industries generate a relatively large number of jobs for the population which, when disaster strikes, are left without adequate household income.

When pointing out such a limitation in post-disaster assessments and assistance programs the intention is not to have the Central and State governments to provide direct assistance to the enterprises and to the affected household members that lose jobs and income; the intention is exclusively to highlight that these enterprises have recovery and reconstruction needs that need to be channelled through the private sector banking and the development banks. In the case of micro-industries, they may require financial assistance through different modalities, since they are not necessarily credit worthy and cannot expect to meet their post-disaster requirements through the private banks.

One of the important phenomenon in the manufacturing sector is the presence of informal sector. Generally, the workers in the informal sector are mostly self-employed engaged in micro-scale manufacturing like handicrafts, home-based food processing, etc. Due to the vulnerabilities of the informal sector and its workers, special efforts should be made to assess the potential adverse impacts to the workers and their families.

In any case, any post-disaster assessment should cover the estimation of damage and production flow changes of the manufacturing sector, in its different types of industries, to ascertain disaster impact and to estimate their recovery and reconstruction financial requirements. Leaving the sector out of the assessment is a sure way to put aside a sizable number of the labour force that may lose employment and income.

Baseline Information

The following baseline information on the characteristics and capacity of the manufacturing sector and its different branches of activity must be obtained to provide the quantitative basis required for the assessment:

- Number and size of industrial establishments, by branch, type and size of industry, existing in the affected area;
- Typical physical facilities in each of the above, including a description of the number and capacities of industrial buildings, equipment and machinery;
- Information on annual or monthly gross production for each industrial establishment; and
- Quantitative information on the usual destination of manufactured goods, whether they are produced for domestic consumption or for export to other countries.

This type of information is available in the most recent industrial survey or census that the country or State may have undertaken, which may have been conducted either by the ministry of industry or by the Statistical Office in the affected State. Further information may be obtained from the national accounts handled by the Central and State Statistical Offices. Since this information may already be out of date at the time of the assessment, projections to the current year must be made by the industry assessment team on the basis of recent growth rates for the sector in the affected State.

Additional information may be obtained through direct contacts with private sector associations of industry, which may have or may be able to obtain full particulars about the installed capacities and production of their associated enterprises. In fact, such private sector bodies may become partners in conducting the assessment, since they are likely very keen in defining post-disaster needs for recovery and reconstruction.

On the basis of the previously listed information, a typology of industries, by branch of industrial activity, size, and private and public ownership is to be defined for purposes of the assessment. The branches of industrial activities to be analyzed should be defined on the basis of the national accounting system of the country in question, as described above.

Post-Disaster Situation and Performance

The manufacturing sector assessment team should conduct field visits to determine the effects of the disaster in the affected industries, and/or rely on existing reports from qualified stakeholders that may have already conducted assessments, however preliminary they may be. In the latter case, the industry sector assessment team should validate, homogenize and supplement the existing estimations on the basis of their primary observations in the field.

In addition to the above, a sample survey of typical manufacturing establishments is to be conducted on a parallel fashion, in order to be able to assess the value of damage and to estimate possible changes in production flows for the sector. Needless to say, this sample survey should cover a sufficient number of all types of affected industries in the disaster area to obtain representative values of damage and production losses, as well as representative needs for recovery and reconstruction for the sector. A questionnaire for such sample survey has been developed and frequently and successfully used in other disaster-stricken countries.

As indicated before, any existing reports – however partial in coverage – must be used by the manufacturing sector team in conjunction with the field visits and the sample survey mentioned above, to estimate the number of industrial establishments of each pre-defined type that may have sustained total or partial destruction and whose production may have been affected directly or indirectly by the disaster.

The field visits by the assessment team, coupled with the sample survey questionnaire responses, should enable to define the average type and value of damage for each industry establishment type, the time of production stoppage or decline due to different reasons[13], and the likely requirements for recovery and reconstruction. During the same field visits, unit reconstruction and replacement costs for repair and

[13]Production stoppage or decline may be due to several possible reasons, such as: destruction of premises, equipment and machinery; temporary unavailability of raw materials for processing and of essential inputs such as electricity and water; and temporary unavailability of sufficient labor.

rebuilding of physical assets as well as replacement of equipment and machinery are to be obtained, through interviews with industry executives and representatives. Any difficulties and limitations foreseen by the owners of such industries – for instance, in terms of financial and credit requirements, availability of raw materials and inputs, availability of labour, time required for replacement of specialized equipment and machinery, etcetera – are also to be identified.

On the basis of the information thus collected and in combination with the baseline data on existing physical capacities and normal or non-disaster production, the manufacturing sector assessment team must develop a scenario of how the sector, will likely function after the disaster until full recovery and reconstruction is achieved. This would include developing separate calendars for the repair and reconstruction of buildings and other facilities, replacement of equipment and machinery and for the resumption of normal or non-disaster production levels over time.

Estimation of Disaster Effects

After a disaster, the manufacturing sector may sustain the destruction of its assets (damage) that may include buildings, equipment and machinery, stocks of raw materials and of manufactured goods.

In addition, the sector may face disruptions in its production flows, including production decline arising from the fact that the sector assets are destroyed or to other causes associated to the disaster (such as lack of raw materials, strategic inputs of water and electricity, temporary absence of labour, lack of working capital, etcetera). Industries may also face higher costs of production that arise from having to purchase raw materials and inputs from alternative, more costly sources.

Some branches of industry – such as the food-producing industries – that rely in the production obtained from other sectors of the economy for raw material purposes may also sustain production decline even if no damage has happened to the industrial facilities.[14]

As in the case of other sectors, the value of damage in the manufacturing industry is measured initially in physical terms and is subsequently converted into monetary terms by using the reconstruction or replacement cost of the destroyed physical assets, to the same quality and quantity standards and using unit replacement costs that prevailed prior to the disaster.[15]

Changes in production flows in the manufacturing sector refer to the value of the decline in industrial output and to possible increases in production costs that may arise after, and as a consequence of, the disaster. Increases in production costs represent in fact increases in intermediate consumption for the sector, and are to be treated accordingly when estimating the macroeconomic impact of the disaster. Post-disaster reconstruction activities, on the other hand, may actually induce an increase in the demand and production

[14]This is a typical example of grain milling and other food processing industries that after a disaster may face shortages of raw materials for processing, due to the primary production losses in agriculture, livestock and fishery, even if the industrial capacity has not been negatively affected by destruction.

[15]The possibility of reconstruction or replacement using improved, disaster-resilient standards, as part of a possible strategy of "building back better", is to be introduced later when estimating financial requirements for recovery and reconstruction.

of certain manufactured goods, which case is analyzed later on in the assessment when estimating the possible positive impact of reconstruction.

The assessment of disaster effects in the manufacturing sector is more complex than in other sectors of economic activity in view of the usually large number of existing industrial establishments, of different types and size, which are usually spread over large areas of a country. Moreover, despite the fact that there is a ministry of industries, most industrial establishments are privately owned,a fact that increases the difficulty to obtain information on disaster effects. Therefore, a special sample survey of affected industrial establishments should be carried out in parallel to the field visits to be made by the manufacturing sector assessment team, and its results are to be combined with the existing baseline information in order to cover the entire universe of the sector.

To facilitate the assessment, the cooperation of industrial associations of the private sector, which usually have direct access to information from its associated individual members and which share interest in obtaining post-disaster assistance, should be enlisted.

The composition of the assessment team for the manufacturing sector should include civil or industrial engineers for the estimation of damage; the estimation of production flow changes usually requires the participation of industrial economists with relevant experience in the field.

Destruction of premises, equipment and machinery

The value of destroyed assets (damage) in this sector should be estimated on the basis of the cost to rebuild or repair the buildings and other associated facilities that were totally or partially destroyed, as well as the replacement value of the furniture, equipment, machinery and supplies that were also similarly affected. It is to be assumed that these assets need to be replaced with the same capacity and quality they had prior to the disaster, and using the unit reconstruction and replacement costs that prevailed at the time of the disaster.[16]

In view of the usually very large number, size and type of industrial establishments existing in the disaster-affected area, the damage assessment must rely on information obtained from the already-mentioned, parallel sample survey to define average values of damage for each type or branch of industry, and on counts of the number of each industry type that were either totally or partially destroyed. Then, an extrapolation of the value of damage to cover the entire universe of industrial establishments in the affected area or State must be made based on an assumed ratio of destructed versus total number of industry shops[17]. The accuracy of this extrapolation of course is of paramount importance, and the manufacturing sector assessment team should devote sufficient time in order to discuss and agree on such ratio, so that results are reliable.

[16]Any higher costs involved in building to improved, disaster-resilient standards and in retrofitting existing structures will be included as part of the subsequent estimation of needs in the assessment. If for some reason, the equipment and machinery that was destroyed can only be substituted by more modern and capable machinery, the additional costs involved should be taken into consideration during the estimation of needs.

[17]In some other countries, when an actual ratio has not been possible to obtain for the particular assessment under reference, use has been made of the ratio of destroyed to existing housing units (obtained from the housing sector assessment) to be representative of the ratio for the case of micro-sized and small-to-medium sized enterprises.

In addition to the estimated value of damage, the manufacturing sector assessment team should obtain data on the average age of the destroyed infrastructure, machinery and equipment, and deliver such information to the macroeconomic assessment team for estimation of disaster impact on the capital account. It is to be noted, however, that the value of destroyed assets is that of their replacement costs, and not that of their depreciated or "book value".

In spite of the already-acknowledged low penetration rate of insurance in India, the industrial sector assessment team should obtain information on the possible existence of insurance on destroyed premises, machinery and equipment as well as on industrial production. The questionnaire for the industrial sample survey includes questions that are pertinent to the issue of insurance, and the manufacturing sector assessment team should inquire about the matter during the field visits. The manufacturing assessment team should also visit local insurance enterprises in order to obtain information on insurance coverage for the sector, the typical percentage of covered assets and production and the likely delay that may occur before delivery of insurance proceeds to the affected industrial establishments.[18]

Disruption of industrial production

The estimation of the value of possible and temporary industrial production flow changes must be made by the manufacturing assessment team on the basis of several considerations, of which the time frame for their occurrence is of paramount importance. Production flow changes will normally occur over the time period required to achieve full reconstruction of premises, replacement of destroyed machinery, and to obtain full availability and flow of raw materials and inputs. Production flow changes are likely to occur due to:

- Damage to the industrial capacity, in terms of destruction of buildings, equipment and machinery;
- Temporary stoppage of production due to lack of electricity or water;
- Temporary disruption of raw material availability and inflow;
- Temporary unavailability or shortages of labour;
- Future unavailability of raw materials in agro-industrial plants due to expected future losses in agriculture, livestock and fishery production that may occur after the disaster itself;[19]
- Insufficiency or non-existence of working capital at the enterprise; and
- Possible changes (decline or increase) in demand of the manufactured goods, which may arise from possible generalized income decline of the population and from the expected high demand for construction materials for the reconstruction, respectively.

The manufacturing sector assessment team should derive a preliminary calendar of how and when the above mentioned limiting factors would be overcome, giving due consideration to the availability of and

[18]The manufacturing sector assessment team should realize that the value of damage is not to be reduced by the amount of possible insurance coverage; the possible availability of insurance is to be used later on when estimating the value of recovery and reconstruction requirements. Putting it in different words, the existence of insurance – total or partial – does not affect the value of destroyed assets and lower production, but will diminish the amount of recovery and reconstruction requirements.

[19]This is a typical case for the food-processing industry, but also applicable to other agro-industry enterprises that may face shortages of raw materials after the disaster, caused by future losses in primary agriculture, livestock and fishery production.

difficulties to obtain adequate financing and to the time required to import replacement equipment and machinery that is not manufactured in India and that may need to be imported from abroad.

The changes in production flows to be estimated in the manufacturing sector should include both possible production decline and possible operational cost increases. Production decline losses are to be estimated on the basis of the expected time frames required to achieve normal or non-disaster levels of production, after overcoming the possible limitations described above. Increased operational costs may arise due to the following possible reasons:

- Payment of overtime to staff to attend and solve most urgent problems in the factories immediately after the disaster occurs;
- Rental of alternative premises while the destroyed or damaged ones are being rebuilt or repaired;
- Temporary acquisition of electricity and water for the production process from alternative sources, such as renting or acquiring portable power generators or resorting to purchase water from alternative sources other than the pipeline network; and
- Temporary acquisition of raw materials from alternative sources that may be more costly and/or located in far-away locations including other countries.

The latter higher costs of production constitute, in fact, increased intermediate consumption for the industrial process, which would have a negative bearing on the added value of industrial production but which may increase commerce sales.

The estimated values of damage and changes in production flows should be broken down according to ownership by public and private sector. In this regard, it should be recalled that some industrial enterprises might be public-sector owned, private sector owned, as well as some cases that may be jointly owned.

Estimation of Disaster Impact

The industrial or manufacturing sector assessment team must make additional estimations in this sector that may have an impact at both the macro-economic and personal or household levels, and deliver them to the separate assessment teams handling those issues.

For the macro-economic impact analysis, the following figures must be estimated and delivered to the macro-economic assessment team:

- The estimated value and calendar of industrial production flow changes (including gross production decline and possible higher production costs), expressed in current value, to be used for the analysis of disaster impact on gross domestic product and growth;
- The estimated value of industrial goods that will not be possible to export to other countries due to the estimated decline in production, and/or the estimated values of goods that may need to be imported from abroad due to shortages in their domestic production, since they will have a bearing on the balance of trade and payments;
- The estimated imported component of the manufacturing sector reconstruction costs (including the items that are not produced locally in India and that will have to be imported from abroad), expressed

in percentage (%) terms of reconstruction needs once they have been assessed, to be used for the analysis of disaster impact on the balance of payments;

– Estimated values of tax revenues that will not be accrued by the Central or State governments due to the decline in industrial production, to be used for fiscal sector impact analysis; and

– Values of decline in production and higher production costs arising from the disaster in the case of government-owned industrial enterprises, to be used in the analysis of disaster impact on the fiscal sector.

In order to estimate possible disaster impact at personal or household levels and on human development, estimates of industrial production decline and of associated employment losses should be delivered to the team in charge of the subject. It is to be remembered that the subsequent losses in personal or household income that arise from production losses in the manufacturing sector should not to be added to the estimated value of production flow changes, since that would result in double accounting of disaster effects. Rather, these losses in personal and household income are disaster effects measured at a different level of analysis.

Estimation of Post-Disaster Recovery and Reconstruction Requirements

Financial requirements or needs for recovery of the manufacturing sector are defined as the amounts of funding that are required to ensure returning the sector to its normal or non-disaster level of production performance.

The value of such needs may include the availability of credit to provide the affected industrial establishments with sufficient working capital to re-start and conduct normal operations, which also may include financing to reschedule non-performing loans arising from the disaster. It is to be noted that such financing is not expected to come from the Central or State governments; rather, the government should make the necessary representations to the development and private banking system to ensure the availability of sufficient fresh funding for recovery purposes, under softer-term conditions to adjust to the post-disaster conditions.[20] Recovery financial resources may be channelled to industrial entrepreneurs through a set of alternatives ways, depending on their size and credit worthiness, which may include:

– Cash grants to micro-enterprises;

– Soft-term credit with lower-than-normal interest rates and long repayment periods for small to medium sized enterprises (SMEs), channelled through the development and private banks; and

– Possible temporary tax relief schemes for large industries that may be partially insured or non-insured.

The amounts required for such recovery financing may be estimated by industrial economists in the manufacturing sector assessment team on the basis of the value of production decline caused by the

[20] Needless to say, this refers to lower interest rates and longer repayment periods, different from the normal credit conditions that govern normal banking operations.

disaster, for each type and kind of industrial establishment. Experience acquired in the application of disaster impact assessment over the past 40 years shows that industrial sector recovery needs may range between 25 to 40 per cent of the estimated value of production losses[21]. Data arising from the sample survey of industrial establishments may assist the manufacturing sector assessment team members to define the actual range of working capital needs as a function of production losses.

The manufacturing sector assessment team should next deduct from the above-estimated recovery needs any expected amounts of insurance-on-production proceeds that would be forthcoming to the industrial enterprises which may have had such type of insurance coverage, to arrive at the net value of economic recovery needs.

Needs for reconstruction under a "building-back-better" strategy (that includes disaster-resilient features) need to be estimated by the manufacturing assessment team taking the estimated value of replacement of destroyed assets (including buildings, equipment and machinery) and increasing it by a certain percentage whose magnitude will be a function of the degree of technological modernization and disaster-risk reduction defined in the adopted reconstruction strategy. This means that the value of reconstruction needs will be higher that the estimated value of damage.

In this connection, the manufacturing sector assessment team should keep in mind the fact that replacement of destroyed equipment and machinery may not be possible using the same characteristics and capacities which the assets had prior to the disaster, because of technological obsolescence, and that the replacement equipment and machinery may have improved characteristics and performance as well as different unit costs. Such issue needs to be factored in when estimating post-disaster reconstruction requirements.

Experience acquired in this regard, over the past 40 years of disaster impact assessment, reveals that the range to be used for estimating needs over damage in the manufacturing sector may range from 15 to 30 per cent, depending on the type of equipment and machinery involved[22]. The exact percentage to be adopted in each case of equipment and machinery to be replaced is to be defined by industrial engineers that compose the manufacturing sector assessment team.

The estimated value of reconstruction needs is to be reduced whenever the industrial enterprises had insurance on destruction of assets, after data is obtained from insurance companies in regard to the likely value of insurance proceeds that the industrial enterprises may actually receive in due time.

Human recovery needs in this sector refer to the possible and temporary loss of employment and income of the labour force associated to the manufacturing sector, arising from the destruction and production disruption caused by the disaster, until full recovery and reconstruction is achieved. The amounts of employment losses and corresponding income decline are not estimated by the manufacturing assessment team. Rather, the data on production decline and its estimated time period of occurrence as estimated by the manufacturing sector assessment team is to be used by the human recovery needs assessment team as an input to estimate the personal or household income decline that will be sustained by the labour force of the industry and other sectors of economic activity.

[21]See Jovel, Roberto, Damage, Loss and Needs Assessment Guidance Notes, Volume 3, Estimation of Post-Disaster Needs for Recovery and Reconstruction, Global Facility for Disaster Reduction and Recovery, The World Bank, Washington, D.C., 2010.

[22]See note above.

Manufacturing Sector

STANDARD PROCEDURES FOR SECTOR ASSESSMENT

Recommended Assessment Team

The composition of the sector assessment team may vary by the type of disaster and the extent of the likely damage and production flow changes.

Organization and Personnel	Role in the Sector Assessment

State Personnel from:
• **Department of Heavy Industries and Public Enterprises**
• **Department of Public Enterprises (DPE)**
• **Department of Micro, Small and Medium (MSM Enterprises**
• **Local departments and offices in the disaster-affected area:**
  • Civil Engineer (Manufacturing)
  • Industrial Engineer
  • Mechanical Engineer
  • Manufacturing Investment Specialist
  • Industrial Economist
  • Manufacturing Operations Specialist
  • **Goods/Equipment Buyer**
	Lead and coordinate

Personnel from:
• **Ministry of Heavy Industries and Public Enterprises**
• **Department of Public Enterprises (DPE)**
• **Ministry of MSM Enterprises**
• **Ministry of Corporate Affairs**
• **National Small Industries Corporation Limited (NSIC)**
  • Civil Engineer (Manufacturing)
  • Industrial Engineer
  • Mechanical Engineer
  • Manufacturing Investment Specialist
  • Industrial Economist
  • Manufacturing Operations Specialist
  • Goods/Equipment Buyer
  • Logistics/supply chain expert
	Provide baseline information and facilitate the field assessment of damages and losses

Development partners (if active in the sector)	Participate and provide technical advice

Steps in conducting a PDNA in the manufacturing sector

Introduction

The manufacturing sector has both the formal and informal sectors which should be included in the assessment. Although the informal sector may be difficult to assess due to its nature, they must be assessed since a large number of people depend on the micro-scale manufacturing activities for their livelihood. The inclusion of their assessment in the PDNA will provide the necessary information to the government on how the informal sector can be integrated in the post disaster recovery program.

Step 1. Collect baseline information on sector assets and production flows

Baseline information must be compiled before the field assessment or, if possible, prior to the occurrence of disaster. The baseline data should be validated before the field visit to serve as the basis for the estimation of damages and losses for the disaster-affected area/s. This data can be compiled at the State/Region office or at the District levels. The tables below can be used for the baseline information.

Table 1. Baseline information of manufacturing facilities in a District

Name of District:								
Type of company in the Formal Sector	Number							
	Micro		Small		Medium		Large	
	Public	Private	Public	Private	Public	Private	Public	Private
A. Manufacturing								
Food (Meat, Fish, Fruits, Vegetables and Oils)								
Dairy Products								
Grain Mills Products								
Other Food Products								
Beverages								
Tobacco Products								
Spinning, Weaving and Finishing of Textiles								
Wearing Apparel								
Leather and Fur Products								
Wood and Wood Products								
Furniture								
Paper and Printing								
Rubber, Petroleum Products								
Chemicals and Chemical Products								
Non-metallic Products								
Basic Metals								

Metal Products and Machinery								
Electrical Machinery								
Other Manufacturing								
Transport Equipment Manufacturing								
Others								
TOTAL								

	Micro		**Small**	
Type of companies in the Informal Sector	**Number of Businesses**	**Number of People Employed**	**Number of Businesses**	**Number of People Employed**
Food Processing				
Handicrafts				
Others (Enumerate)				
TOTAL				

Note for filling Table 1

- *The businesses included in the above table are those that are not included in the assessment of the other sectors. For example, airlines, buses, taxis etc. should not be included here since they are subsumed in the assessment of the transport sector. To avoid double counting, the assessment team must have knowledge of the coverage of the other sectors.*
- *The businesses in the informal sector must be included in the list.*
- *In the manufacturing sector, most of the companies are private in nature.*

Sources of Information

The sources of baseline information may vary by state. However, the critical list of the likely sources of information is provided below.

Ministry of Statistics and Programme Implementation	http://www.mospi.gov.in
The Registrar General & Census Commissioner, India	http://censusindia.gov.in
National Institution for Transforming India	http://niti.gov.in
Ministry of Food Processing Industries	http://mofpi.nic.in
Ministry of Micro, Small & Medium Enterprises	http://msme.gov.in/mob/home.aspx
Open Government Data (OGD) Platform India	https://data.gov.in
Society of India Automobile Manufacturers	http://www.siamindia.com
Make in India Initiatives	http://www.makeinindia.com
India Brand Equity Foundation	http://www.ibef.org

Note 1: Please use similar institutions at State level for baseline Information

Note 2: For Non-Government information sources, please search suitably

Step 2. Estimate value of damage and production flow changes

With the baseline information, field assessment should be undertaken in the affected Districts after a disaster. The assessment team from the State must work with their local counterparts in the Districts to ensure that the estimates for the damages and losses in the sector are accurate to the extent possible. Direct interviews with private contractors or government officials involved in the construction and repair of facilities can also be conducted during the field trip in order to validate unit costs of repair and reconstruction (which is already contained in the baseline data).

It should be noted that since there is a possibility that only one company provides the service to a number of Districts and States; caution should be exercised to avoid double counting. It is recommended that the assessment of damages and losses of the company should be accounted for in the District where the main office of the company is located. However, if the main office is located outside the disaster area, the assessment team must account for the damages and losses of the company with an indication as to where such damages and losses occurred.

Step 2.1. Estimate the damages and losses to manufacturers in the formal sector

Repair and replacement costs should be estimated for the damages of the sector. The time needed to reconstruct the damages should also be estimated. During the field visits to the disaster sites, the assessment team should interview the officers of the company/iess to ascertain the extent and value of the damages and the estimated period before operations can be fully restored to the pre-disaster level.

To assess the value of damages and losses, the following can be done:

a) The assessment team can arrange a meeting with the owners of manufacturing companies and require them to fill out the questionnaire below.

The following table should be used as a questionnaire in interviewing key informants.

Table 2. Questionnaire on the value of damages and losses of a company in the manufacturing formal sector

<table>
<tr><td colspan="7">Name of District:</td></tr>
<tr><td>Name of Company</td><td colspan="6"></td></tr>
<tr><td>Line of Business</td><td colspan="6">Manufacturing ( ) Others ( )</td></tr>
<tr><td>Category</td><td colspan="6">Micro ( ) Small ( ) Medium ( ) Large ( )</td></tr>
<tr><td>Ownership</td><td colspan="6">Public ( ) Private ( ) Public-Private Joint Venture ( )
Public-Foreign Joint Venture ( ) Private-Foreign Joint Venture ( )</td></tr>
<tr><td>Number of Employees</td><td>Male</td><td></td><td>Female</td><td colspan="3"></td></tr>
<tr><td colspan="7">ESTIMATED DAMAGES</td></tr>
<tr><td rowspan="2">Damage to Structures and Assets</td><td colspan="2">Totally destroyed</td><td colspan="2">Partially damaged</td><td rowspan="2">Total damages (Rs)</td><td rowspan="2">Average Time to Replace or Repair (Days)</td></tr>
<tr><td>Number of totally destroyed</td><td>Average Replacement Cost (Rs)</td><td>Number of partially damaged</td><td>Average Repair Cost (Rs)</td></tr>
<tr><td></td><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td></tr>
</table>

Structures						
Equipment						
Stocks/Inventories						
Others (Specify)						
TOTAL						

ESTIMATED LOSSES				
Types of Losses	**Disaster Year**	**Year 1**	**Year 2**	**Total (Rs)**
Foregone Income				
Cleaning up of Debris				
Higher Operating Costs				
Other Unexpected Expenses				
TOTAL				

Notes for filling Table 2 and 3

- *The assessment team must specify the assets of the company that is being assessed. For instance, in the agro-industry sub-sector, assets can include:*
  - *Structures: office buildings, factory buildings, warehouses;*
  - *Equipment: production equipment, machineries, and generators;*
  - *Stocks/Inventories: raw agricultural produce (input), product packaging, final products (output);*
  - *Others: vehicles, forklifts, and other assets.*
- *'Average Replacement Cost' will be the average pre-disaster value of the structures and assets that were totally destroyed while 'average repair cost' will be the estimated cost of repair of the partially damaged assets.*
- *In formula, the total damages of the companies surveyed will be (Column E) = (Column A) x (Column B) + (Column C) x (Column D).*
- *Years 1 to 2 are the years after the disaster.*

A note on estimated losses:

- *Losses in the sector will include the following:*
  - *Foregone income after the structures, equipment and machineries of factories were damaged or destroyed by disasters.*
  - *Additional expenses to clean and rehabilitate the factory site after destruction.*
  - *Possible higher cost of operation that may arise after the disaster, such as payment of higher rates of electricity from alternative sources, or acquiring raw materials from alternative sources, or renting temporary premises while repairing or rebuilding the original premises*
- *These losses would continue during the entire period of reconstruction and recovery and are expressed in monetary values at current prices.*

Step 2.2. Estimate the damages and losses to manufacturers in the informal sector

To assess the value of damages and losses, the following can be done:

a) For the numerous small traders and vendors in the informal sector, the assessment team can interview with the head of their association to get the estimate of the number of vendors affected and the aggregate value of their damages and losses

Table 3. Questionnaire on the value of damages and losses of a company in the manufacturing informal sector

Name of District:						
Name of Company						
Line of Business	Food processing ( ) Handicrafts ( ) Others ( )					
Category	Micro ( ) Small ( )					
Ownership	(Private)					
Number of Employees	**Male**		**Female**			
ESTIMATED DAMAGES						
Damage to Structures and Assets	**Totally Destroyed**		**Partially Damaged**		**Total Damages (Rs.)**	**Average Time to Replace or Repair (Days)**
	Number of totally Destroyed	**Average Replacement Cost (Rs)**	**Number of Partially Damaged**	**Average Repair Cost (Rs.)**		
	A	**B**	**C**	**D**	**E**	**F**
Structures						
Equipment						
Stocks/Inventories						
Others (Specify)						
TOTAL						
ESTIMATED LOSSES						
Types of Losses	**Disaster Year**			**Year 1**	**Year 2**	**Total (Rs.)**
Foregone Income						
Cleaning up of Debris						
Higher Operating Costs						
Other Unexpected Expenses						
TOTAL						

Step 2.3 Summarize the damages and losses in the sector in the District

Based on the survey of businesses, the damages and losses can be summarized in the following table.

Table 4. Summary of damages and losses

Name of District:																
Total Number of Affected Workers in the Formal Sector									Male				Female			
Total Number of Affected Workers in the Informal Sector									Male				Female			
Formal Sector	Within the Disaster Year (Rs)								Losses Beyond Disaster Year (Rs)							
	Damages				Losses				Year 1				Year 2			
	Mi	S	Me	L	Mi	S	Me	L	Mi	S	Me	L	Mi	S	Me	L
Manufacturing																
Construction Materials																
Beverages																
Chemicals																
Agro-industry																
Others																
Informal sector																
Food Processing																
Handicrafts																
Others (Enumerate)																
TOTAL																

Note for filling Table 4

- *The number of those in the informal sector and the estimated total value of their damages and losses are derived from the interview of the head of their associations. The informal sectors are generally microbusinesses by category.*
- *"Mi" refers to micro enterprises*
- *"S" for small enterprises*
- *"Me" for medium enterprises*
- *"L" for large enterprises*
- *The value of damages and losses should be placed under the category to which the businesses belong. For example, the damages and losses of a medium-sized business should be placed under the Me column.*

Step 2.4 Summarize the damages and losses in the sector in the State

Once the summary table for each affected District has been filled out, the information should be used to summarize the damages and losses at the State level. The summary table below can be used.

Table 5. Summary of damages and losses in a State

Name of State:																
Total Number of Affected Workers in the Formal Sector									Male				Female			
Total Number of Affected Workers in the Informal Sector									Male				Female			
Formal Sector	Within the Disaster Year (Rs.)								Losses Beyond Disaster Year (Rs)							
	Damages				Losses				Year 1				Year 2			
	Mi	S	Me	L	Mi	S	Me	L	Mi	S	Me	L	Mi	S	Me	L
Manufacturing																
Construction Materials																
Beverages																
Chemicals																
Agro-industry																
Others																
Informal Sector																
Food Processing																
Handicrafts																
Others (Enumerate)																
TOTAL																

Step 3. Analyze the impacts of the damages and losses to affected population

The assessment team should analyze all potential impacts of the damages and losses of the sector and must answer the following questions:

- Are there potential losses of employment in the formal sector?
- Is there a possible reduction in foreign currency earnings if the industry affected is exporting its products like cement, etc.
- Are there potential losses of livelihood in the informal sector?
- What are the impacts on the quality of life of the affected population, especially the poor?

The following matrix can be used to express the social impacts of the damages and losses to the commerce and industry sector.

Matrix 1. Social impacts of the damages and losses to the commerce and industry sector

Area of Impacts	Expected Impacts						Brief Description of Impacts
	General Population			Women and Children			
	S	M	L	S	M	L	
Employment/Income							
Livelihood							
Poverty							
Others (Specify)							

Notes for filling Matrix 1

- *The expected impacts are segregated into a) the impacts on the general population; and b) the impacts on women and children measured as severe (S), moderate (M) or low (L). The assessment team should mark under the column whether the impacts are S, M or L.*
- *Severe impacts are very distinct and extensive change in the situation for more than 50% of the people in the sector which will require outside assistance for more than 6 months to enable them to cope and recover.*
- *Moderate impacts are distinct changes in the situation affecting 20% to 50% of the people in the sector which may require 3 to 6 months outside assistance to enable the people to cope and recover.*
- *Low impacts are distinct changes but less than 20% of the people and may not be widespread or only in limited areas which may require less than 3 months of outside assistance before the people recover.*
- *The impacts can be briefly described under the column "Brief Description of Impacts". For example, a brief description of a severe "employment" impact can be a massive retrenchment of employees by damaged factories; the "livelihood" can be described as the number of micro entrepreneurs whose businesses were totally destroyed; while the impact to "poverty" can be the number of people whose living standards will go down in the poverty level.*
- *The impacts on women and children may be different from the general population. For instance, a large number of women may lose their livelihood if most of them are engage in small scale trading. The assessment must be able to identify some other issues.*

Step 4. Identify the recovery strategies and estimate recovery and reconstruction needs

The post-disaster needs must be based on a framework where policies and strategies are likewise integrated. After analyzing the potential effects and impacts if no assistance will be provided to the sector, the aggregate needs of the sector must be estimated.

Step 4.1 Identify recovery and reconstruction strategies

After the consolidation of the field assessment, the assessment team must identify or recommend the policies and strategies for the recovery and reconstruction for the sector.

The following are some of the general policies and strategies that could be considered.

A. Policy Measures

There are certain policies that can be adopted over a limited period, which can provide incentives to the private sector to reconstruct damaged assets with higher standards of resilience. Among them are:

1. Income tax breaks for private companies such as:
    a. Temporary reduction or freeze or deferment in the collection of tax;

b. Temporary freeze on basic service charges in the utilization of certain services over the time of the recovery phase;

c. Non-collection of property taxes for the duration of the recovery period;

d. Exemption from registration fees for replacements of the destroyed equipment and machinery over a certain period of time.

2. Subsidizing construction materials and equipment to be imported by private companies during the recovery and reconstruction phase through an exemption from paying customs duties and other levies.

3. Extending bank guarantees on loans by the government to enable the private sector to rebuild immediately.

B. Strategies

The following strategies can be adopted for the post-disaster recovery and reconstruction activities:

a. **Building Back Better (BBB)**. Recovery activities based on BBB principles will promote longer-term disaster risk reduction and management. BBB principle should look at the how to make infrastructure and facilities safer from future disasters such as adopting stronger engineering design, the advantages of resettlement of facilities in disaster-safe areas instead of rebuilding in the same disaster-prone areas, etc.

b. **Focus on the most vulnerable and socially disadvantaged groups such as children, women, and the disabled**. Recovery programming needs to give priority to the most vulnerable groups, including female-headed households, children and orphans, and the poor as well as take into account those with special needs.

c. **Community Participation and Use of Local Knowledge and Skills**. The participation of the community in all the processes (identification, planning, design and implementation) of recovery activities will help ensure the acceptability of projects and optimize the use of local initiatives, resources and capacities.

d. **Secure development gains**. Recovery strategies, even if they are different, must be supportive of existing development plans and must attempt to re-establish and secure previous development gains.

e. **Coordinated and coherent approaches to recovery**. Projects for disaster recovery must have the full and effective coordination among all involved agencies based on comprehensive information exchange, flexibility in administrative procedures, and uniformity of policies. In some instances, a special new agency may be needed to oversee, coordinate and monitor complex disaster recovery programs. Under this strategy, capacity building activities for the local public administration may be part of the recovery activities including a well-defined monitoring and evaluation system for the overall implementation of the recovery plan.

f. **Efficient use of financial resources**. The overall strategy should also include the identification of funding sources that are suited for the recovery activities. It should be clear how assistance to the recovery of the private sector would be delivered. Also, cheaper source of funding, from international donor partners, should be initially identified for longer-term expensive projects.

g. **Transparency and accountability**. The overall plan and implementation of projects for recovery must

be transparent, especially to those affected, through open and wide dissemination of information on all aspects of the recovery process. An effective monitoring system must be established.

Step 4.2 Estimate recovery needs

Recovery needs are intended to bring back normalcy in the sector as quickly as possible. Recovery activities should include those that will enable companies to resume their normal operations. Some of the possible recovery-related activities in the sector can include:

- Repairs of the damages to structures, which were affected by strong winds and floods.
- Emergency procurement of vital equipment necessary to normalize operations.
- Clearing of debris that may have affected the sector.
- Emergency credit for re-capitalization.

Step 4.3 Estimate reconstruction needs

Reconstruction needs are generally long-term in nature (3 years and more) and are intended to 'build back better' from the ruins of a disaster. It is to be noted that reconstruction activities should include both public as well as private facilities and may require different types of financing strategies.

It should be further noted that since the companies in this sector are revenue-generating enterprises, financing their needs can come through soft-term credit schemes for the reconstruction and repair of their damaged assets. Such schemes can be accompanied by technical assistance for improved disaster resilient standards of construction.

Some possible reconstruction related activities in the sector could include the following:

- Soft-term credit for the replacement or reconstruction of affected structures under a 'building back better' strategy to ensure future disaster resilience through the adoption and enforcement of improved construction standards;
- Procurement of equipment and machinery;
- Cost of replacing furniture and equipment that were destroyed, may be included within the needs for reconstruction, unless they have been covered under the recovery needs to provide temporary services for the affected area;
- Structural retro-fitting of undamaged or partially damaged structures so that they are not affected by disaster event in the future; and/or
- Relocation to safe areas.

Step 4.4 Prioritize identified projects for recovery

Among the projects identified, relative priorities can be set in order to determine which among them are the more important. Based on the broad strategies for recovery, the assessment team should select the priority projects/activities among the identified needs.

The prioritization can be made by using a set of impact indicators and the level by which the projects can achieve said impacts. Examples of the criteria that can be used are the following, among others:

a. **Economic impact**, which can be evaluated in terms of the relative cost to the government of not undertaking reconstruction or rehabilitation.

b. **Equity and social impact**, which can be in terms of the number of beneficiaries who are poor and destitute and who could not afford to rebuild on their own without outside support.

c. **Sustainability**, which can be in terms of the reduction of risks and vulnerability of the people and other economic assets to future disasters.

The criteria above can be placed in a matrix like the one below where the impacts are ranked according to low, medium or high.

This matrix can show the relative benefits of proposed projects to the people in the affected areas, which, in turn, will inform and assist the government in determining the priority projects within the sector.

Matrix 2. Impacts of identified post-disaster projects

Name of Proposed Project	Expected Impacts on Recovery								
	Economic impact			Equity and Social Impact			Sustainability		
	High	Medium	Low	High	Medium	Low	High	Medium	Low

The projects identified by the assessment team must be included in the above matrix.

Step 4.5 Summarize the estimated recovery and reconstruction needs and draft the implementation schedule

Based on the prioritized recovery and reconstruction needs, a summary should be created by the assessment team enumerating the post-disaster projects for the recovery and reconstruction.

The identified needs should have a rough schedule of implementation outlining at the very least the activities, timing and budget required for all the programs and projects. The following techniques can be considered:

1. Identify the specific projects according to their relative urgency or priority in relation to recovery.
2. Plot the timeline of activities of all the projects, with the urgent ones on top, in a Gantt chart with the corresponding funding requirement on an annual basis. This will assist the national government in programming the necessary funds over a certain time period, like on a quarterly or annual basis.
3. Identify and include in the list of projects that need further feasibility studies, which may be funded by foreign grants.
4. To the extent possible, a logical framework (log-frame) should be created for each of the project proposed for inclusion in the recovery plan. Log-frames are normally required by foreign donors to consider project proposals.

The recovery and reconstruction needs of the sector can be summarized in the table below showing the financing requirements over the years.

Reconstruction needs mostly require long-term implementation periods. They normally require three or more years to complete.

Table 6. Summary of recovery and reconstruction needs in the sector.

Name of Specific Projects	Annual Needed Amount of Assistance (Rs)						Total Needs
	Disaster Year	Year 1	Year 2	Year 3	Year 4	Year 5	(Rs)
Recovery Projects							
Formal Sector							
a.							
b.							
Informal Sector							
Total							
Reconstruction Projects							
Formal Sector							
a.							
b.							
Informal Sector							
a.							
b.							
Total							
GRAND TOTAL							

Note for filling Table 8

Project titles can be inserted under the column on recovery and reconstruction needs

Step 5. Draft the post-disaster damages, losses and needs (PDNA) report of the sector

With all the information gathered using the previous steps, the assessment team can draft a report that includes the inputs from the sectors in the overall recovery and reconstruction plan. The following format may be considered:

1. Brief description of the sector in the disaster-affected areas.
2. Damages in the sector by areas and by types of assets affected.
3. Losses in the sector emphasizing the losses in income, increase in expenditures, estimated period before normalcy will be attained, etc.
4. Impact on the livelihood, individual households, vulnerable groups and the consequences to the greater community if no assistance for recovery will be provided.
5. Proposed strategies for recovery and reconstruction of the sector.
6. Needs of the sector, by priority, and the draft schedule of implementation with the estimated funds required for each project over time.

The draft sector report should be submitted to the State Disaster Management Office for consolidation.

Electrical Sector

This section contains the following contents – specific to this sector – in order to guide the user to successfully conduct post-disaster needs assessment in India:

1. **The Introduction to the Sector**
    a. Baseline information
    b. Post-disaster Situation and Performance
    c. Estimation of Disaster Effects
    d. Estimation of Disaster Impact
    e. Estimation of Post-Disaster Recovery and Reconstruction Requirements
2. **The Standard Procedure for the Sector Assessment**
    a. Recommended Assessment Team
    b. Steps in conducting a PDNA in the electrical sector
        - Collect baseline information on sector assets and production flows
        - Estimate value of damage and production flow changes
        - Analyze the impacts of the damages and losses to affected population
        - Identify the recovery strategies and estimate recovery and reconstruction needs
        - Draft the post-disaster damages, losses and needs (PDNA) report of the sector

The user is advised to refer to:

a. The "Introduction of the PDNA Manual" for a complete information of the concepts and definitions on the post-disaster needs assessment (PDNA);
b. The section on "Disaster Effects, Impact Assessment, Needs Estimation" for a more detailed discussion in identifying the possible impacts within and across sectors; and
c. The section on "Estimation of Post-Disaster Recovery and Reconstruction Needs" for a more detailed discussion on identifying and prioritizing post-disaster needs.

Introduction

In accordance with the worldwide system of national accounts, the electrical sector comprises the following activities or components[23] : a) generation of electricity in different types of power plants; b) transmission of electricity from the generation plants to the distribution grids; and c) distribution and sales of electricity to the end-users. Each of these components of the electrical sector may be owned and operated either by public sector or government-owned enterprises, or by privately owned companies. Despite their ownership, they may be affected by any type of disaster and must be included in the assessment of disaster effects, impacts and recovery needs.

The electricity generated is usually consumed by different types of users, including residential, industrial, commerce, agriculture, public lighting and others (See Table 1 which provides an example of electricity consumption by sector in Andhra Pradesh in 2011-12). Each consumer sector has different demands for electricity, which change over time and is charged for its consumption at different rates for the amount of electricity they utilize as well as fixed charges for the power capacity they require.

Table 1. Annual consumption of electricity in Andhra Pradesh by Consumer Sector in 2011-12

Sector	GWh	%
Residential	16,914	24.3
Commercial	5,711	8.2
Industry low/medium voltage	3,128	4.5
Industry high voltage	19,567	28.1
Agriculture	19,076	27.4
Transport	1,887	2.7
Public lighting	1,513	2.2
Public water works sanitation	793.22	1.1
Miscellaneous	1,831	2.6
Total	69,628	100.0

Source: Central Electricity Authority, Ministry of Power

Electricity tariffs charged to consumers vary from State to State, as a function of the actual cost of generation, transmission and distribution, and are defined from time to time by the State Electricity Regulatory Commission.

After a disaster, the electrical sector may sustain destruction of its physical, durable assets (damage) as well as subsequent changes or disruptions in its production flows, which may include a temporary decline in production and sales of electricity and possible increases in production costs in each of the system components (generation, transmission and distribution), until recovery is attained. Changes in production

[23]According to the India System of National Accounts, this sector falls under "Electricity and Gas".See United Nations, International Standard Industrial Classification of All Economic Activities, Rev.4, New York, 2008. (http://unstats.org/unsd/cr/registry/).

and sales flows may arise from (i) the interruption, however temporary, of the production and supply of electricity due to damage to the electrical system components, and also from (ii) the temporary decline in consumer demand caused by the disaster. With regards to the latter, it must be noted that any destruction caused by the disaster to the electricity-consuming sectors would result in the interruption of their normal electricity demand over the time required to achieve recovery and reconstruction at the consumers´ end. During the assessment, the cost of repairing or rebuilding the electrical system components that have been affected, and the value of the changes in supply of electricity must be estimated in order to estimate disaster effects, as well as the value of recovery and reconstruction requirements.

Putting it differently, the assessment of disaster effects does not involve estimating only the cost of restoring the supply of electricity after the destruction caused by the disaster; rather, the cost of disruption of the production and sales of electricity to all consumers (i.e. the changes in the flows of electricity production and sales) until full recovery is achieved must be factored in to ascertain total disaster effects. This is very important, since it has been found that in many cases of disaster the value of production flow losses may be higher than the value of damage to the electrical system, and it may be so high as to compromise the governance or financial position of the sector enterprises, and may result in the need to introduce or increase government subsidies and/or to increase pre-disaster tariffs for electricity to the consumers.

In this sector, again, damage is initially measured in physical quantities or units, which are later on converted into monetary value using the replacement cost of the affected assets with the same characteristics they had at the time of the disaster. Production flow changes include the possible decline in electrical enterprise revenues that arise from the temporary interruption of electricity supply, the possible temporary increase in operational costs until normal operations are achieved, and the possible temporary decline in electricity demand due to the destruction sustained separately by the sectors of housing, industry, commerce, agriculture and other sectorial consumers. Such changes in production flows are to be expressed in current or nominal monetary values.

In order to integrate the assessment team for the electrical sector it will be essential to have civil and electrical engineers to estimate the value of damage, and economists that may analyze and estimate the value of production flow changes.

a) Baseline information

The first stage of a post-disaster assessment requires the assessment team for the electrical sector to collect quantitative baseline information to define the manner in which the sector functions under normal or non-disaster conditions. Such baseline data provides the point of reference to compare post-disaster sector performance and enable the estimation of damage, losses, impact and needs for recovery and reconstruction for the sector.

The following information, which is normally available in the planning and commercial departments of the electrical enterprises that operate in the sector, is to be collected before field visits are undertaken:

- The characteristics – in terms of geographical or spatial location, installed capacities and operational costs – of all components of the electrical system located in the area affected by the disaster;
- Existing stand-by capacities in both the affected and nearby systems or areas that may be interconnected

to the affected system or that may have the capacity for rapid interconnection as an alternative, temporary solution after the disaster;

- Statistical information on annual electricity generation and sales to the main electricity-consuming sectors, and their seasonal variations over the year, for at least the past three years;
- Projections of above for the current year and for subsequent calendar years;
- Financial information on the enterprises that comprise the sector, including monthly operational data on revenues, production costs per type of power plant, revenues and rates charged to different electricity-consuming sectors;[24]
- Statistical data on population coverage by the electrical sector in both urban and rural areas; and
- Millennium Development Goals for the sector, and specific coverage and access targets for the current and subsequent years.

The last two types of information may be obtained from the government organization in charge of socio-economic development planning in the affected State.

b) Post-Disaster Situation and Sector Performance

This second stage of the assessment involves conducting field surveys by the electrical sector assessment team to ascertain the effects of the disaster on the generation, transmission and distribution capacities of the affected electrical systems. If the personnel from the disaster-affected electrical enterprises have conducted similar field assessments, then the sector assessment team members must collect all existing reports, analyze their contents for consistency and conduct whatever supplemental field visits may be required to verify the previous estimations. In the case of a disaster that may have caused major destruction of housing, industries, commerce, and other sectors that utilize electricity, the field survey must be used also to ascertain the characteristics and extent of the post-disaster decline in electricity demand from such users.

Upon completion of the field visits and after holding extensive discussions with substantive personnel of the enterprises composing the sector in the affected area, the electrical sector assessment team must estimate the remaining post-disaster capacity – in terms of generation, transmission and distribution – and its expected temporary performance, until the system can be repaired and brought back to its full or non-disaster capacity. In order to obtain the entire picture, especially with regards to the post-disaster demand of electricity, the electrical sector assessment team must closely interact with the sectorial assessment teams that cover the sectors that consume electricity: i.e. housing, industry, agriculture, trade, et cetera, to ascertain the possible recovery of electricity demand after reconstruction.

c) Estimation of Disaster Effects

The electrical sector assessment team must estimate the value of destroyed physical assets (damage)

[24]Such information is normally available in the annual reports issued by each electrical enterprise, whether publicly- or privately-owned.

for each of the electrical system components, including its breakdown on each sub-system (power generation plants, transmission subsystems, and electricity distribution grids). In some complex cases, it may be required to separately include some of the main components of each of the subsystems, such as hydropower dams and plants, thermal generation plants, geothermal sources and generation plants and their disposal units; transmission lines and sub-stations; poles and other distribution facilities.

The value of damage must be expressed in terms of the prevailing replacement costs of each system component with the same characteristics they had at the time when the disaster occurred[25]. These unit values may be obtained from the electrical enterprises. As a supplement or for verification purposes, the electrical sector assessment team may wish to contact private building contractors that may have appropriate replacement costs information. It is to be noted that the replacement or repair unit costs to be adopted must not be affected by scarcity or inflation that may arise after the disaster, as appropriate adjustments for such factors will be made later on in the final stage of overall reconstruction planning.

Asset depreciation should not be used in the estimation of the value of damage; however, information on the age of destroyed assets should also be obtained by the electrical sector assessment team, and be delivered to the separate assessment team in charge of analyzing overall or macro-economic disaster impact to ascertain possible disaster impact on the capital account of the State or the nation.

In order to estimate the value of production flow changes, the electrical sector assessment team must develop an objective calendar or schedule of repair and reconstruction of sector assets, duly taking into consideration the availability and schedule of sufficient financing, as well as of replacement machinery, equipment and skilled labor that will enable the return to non-disaster conditions of electrical service supply.

On the basis of the above, the electrical sector assessment team must prepare a preliminary calendar or schedule of electricity supply recovery, together with a similar estimation of post-disaster electrical demand performance, based on the expected calendar of reconstruction of the electricity-consuming sectors. These should be combined in order to define the overall post-disaster performance for the sector, until full recovery of electricity supply and demand is achieved.

In this regard, as in the case of the water supply and sanitation sector, special care must be exercised by the electrical sector assessment team to ensure that the recovery of demand from all electricity-consuming sectors – with special reference to the residential, agricultural, commercial and industrial sectors – is given full consideration in their analysis. It must be borne in mind that if widespread destruction has been caused by the disaster, the demand for electricity will not recover to non-disaster levels, until full reconstruction in the electricity-consuming sectors is achieved, even if electricity supply is restored promptly. It is therefore essential that the electrical sector assessment team coordinate its actions and projections with those of other economic and social sectors that consume electricity in their daily functioning.

Once the anticipated timetable for recovery and reconstruction in the electricity consumer sectors has been pre-defined, the electrical sector assessment team must develop a calendar of the expected recovery of

[25]Should the decision be adopted that system components are to be rebuilt using disaster-resilient features, the additional cost involved (over and above the usual unit costs) may be added at the time when recovery and reconstruction needs are estimated. But the value of damage should conform to the asset characteristics prevailing at the time of the disaster.

those sectors and of the equivalent recovery of revenues of the electrical enterprises. To calibrate such recovery estimation, the electrical sector assessment team should consult with the commercial department of the electrical companies to obtain information on the decline in sales of electricity to consumer-sectors at least during the first month after the disaster.

Production flow changes are then estimated by comparing the non-disaster with the post-disaster performance for the electrical sector, ensuring that the following issues are analyzed in depth:

- Lower operational revenues arising from temporary lower sales to electricity-consuming sectors, until such time as may be required to achieve non-disaster levels of demand, due to: the initial, temporary, total interruption of service; the partial supply of electricity while assets are being repaired or replaced; and the temporary decline in electrical demand from electricity-consuming sectors.[26]
- Higher operational costs incurred by the electrical enterprises due to utilization of stand-by power plants that may have a higher unit cost of operation, and/or higher costs of acquisition of electricity from nearby, unaffected electrical systems.[27]

Production flow changes are to be estimated on a calendar-year basis, for the year in which the disaster occurred and the subsequent years required to achieve full recovery and reconstruction. In addition to this, the electrical sector assessment team must analyze whether as a result of the changes in production flows (revenues and higher costs of operation) the financial position of the electrical enterprises or utility companies has been compromised, as to require a temporary modification to the non-disaster tariff or rates charged to electricity consumers or a temporary government subsidy (or a subsidy increase) to avoid affecting the consumers.

Ownership of the damage and losses is to be defined and broken down by public and private sectors, as their impact must be dealt with differently in the overall analysis of disaster impact.

The electrical sector assessment team must also undertake interviews with local insurance companies to ascertain whether the electrical enterprises operating in the disaster-affected area have any insurance on destruction of assets and on revenue decline due to disasters. Data on possible insurance proceeds amounts will be collected by the electrical sector assessment team, and delivered to the macro-economic assessment team to ascertain recovery and reconstruction needs in subsequent stages of the assessment. In any case, the value of damage and losses should not be decreased by the amount of existing insurance.

The electrical sector assessment team must bear in mind that any production flow losses sustained by the electricity-consuming sectors in view of the absence or insufficiency of electricity – such as housing or residential, agriculture, industry, commerce, etcetera – are to be estimated and accounted for in each

[26]In this regard, it must be remembered that the provision of electricity may be stopped during an initial short period of time immediately after the disaster (from a few hours to a few days): that electricity supply may be resumed on a partial basis during the period of electrical system repairs, until full system reconstruction is achieved. Furthermore, that electrical demand from various electricity-consuming sectors may decline due to extensive damage and destruction of housing, agriculture, mining, industries and commercial establishments and the subsequent overall decline in economic activity in the affected area.

[27]This is typical of the case when damaged hydropower plant electricity generation is temporarily substituted by stand-by thermal power units that have a higher unit cost of operation, or when having to purchase electricity from nearby unaffected systems at unit prices higher than the affected enterprise's own production price levels.

of those other sectors, either as production losses and/or as higher production costs when alternative, higher-cost sources of electricity are chosen as interim solutions. Such losses are not to be included in the assessment of the electrical sector.[28]

d) Estimation of Disaster Impact

Disaster impact may be measured at different levels: sectorial, macro-economic and personal or household levels.

The impact at sector level may be expressed through the decline in electricity production or sales caused by the disaster. As such, it may be expressed in terms of the percentage decline in production or sales of electricity caused by the disaster.

The impact at macro-economic level is to be estimated separately by the macro-economic assessment team, using quantitative information on the decline of electricity production and sales and their consequences estimated by the electrical sector assessment team. For that purpose, the electrical sector assessment team must furnish the following quantitative results to the macro-economic assessment team:

- The value, in current monetary terms, of the post-disaster production and sales of electricity for the current calendar year of the disaster and for at least two sub-sequent years, in comparison to the equivalent values that had been expected if the disaster had not occurred.
- The estimated cost of economic recovery needs, as derived from the estimation of changes in production and sales of electricity flows; of special importance here would be the quantification of possible higher imports of fuel for generation of electricity that may arise due to the disaster.
- The estimated cost of reconstructing the destroyed assets in the electrical system and a calendar of the annual investments required for it. This cost would be equal to the estimated value of damage, duly increased by the cost to introduce disaster-resilient features to the system and thus reduce disaster risk in the future.[29]
- The estimated values of the imported component of reconstruction costs (i.e. of items that are not manufactured in India and must be imported from abroad, such as certain equipment, machinery and other construction materials), so that the macro-economic assessment team may be able to estimate disaster impact on the balance of payments and trade.

[28]The possible temporary post-disaster higher expenditures in electricity that may be sustained by individual households due to unavailability of electricity service from the grid and/or because increases in electricity rates arising from the disaster will be used in the analysis of disaster impact on overall human well-being or quality of life, where possible household income decline and costs of living increases are to be considered, but they are not part of the assessment of the electrical sector.

[29]Experience acquired in many cases of disaster assessment conducted in the past 40 years shows that to estimate reconstruction requirements in the electrical sector, a range of 10 to 20 per cent over the value of damage may be adequate to ensure disaster risk reduction in the electrical sector; however, the actual percentage to be used is to be determined by the electrical sector assessment team on the basis of the specific conditions of each case.

– The estimated values of government costs involved in economic recovery that are over and above the government´s regular contribution to the sector, so that the macro-economic assessment team may estimate disaster impact on the fiscal budget position.

Disaster impact at the personal or household level must be estimated through two different ways. First, a comparison is to be made of the percentage of number of households connected to the electrical grid and having direct access to electricity supply, prior to and after the disaster. Such indicators of pre-disaster and post-disaster household access to electricity are to be used by the macro-social assessment team to estimate overall macro-social impact of the disaster, combining it with other similar indicators from other sectors of activity such as household income decline, access to water supply and sanitation, food security, health, and others. In addition, the disaster may have induced delays in achieving Millennium Development Goals (MDGs) in regard to access of urban and rural families´ direct access to electricity; such facts must also be reported to the macro-social assessment team for use in estimating human development impact.

Second, estimates are to be made by the electrical sector assessment team of the possible household cost arising for the need to substitute non-available electricity for cooking, heating and other uses, which the households may have to spend in purchasing fuel or other energy substitutes. This higher cost to households is to be delivered by the electrical sector team to the macro-social assessment team.

e) Estimation of Post-Disaster Recovery and Reconstruction Requirements

Post-disaster financial requirements or needs in the electrical sector normally include the amounts of financing to (i) ensure the return of the sector to the normal level of production and sales of electricity (recovery needs), plus the amounts of financing required to (ii) achieve physical recovery or reconstruction of destroyed physical assets using disaster-reduction features. In addition to that, there may be additional requirements to (iii) ensure recovery of the quality of life at the personal or household level (human development recovery).

Financial requirements for the electrical sector to achieve economic recovery are defined as the amounts of funding required for the progressive return to normal electricity supply to the consumers and to normal financial operation of the systems. In a sense, recovery needs involve a combination of some of the following activities:

- The cost of urgent rehabilitation works to restore minimum electricity flows in the system;
- Possible costs of inter-connection to other un-affected electrical systems to enable temporary imports of electricity if required;
- Financing of temporary, higher-than-normal costs of generation, transmission and distribution of electricity costs during the time required to rebuild or replace destroyed system components.

The first component of recovery refers to the costs of the restoration of minimum electricity supply usually conducted during a few hours or days after the disaster, through special rehabilitation crews from the electrical enterprises. The second component may apply whenever the damage to the existing electrical

system components is such that electricity must be imported through inter-connection to other nearby, unaffected electrical systems, which may require building additional lines for the required interconnection. The third component refers to the possible, temporary, additional costs involved in situations such as: (i) operating higher-unit-cost power plants while lower-cost, damaged power plant are under repair or reconstruction; (ii) importing electricity from other nearby, undamaged power systems while the affected system is under repair or reconstruction; (iii) covering temporary financial deficits of the electrical companies through government subsidy or increasing government subsidies, during the time required to restore consumer demand. In the latter case, whenever private enterprises are involved, the possibility of providing temporary tax relief of holidays may also be considered.

The amounts of economic recovery needs arise from the estimation of changes in the sector´s economic or production flows, and should never exceed the values as estimated previously by the electrical sector assessment team.

The estimation of financial requirements for reconstruction (or physical recovery) may involve increasing the estimated value of damage to include higher design standards or alternative standards to reduce disaster risk. As examples, the estimated value of damage to transmission lines may be increased to introduce a higher safety of power lines against wind in cases of cyclones or tropical storms, or to account for the cost of utilizing subterranean power lines in certain city areas for the same purpose. Therefore, reconstruction needs will always have a higher value than the value of damage as estimated by the electrical sector assessment team, the increase being a function of the desired degree of risk reduction that may be defined in the strategy for recovery and reconstruction, bearing in mind the available financial resources for the purpose.

The estimation of post-disaster human development recovery requirements for affected individuals and households may be made whenever the latter are significantly affected by the lack or insufficiency of electricity and/or whenever electricity rates have to be increased. After a disaster, rural electricity households may resort to use of wood for cooking and heating purposes, thereby affecting the environment through the unproductive use of forests; urban households may be forced to utilize fuel or wood for cooking and heating purposes and incur into higher expenditures at least over the time required for the electricity sector to recover.

In some countries, as a way to assist affected households, governments may resort to introduce a temporary subsidy to the costs of electricity or to temporarily waive the payment of their electricity bills, and/or to the provision of gas stoves and fuel supplies to the affected families. Such costs are to be estimated by the electrical sector assessment team and deliver them to the macro-social assessment team that is entrusted with estimating human recovery needs. In no case are these human recovery needs be included simultaneously in both the economic recovery needs and in human recovery needs, to avoid double accounting.

Electrical Sector

STANDARD PROCEDURES FOR SECTOR ASSESSMENT

Recommended Assessment Team

The composition of the sector assessment team may vary by the type of disaster and the extent of the likely damage and production flow changes.

Organization and Personnel	Role in the Sector Assessment

Personnel from:
• **State department of power**
• **Department of Petroleum and Natural Gas**
• **Local offices in the disaster-affected area who are:**
  • Electrical Engineer
  • Civil Engineer (Power Generation)
  • Power Generation Investment Specialist
  • Power Operations Specialist
  • Power Generation Economist
  • Power Generation Accountant
Goods/Equipment Buyer
	Lead and coordinate

Personnel from:
• **Ministry of Power**
• **Ministry of Petroleum and Natural Gas**
  • Electrical Engineer
  • Civil Engineer (Power Generation)
  • Power Generation Investment Specialist
  • Power Operations Specialist
  • Power Generation Economist
  • Power Generation Accountant
  • Goods/Equipment Buyer
	Provide baseline information and facilitate the field assessment of damages and losses

Development partners (if active in the sector)	Participate and provide technical advice

Steps in conducting a PDNA in the electrical sector

Step 1. Collect baseline information on sector assets and production flows

Baseline information must be compiled before the field assessment or, if possible, prior to the occurrence of disaster. The baseline data should be validated before the field visit to serve as the basis for the estimation of damages and losses for the disaster-affected area/s. This data can be compiled at the State/Region office or at the District levels. The tables below can be used for the baseline information.

Table 1. Power companies in a District

Name of District:								
Population Connected to Power Grid (%)								
Name of Power Company by Activity	**Power Source**				**Ownership**		**Capacity**	**Unit cost of operation**
	Hydro	**Coal**	**Diesel**	**Others**	**Public**	**Private**	**(KW)**	**(Rs/KW-hr)**
Power Generation								
Company 1								
Company N								
Power Distribution								
Company 1								
Company N								

Notes for filling Table 1

- *It is possible that a power company located in one area serves the needs of other districts or even the whole state. In such a case, the assets of the company may be located in several areas. The assessment team must be cautious about the possibility of double counting. If the power company/ies cover more than one area, they should only be assessed once as part of the area where their main offices are located.*
- *It is possible too that a single power company owns both the generation and distribution components. In such a case, they should be assessed as a single company or unit.*
- *If a power company is a joint venture between the government and a private corporation, it can be considered as a public company for the purpose of PDNA.*

Sources of Information

The sources of baseline information may vary by state. However, the critical list of the likely sources of information is provided below.

Ministry of Statistics and Programme Implementation	http://www.mospi.gov.in
The Registrar General & Census Commissioner, India	http://censusindia.gov.in
National Institution for Transforming India	http://niti.gov.in
Ministry of New and Renewable Energy	http://www.mnre.gov.in
Ministry of Power	http://powermin.nic.in
Central Electricity Authority	http://www.cea.nic.in
India Energy Portal	http://www.indiaenergyportal.org
Open Government Data (OGD) Platform India	https://data.gov.in
Make in India Initiatives	http://www.makeinindia.com

Note 1: Please use similar institutions at State level for baseline Information

Note 2: For Non-Government information sources, please search suitably

Table 2. Baseline information on power costs and demand

Name of District:					
Name of Power Company	**Power Demand Forecast (Kw-Hr)**				**Rate**
	Current Year	**Year 1**	**Year 2**	**Year 3**	**Rs/KW-Hr**
Company 1:					
Residential					
Commercial					
Industrial					
Others					
Company 2:					
Residential					
Commercial					
Industrial					
Others					
Company N:					
Residential					
Commercial					
Industrial					
Others					

Note for filling Table 2

- *The names of the companies operating in the area should all be included.*
- *Years 1 to 3 are the forecast power demand.*

Step 2. Estimate value of damage and production flow changes

With the baseline information, field assessment should be undertaken in the affected Districts after a disaster. The assessment team from the State must work with their local counterparts in the Districts to ensure that the estimates for the damages and losses in the sector are accurate to the maximum extent possible. Direct interviews with private contractors or government officials involved in the construction and repair of facilities can also be conducted during the field trip in order to validate unit costs of repair and reconstruction (which is already contained in the baseline data).

It should be noted that since there is a possibility that only one power company supplies electricity to a number of districts and states, caution should be exercised to avoid double counting. It is recommended that the assessment of damages and losses of the power company should be accounted for in the district where the main office of the power company is located. However, if the main office is located outside the disaster area, the assessment team must account for the damages and losses of the company with an indication as to where such damages and losses occurred.

Step 2.1. Estimate the damages and losses to energy/power facilities

Repair and replacement costs should be estimated for the damaged components of power companies. The time needed to reconstruct the damages should also be estimated. Aside from field visits to the disaster sites, the assessment team should interview the officers of the power company/s to ascertain the extent and value of the damages and the estimated period before the power can be fully restored to the pre-disaster level. The officials and experts in the power company/ies can estimate the damages of their respective companies more accurately. Moreover, considering that some of the damages may cover a wide area that may be inaccessible to the assessment team, the people in the power company/ies can get the data quicker from their colleagues in the field.

The value of totally damaged assets can be summarized in the following table which should be used in interviewing the officials of the power company/ies as a questionnaire.

Table 3. Damages and losses of a power company

Name of Power Company		
Location (District)		
Type of Power Company		Power Generation: Hydropower ( ) Coal ( ) Diesel ( ) Others ( )
	Power Distribution: Corporation ( )	

Ownership	Public ( ) Private ( )					
Number of Clients Affected:						
Residential						
Commercial						
Industrial						
Others						
ESTIMATED DAMAGES						
Damage to Structures and Assets	**Totally destroyed**		**Partially damaged**		**Total Damages (Rs.)**	**Average Time to Replace or Repair (Days)**
	Number of Totally Destroyed	**Average Replacement Cost (Rs.)**	**Number of Partially Damaged**	**Average Repair Cost (Rs.)**		
	A	**B**	**C**	**D**	**E**	**F**
Power Generation						
Structures						
Equipment						
Others						
Transmission System						
Structures						
Equipment						
Vehicles						
Others						
Distribution Grids						
Structures						
Equipment						
Power stations						
Sub-stations						
Power cables						
Others						
Main Office						
Structures						
Equipment						
Inventories						
Others						
TOTAL						
ESTIMATED LOSSES (Rs)						
Types of Losses	**Disaster Year**	**Year 1**	**Year 2**	**Total (Rs)**		

Foregone income				
Cleaning up of debris				
Higher operating costs				
Other unexpected expenses				
TOTAL				

Notes for filling Table 3

- *The power company/ies should fill out information appropriate to their assets. Structures will include dams, field offices, etc.*
- *There are various machineries and equipment in the power systems like turbines, computers, vehicles, etc. Inventories will include power lines, posts, spare parts, etc. They should all be assessed especially those that are vital to the operation.*
- *'Average Replacement Cost' will be the average pre-disaster value of the structures and assets that were totally destroyed.*
- *'Average Repair Cost' will be the average cost of repair of the structures and assets that were partially damaged.*
- *In formula, the total damages will be (Column E) = (Column A) x (Column B) + (Column C) x (Column D).*

A note on estimated losses:

Losses in the electricity sector will include the following:

- *Foregone sales in electricity due to the shutdown of the power system while the system is under repair or reconstructed after a disaster. This can include both short-term shutdown for repairs and longer-term shut-down due to reconstruction.*
- *Lower sales in electricity due to the decline in demand from consumers (households or companies) that have been affected by the disaster.*
- *Higher cost of operation which occurs when damaged power electricity are substituted by alternative stand-by plants that have a higher unit cost of production or when electricity has to be imported from a different system that has higher operating costs.*
- *Additional expenses to clean up the debris.*

In the electricity sector losses occur until full capacity and supply have been re-established in all system components and user demand (in all sectors) has been restored to pre-disaster levels. Losses are expressed in monetary termsat current values.

Step 2.2 Summarize the damages and losses in the sector in a District

Based on the survey of power companies, the damages and losses can be summarized in the following table.

Table 4. Summary of damages and losses in a District

Name of District:								
Total Number of Clients Affected:								
Residential								
Commercial								
Industrial								
Others								
Name of Power Companies	Within the Disaster Year				Losses Beyond Disaster Year			
	Damages		Losses		Year 1		Year 2	
	Public	Private	Public	Private	Public	Private	Public	Private
Company 1								
Company 2								
Company N								
TOTAL								

Notes for filling Table 4

- *It should be noted that it is very possible that only one company provides the power needs of the district or even a state.*
- *'Public' and 'private' refers to the ownership of the power company.*
- *The damages and losses should be accounted for under the type of ownership of the company.*

Step 2.3 Summarize damages and losses of the sector in a State

Once the summary table for each affected district has been filled out, the information should be used to summarize the damages and losses at the State level. The summary table below can be used.

Table 5. Summary of damages and losses in a State

Name of State:								
Total Number of Clients Affected:								
Residential								
Commercial								
Industrial								
Others								
Name of District	Within the Disaster Year				Losses Beyond Disaster Year			
	Damages		Losses		Year 1		Year 2	
	Public	Private	Public	Private	Public	Private	Public	Private
District A								

Company 1								
Company 2								
District B								
Company 1								
Company 2								
District N								
Company 1								
Company 2								
TOTAL								

Drought

Droughts can cause more losses than damages. Structures and equipment are seldom affected by droughts but losses in production happen. In cases of drought, losses in this sector will be on the reduction in the output of hydropower plants. The impacts of droughts on power will, however, impact also on the other sectors that are dependent on the electricity supply. However, since drought can be predicted and does not occur suddenly (slow-onset phenomenon), its effects can be mitigated by advising the power companies beforehand to prepare contingency plans that will address a possible power supply shortage due to the expected drought. Nevertheless, if and when drought occurs, the impacts to the people and the larger community and economy as enumerated and explained below, can be expected.

Step 3. Analyze the impacts of the damages and losses to affected population

The assessment team of the power sector should analyze all potential impacts of the shut-down of electricity supply in relation to, among others:

- The possible effects on hospital operations, productivity, government services, etc. if power supply is not restored immediately.
- The additional costs to families if they will have to procure other sources of power.
- Possible losses of employment if the power sector will have to lay off workers.
- Potential adverse environmental impacts like if and when fuel leaks to ecologically sensitive areas.

The following matrix can be used to express the social impacts of the damages and losses to the power supply sector.

Matrix 1. Social impacts of the damages and losses to the power supply sector

Area of Impacts	Expected Impacts						Brief Description of Impacts
	General Population			Women and Children			
	S	M	L	S	M	L	
Health							
Education							

Government Services							
Added Cost to Households							
Employment							
Economic Productivity							
Others (Specify)							

Notes for filling Matrix 1

- *The expected impacts are segregated into a) the impacts on the general population; and b) the impacts on women and children measured as severe (S), moderate (M) or low (L). The assessment team should mark under the column whether the impacts are S, M or L.*
- *The impacts can be briefly described under the column "Brief Description of Impacts". For example, a brief description of a severe "impact on health" and "education" can be the inability of hospitals to conduct medical procedures and the suspension of classes over a longer period; the "added cost to households" can be described as the higher cost of fuel for lighting and cooking; while the impact to "government services" can be the inability or lesser capacity of the government to render vital services like the police or administrative matters due to the absence of power supply. Employment and economic productivity can occur too if big industries (factories, tourism, etc.) are unable to resume normal operations due to power outage.*
- *The impacts on women and children may be different from the general population. For instance, pregnant women and small children who need more of medical care may be adversely affected if power supply will hamper the operations of medical clinics. Hospitals may not be able to provide pre-natal care or immunization to infants without power supply.*

Step 4. Identify the recovery strategies and estimate recovery and reconstruction needs

The post-disaster needs must be based on a framework where policies and strategies are likewise integrated. After analyzing the potential effects and impacts if no assistance will be provided to the sector, the aggregate needs of the sector must be estimated.

Step 4.1 Identify recovery and reconstruction strategies

After the consolidation of the field assessment, the assessment team must identify or recommend the policies and strategies to be followed for recovery and reconstruction for the sector. The following are some of the general policies and strategies that could be considered.

A. Policy Measures

There are certain policies that can be adopted over a limited period, which can provide incentives to the private sector to reconstruct damaged assets with higher standards of resilience. Among them are:

1. Income tax breaks for private companies such as:

a. Temporary reduction or freeze or deferment in the collection of tax;

b. Temporary freeze on basic service charges in the utilization of certain services over the time of the recovery phase;

c. Non-collection of property taxes for the duration of the recovery period;

d. Exemption from registration fees for replacements of the destroyed equipment and machinery over a certain period of time.

2. Subsidizing construction materials and equipment to be imported by private power companies during the recovery and reconstruction phase through an exemption from paying customs duties and other levies.

3. Extending bank guarantees on loans by the government to enable the private sector to rebuild immediately.

B. Strategies

The following strategies can be adopted for the post-disaster recovery and reconstruction activities:

a. **Building Back Better (BBB)**. Recovery activities based on BBB principles will promote longer-term disaster risk reduction and management. BBB principle should look at the how to make infrastructure and facilities safer from future disasters like stronger engineering design, the advantages of resettlement of facilities in disaster-safe areas instead of rebuilding in the same disaster-prone areas, etc.

b. **Focus on the most vulnerable and socially disadvantaged groups such as children, women, and the disabled**. Recovery programming needs to give priority to the most vulnerable groups, including female-headed households, children and orphans, and the poor, and take into account those with special needs.

c. **Community Participation and Use of Local Knowledge and Skills**. The participation of the community in all process (identification, planning, design and implementation) of recovery activities will help ensure the acceptability of projects and optimize the use of local initiatives, resources and capacities.

d. **Secure development gains**. Recovery strategies, although may be a separate set of activities, must be supportive of existing development plans and must attempt to re-establish and secure previous development gains.

e. **Coordinated and coherent approaches to recovery**. Projects for disaster recovery must have the full and effective coordination among all involved agencies based on comprehensive information exchange, flexibility in administrative procedures, and uniformity of policies. In some instances, a special new agency may be needed to oversee, coordinate and monitor complex disaster recovery programs. Under this strategy, capacity building activities for the local public administration may be part of the recovery activities including a well-defined monitoring and evaluation system for the overall implementation of the recovery plan.

f. **Efficient use of financial resources**. The overall strategy should also include the identification of fund sources that are suited for the recovery activities. It should be clear how assistance to the recovery of the

private sector would be delivered. Also, some cheaper source of funds from international donor partners should be initially identified for longer-term expensive projects.

g. **Transparency and accountability**. The overall plan and implementation of projects for recovery must be transparent, especially to those affected, through open and wide dissemination of information on all aspects of the recovery process. An effective monitoring system must be established.

Step 4.2 Estimate recovery needs

Recovery needs are intended to bring back normalcy in the sector as quick as possible. In the power supply sector, quick recovery efforts must be undertaken especially as a great number of people and businesses depend on it for their activities.

Recovery activities should include those that will enable companies to resume their normal operations. Some of the possible recovery-related activities in the power sector can include:

1. Urgent repair of the damages to the generation, transmission and distribution system, which are normally affected by strong winds and floods. Among the repairs that may be required are cable wires, transformers and others.
2. Emergency procurement of alternate generators or connecting to other existing power grids to supply the needs of basic lifelines like hospitals, police and military needs, transportation, etc.
3. Clearing of debris that may have affected the various sub-systems of the power sector. In some cases, this may be part of repairs like the clearing of trees that fell off the power lines.
4. Assistance to electricity users in checking or repairing their individual electrical installations to assure safety after the disaster.
5. Freezing of electricity billings can be adopted as a recovery measure at least in those cases where no metering exists and where a fixed rate is charged to users, until full recovery of the service is achieved.

Step 4.3 Estimate reconstruction needs

Reconstruction needs are generally long-term in nature (3 years and more) and are intended to 'build back better' from the ruins of a disaster.

It is to be noted that reconstruction activities should include both public as well as private facilities and may require different types of financing strategies.

It is important to know that since the power companies are revenue-generating enterprises, financing their needs can come through soft-term credit schemes for the reconstruction and repair of their damaged assets. Such schemes can be accompanied by technical assistance for improved disaster resilient standards of construction.

Some possible reconstruction related activities in the sector could include the following:

- Soft-term credit for the replacement or reconstruction of affected structures under a building-back-better strategy to ensure future disaster resilience through the adoption and enforcement of improved construction standards;

- Procurement of equipment and machinery;
- Cost of replacing furniture and equipment that were destroyed may be included within the needs for reconstruction, unless they have been covered under the recovery needs to provide temporary services for the affected area;
- Structural retro-fitting of undamaged or partially damaged structures so that they are not affected by disaster event in the future;
- Relocation of power plants to safe areas; and
- Other mitigation measures such as construction of support infrastructure to prevent serious landslides and floods to energy facilities.

Step 4.4 Prioritize identified projects for recovery

Among the projects identified, relative priorities can be set in order to determine which among them are the more important. Based on the broad strategies for recovery, the assessment team should select the priority projects/activities among the identified needs.

The prioritization can be made by using a set of impact indicators and the level by which the projects can achieve said impacts. Examples of the criteria that can be used are the following, among others:

a. **Economic impact**, which can be evaluated in terms of the relative cost to the government of not undertaking reconstruction or rehabilitation.

b. **Equity and social impact**, which can be in terms of the number of beneficiaries who are poor and destitute and who could not afford to rebuild on their own without outside support.

c. **Sustainability**, which can be in terms of the reduction of risks and vulnerability of the people and other economic assets to future disasters.

The criteria above can be placed in a matrix like the one below where the impacts are ranked according to low, medium or high.

This matrix can show the relative benefits of proposed projects to the people in the affected areas, which, in turn, will inform and assist the government in determining the priority projects within the sector.

Matrix 2. Impacts of identified post-disaster projects

Name of Proposed Project	Expected Impacts on Recovery								
	Economic Impact			Equity and Social Impact			Sustainability		
	High	Medium	Low	High	Medium	Low	High	Medium	Low

The projects identified by the assessment team must be included in the above matrix.

Step 4.5 Summarize the estimated recovery and reconstruction needs and draft the implementation schedule

Based on the prioritized recovery and reconstruction needs, a summary should be created by the assessment team enumerating the post-disaster projects for the recovery and reconstruction.

The identified needs should have a rough schedule of implementation outlining at the very least the activities, timing and budget required for all the programs and projects.

The following techniques can be considered:

1. Identify the specific projects according to their relative urgency or priority in relation to recovery.
2. Plot the timeline of activities of all the projects, with the urgent ones on top, in a Gantt chart with the corresponding funding requirement on an annual basis. This will assist the national government in programming the necessary funds over a certain time period, like on a quarterly or annual basis.
3. Identify and include in the list of projects that need further feasibility studies, which may be funded by foreign grants.
4. To the extent possible, a logical framework (log-frame) should be created for each of the project proposed for inclusion in the recovery plan. Log-frames are normally required by foreign donors to consider project proposals.

The recovery and reconstruction needs of the sector can be summarized in the table below showing the financing requirements over the years.

Note: Reconstruction needs mostly require long-term implementation periods. They normally require three or more years to complete.

Table 6. Summary of recovery and reconstruction needs in the power supply sector.

Name of Specific Projects	Annual Needed Amount of Assistance (Rs)						Total Needs (Rs)
	Disaster Year	Year 1	Year 2	Year 3	Year 4	Year 5	
Recovery Projects							
Total							
Reconstruction Projects							
Total							
GRAND TOTAL							

Notes for filling Table 6

- *Project titles can be inserted under the column on recovery and reconstruction needs.*
- *Columns can be added to accommodate any additional reconstruction needs beyond Year 2.*

Step 5. Draft the post-disaster damages, losses and needs (PDNA) report of the sector

With all the information gathered using the previous steps, a report can be drafted by the assessment team, which will be the inputs of the sector in the overall recovery and reconstruction plan. The following format may be considered:

1. Brief description of the sector in the disaster-affected areas.
2. Damages in the sector by areas and by types of assets affected.
3. Losses in the sector emphasizing the losses in income, increase in expenditures, estimated period before normalcy will be attained, etc.
4. Impact on the livelihood, individual households, vulnerable groups and the consequences to the greater community if no assistance for recovery will be provided.
5. Proposed strategies for recovery and reconstruction of the sector.
6. Needs of the sector, by priority, and the draft schedule of implementation with the estimated funds required for each project over time.

The draft sector report should be submitted to the State Disaster Management Office for consolidation.

Water Supply and Sanitation Sector

This section contains the following contents – specific to this sector – in order to guide the user to successfully conduct post-disaster needs assessment in India:

1. **The Introduction to the Sector**
    a. Baseline information
    b. Post-disaster Situation and Performance
    c. Estimation of Disaster Effects
    d. Estimation of Disaster Impact
    e. Estimation of Post-Disaster Recovery and Reconstruction Requirements

2. **The Standard Procedure for the Sector Assessment**
    a. Recommended Assessment Team
    b. Steps in conducting a PDNA in the water supply and sanitation sector
        - Collect baseline information on sector assets and production flows
        - Estimate value of damage and production flow changes
        - Analyze the impacts of the damages and losses to affected population
        - Identify the recovery strategies and estimate recovery and reconstruction needs
        - Draft the post-disaster damages, losses and needs (PDNA) report of the sector

The user is advised to refer to:

a. *The "Introduction of the PDNA Manual" for a complete information of the concepts and definitions on the post-disaster needs assessment (PDNA);*
b. *The section on "Disaster Effects, Impact Assessment, Needs Estimation" for a more detailed discussion in identifying the possible impacts within and across sectors; and*
c. *The section on "Estimation of Post-Disaster Recovery and Reconstruction Needs" for a more detailed discussion on identifying and prioritizing post-disaster needs.*

Introduction

In India, only the value of destroyed physical, durable assets are usually estimated during assessments of disaster effects and impacts for the water supply and sanitation sector; no consideration is given to the changes in production flows of the sector.[30]

As an example, consider the case of the Gujarat earthquake in 2001 where an assessment of disaster impact was conducted with assistance from the World Bank and the Asian Development Bank (ADB). In that case, the value of destroyed premises, equipment and other assets of rural water supply systems as well as that of urban municipal water and sanitation systems was estimated at about 373 crore Rupees.[31] No changes in production flows were estimated, despite the widespread destruction, which limited the provision of water and sanitation services. In fact, several surface-water systems, about 400 deep wells and pumping stations, transmission works and distribution pipeline systems were destroyed or damaged severely. Only about 30 per cent of the usual supply was provided to the population after the disaster through the use of water tanks and other means, until reconstruction was completed. This means that the utility companies spent relatively large amounts of money to meet such increased costs of operation, and also that their revenues remained well below the normal levels.

When such situation occurs, the financial capacity of the sector is compromised – a disaster impact on governance for the sector – and remedial measures such as the introduction or increase in State government subsidies, and/or an increase (however temporary) needs to be made in the tariffs or rates charged to consumers. Needless to say, the individual or household consumers receive a negative impact on their quality of life and human development conditions due to the unavailability of a full supply and access to water and sanitation and to the need to spend more to obtain such services.

The methodology for disaster effects, impact and needs assessment must include the full analysis of disaster effects, covering the destruction of assets, the resulting changes in production flows, the impact of the disaster on governance (e.g. the estimation of financial constraints on the utility companies arising from the disaster), and the impact at the personal and household level.

According to the System of National Accounts the water and sanitation sector covers four separate activities:[32]

- Water collection, treatment and supply;
- Sewerage;
- Waste collection, treatment and disposal activities; materials recovery; and
- Remediation activities and other waste management services.

Under water collection, treatment and supply the following activities are included: collection of water from rivers, lakes, wells, etcetera; collection of rainwater; purification of water for water supply purposes; treatment

[30]According to the India System of National Accounts, this sector falls under "Water supply, sewerage and waste management".

[31]See India: Gujarat Earthquake Recovery Program; Assessment Report, page 12, The World Bank and Asian Development Bank, March 2001.

[32]See United Nations, International Standard Industrial Classification of All Economic Activities, Rev.4, New York, 2008. (http://unstats.org/unsd/cr/registry/).

of water for industrial and other purposes; desalting of sea or groundwater to produce water as the principal product of interest; distribution of water through mains, trucks or other means; and, operation of irrigation canals. However, the provision of irrigation services through sprinkler systems and similar agricultural services are not included.

Under sewerage the following activities are included: operation of sewer systems or sewer treatment facilities; collecting and transporting of human or industrial wastewater from one or several users as well as rainwater by means of sewerage networks, collectors, tanks and other means of transport; emptying and cleaning of cesspools and septic tanks, sinks and pits from sewage and the servicing of chemical toilets; treatment of wastewater (including human and industrial wastewater, water from swimming pools, etcetera); and maintenance and cleaning of sewers and drains.

Waste collection covers both non-hazardous and hazardous waste. Under the first subdivision are included: collection of non-hazardous solid waste within a local area, such as from households and businesses; collection of recyclable materials; collection of used cooking oils and fats; and collection of refuse in litter bins in public places. It also includes the collection of construction and demolitions waste; collection and removal of debris such as brush and rubble; collection of waste output from textile mills; and operation of waste transfer stations for non-hazardous waste. The second subdivision covers the collection of hazardous waste such as used oil from shipment or garages, bio-hazardous waste, used batteries and the operation of waste transfer stations for hazardous waste.

The following activities are included under waste treatment and disposal of non-hazardous waste: operation of landfills; disposal of non-hazardous waste by combustion or incineration with or without generation of electricity, steak, fuels, biogas or other by-products; treatment of organic waste for disposal; and production of compost from organic waste. In the case of hazardous waste, the following activities are included: operation of facilities for treatment of hazardous waste; treatment and disposal of toxic live or dead animals and other contaminated waste; incineration of hazardous waste; disposal of used goods such as refrigerators to eliminate harmful waste; treatment, disposal and storage of radio-active nuclear waste, including hospital waste; and encapsulation, preparation and other treatment of nuclear waste for storage.

Material recovery activities include: processing of metal and non-metal waste and scrap and other articles into secondary raw materials, usually involving mechanical or chemical transformation processes; recovery of garbage materials from waste streams, and recovery, separation and sorting of commingled recoverable materials such as paper, plastics, used beverage cans and metals.

Finally, remediation activities and other waste management services include: decontamination of soil and groundwater at the place of pollution; decontamination of industrial plants or sites; decontamination and cleaning of surface water following accidental pollution; cleaning up of oil spills and other kinds of pollution on land, surface waters, ocean waters; cleaning up of asbestos, lead paint and other toxic materials; clearing of landmines, and other specialized pollution-control activities.

a) Baseline information

To enable the undertaking of a post-disaster needs assessment, the following baseline information needs

to be collected by the assessment team to provide the basis for estimating disaster effects, impacts and needs:

- The characteristics (geographical or spatial location, and production, treatment, pumping, conveyance, storage, distribution and disposal) installed capacities of the main components of the water and sanitation systems located in the affected area itself.
- Existing similar capacities in nearby unaffected locations that may be used as alternative, temporary solutions after disasters.
- Statistical data on water supply, wastewater and solid waste disposal by main users, and their seasonal variation over the calendar year.
- Projections of above for the current and subsequent calendar years.
- Financial information on the public and private enterprises that provide services in the sector, including annual or monthly operational data on revenues and production costs, as well as data on the differential rates charged to each type of user[33].
- Statistical data on population coverage by water and sanitation facilities in both urban and rural areas.
- Millennium Development Goals for the sector and specific coverage and access targets (such as percentage of homes with direct connection and access to water and sanitation services in urban and rural areas) set for the current and subsequent years.

Sources of Information

The sources of baseline information may vary by state. However, the critical list of the likely sources of information is provided below.

- Information from the Ministry in charge of urban water supply and rural water supply;
- Central and State Statistical Offices;
- Sector reports conducted by development partners;
- Feasibility studies conducted for related projects;
- Annual reports of companies;
- Environmental impact assessment reports;
- Project evaluation reports;
- Field visits or interviews;
- Reports by NGOs; and
- Newspaper articles

b) Post-Disaster Situation and Performance

The second stage of the assessment requires the undertaking by the water and sanitation assessment team of a field visit (or visits, depending on the extent of the affected areas and the complexity of the issues)

[33]In the case of privately owned enterprises, this information is normally available in annual reports that by law are to be submitted by the enterprise to its stockholders.

to ascertain the effects of the disaster on the sector. It is also possible that the assessment team may need to review and field-verify disaster effects information and reports prepared earlier by other stakeholders.

After conducting the field surveys and holding in-depth discussions with substantive personnel from the enterprises (if they are not part of the assessment team) and with selected representatives of the consumers, the water and sanitation assessment team must be able to determine the remaining production capacity of each subsystem and its temporary performance, until the time when the systems can be repaired or rebuilt and brought back to their non-disaster level of operation.

c) Estimation of Disaster Effects

When a disaster occurs – as in all sectors of economic and social activity – the water and sanitation sector may sustain destruction of its physical assets (damage) and changes in its production flows, which may include both decline in production and sales of water and sanitation services and possible higher costs of systems operation.

The water and sanitation sector has distinct organizational features depending on whether it covers urban and rural areas. In urban areas, water and sanitation services are provided to the users through collective systems. In many rural areas, households usually own their own facilities that may include shallow wells and sanitary latrines or septic tanks; in some cases, community-owned system may be present. Each of these different types of systems will have to be analyzed by the water supply and sanitation assessment team for possible post-disaster effects and impact.[34]

In order to set up the water and sanitation sector assessment team, it is necessary to consider that civil or sanitary engineers are normally required for the assessment of damage; and the estimation of production flow changes usually requires the participation of economists or accountants with relevant experience in the water and sanitation field. Such diverse expertise is essential for the conformation of the assessment team.

For each of the drinking water supply, wastewater and solid waste subsystems in urban and rural areas, the value of destroyed physical assets (damage) must be estimated. A further breakdown may be required for the main individual components of these subsystems, including inter alia dams, wells, water-treatment plants, pumping stations, pipelines, storage tanks, distribution grids, sewerage facilities, latrines and septic tanks in the rural areas, and solid waste collection, treatment and disposal facilities.

The replacement value of destroyed assets must be ascertained using pre-disaster construction or replacement costs, that may be obtained either from private contractors presently involved in similar work in the affected country or area, or from the planning department of the affected utility enterprises that may have new, similar projects in the planning or construction stages. The replacement values to be adopted for the estimation of the value of damage are those that prevailed at the time just prior to the disaster, and not those affected by scarcity or speculation after the disaster; adjustments for the latter factors will be dealt with when overall reconstruction needs are considered.

Replacement values are used for the estimation of damage, but the assessment team must also ascertain

[34]To ensure a systematic, coherent and consistent treatment of different systems, whether collective or isolated, individual or community-owned, the water supply and sanitation assessment team should deal with the assessment for the entire sector covering both urban and rural systems.

the year when each damaged component of the individual systems was originally built. This information is required, not because depreciated or "book" value is to be used in the assessment, but because the macro-economic assessment team requires it for their subsequent estimations on disaster impact on the capital account of the country or State.

In addition, the water and sanitation team should meet with local insurance company representatives to ascertain whether the sector enterprises had any insurance coverage on the assets destroyed by the disaster. In addition, these meetings would enable to find out the possible amounts of insurance proceeds that may be expected after the disaster. However, the value of expected insurance proceeds is to be used for the estimation of reconstruction needs and not for the estimation of the value of damage.

To estimate production flow changes in this sector, an objective calendar of repair and replacement of the affected assets should be developed by the water and sanitation assessment team, giving due consideration to the availability and delivery schedule of adequate financing, as well as of replacement materials, equipment and machinery, and that will enable returning the system to normal (or non-disaster) conditions of service.

Based on the above, a preliminary calendar or schedule of capacity and access to water and sanitation service recovery must be developed by the water and sanitation assessment team. Furthermore, when the demand for services has been considerably affected – i.e. when destruction of housing and industries is widespread in an urban area, for instance – projections of recovery for the demand of water supply and sanitation services must be made on the basis of the reconstruction calendar of the respective sectors of housing and industry, and superimposed on the calendar of recovery of the water and sanitation services.

Production flow changes are then estimated by comparing the "non-disaster" to the "post-disaster" performance of each subsystem, ensuring that the following issues are duly examined:

- Temporary decline in operational revenues of the sector enterprises, until services are brought back to normal levels, due to the brief total suspension of operations and partial supply of services while assets are under repair, and due to possible temporary decrease of demand from consumers[35].
- Temporary increase in operational costs (due to use of alternative sources or means of water, wastewater and solid waste supply and disposal, the temporary operation of damaged system components, or the temporary, more-intensive operation of undamaged system components)[36].

A word of caution is required here for the assessment team members. In practice, it is quite possible that the water and sanitation systems may be repaired and reconstructed before the overall consumer demand

[35]The operation of the services may be fully stopped during an initial short period of time immediately after the disaster (a few hours to a few days), to be partially resumed during the period of repairs until full system reconstruction is achieved. In addition, service demand may drop due to extensive destruction in cities caused by the disaster and the subsequent overall lower economic activity. These temporary interruptions or partial operations for each subsystem would result in corresponding revenue decline for the enterprises.

[36]Among the possible items to be considered under this heading are: temporary higher costs of chemicals required to ensure quality of drinking water; higher water-distribution costs when temporarily using tanker trucks to reach users and/or the temporary free distribution of bottled water; the more-intensive operation of water systems to compensate for higher water flow losses in damaged system components (such as distribution or conveyance water mains); cleaning of sewerage systems and treatment plants after flooding; higher transport costs to collect and dispose of solid waste, etcetera. In some cases, salt-water desalination plants are installed and operated in coastal areas or in small island development countries affected by disasters, which imply a very high cost of operation. Such higher costs of post-disaster operation translate into higher intermediate consumption for the macro-economic impact analysis.

for its services recovers to non-disaster levels in the affected area. In the case of major disasters, where destruction of entire cities has occurred, the demand of water and sanitation services would not recover to non-disaster levels until full reconstruction of housing and industries is achieved; in such cases, revenues for the service enterprises would not recover until full reconstruction of the housing and other sectors is achieved. Therefore, the water and sanitation sector assessment team must interact closely with the housing and industry sector assessment teams to ascertain their likely period of reconstruction.

Production flow changes should be estimated on a calendar-year basis, including those of the year in which the disaster occurred and the subsequent years of recovery and reconstruction. In addition, the water and sanitation sector assessment team should analyze whether the estimated production flow changes (temporary lower revenues and higher costs of operation) have compromised the financial position of the utility companies in the sector, so much that a temporary modification of the tariffs charged to consumers is required as a result of the disaster, or whether a special subsidy is required from the State government in lieu of an increase in tariffs.

The ownership of damage and production flow changes is to be defined and broken down into public and private sector.

During the estimation of production flow changes, the water and sanitation assessment team should inquire with local insurance companies whether the disaster-affected enterprises had any insurance on revenue losses. While any possible insurance proceeds due to revenue losses would not reduce the estimated value of production flow changes or decline, the value of such insurance proceeds is to be used later on in the assessment for the estimation of recovery needs.

The assessment team members must keep in mind that any production flow losses arising in water-consuming sectors – such as agriculture, industry, trade and tourism, for instance – as a result of the non-provision or inadequacy of water supply, are to be estimated and accounted for in each of those sectors, either as production losses and/or as higher production costs when alternative, higher-cost sources of water are chosen by them as interim solutions.

In addition to the estimation of disaster effects on assets and production flows for the sector which was described previously, the water and sanitation assessment team must also obtain information on possible higher costs incurred by individual households in obtaining access to these services, as an input for the analysis of disaster impact on human development and quality of life for the population. These possible higher costs are different in urban areas that in the case of rural areas. Indeed, in urban areas, households may be forced to purchase bottled water whenever their access to drinking water from the damaged public systems is not sufficient, and this fact would increase their normal costs of living. In rural areas, several possible cases of higher costs can be foreseen: women and children may have to devote more time to fetching water from public sources (and thus have less time available to other productive and reproductive activities, including some cases in which children may have to forego attending school to take care of these chores); unforeseen household expenditures to deepen, cleanup and disinfect shallow water wells and septic tanks and latrines that may have been flooded, and others.

The assessment team, through direct field interviews with affected families and/or special sample surveys, should collect information on these types of temporary higher household costs of living and their amount. A word of caution: these household costs are not to be added to the water and sanitation sector production

flow changes estimated before, since such expenditures are not included in the production accounts. Instead, these additional costs of living are to be used independently by the human development impact assessment team to compare with the data on household or personal income decline to ascertain the impact of the disaster on quality of life, and would also be required by the macro-economic assessment team for use when estimating the higher production levels that will occur after the disaster in the sectors of economic activity where such inputs – i.e. bottled water in industry, tools and cement for deepening and chemicals for disinfecting sanitation facilities – are to be produced at higher amounts.

d) Estimation of Disaster Impact

In addition to the estimation of the value of destroyed assets and production flow changes, the water and sanitation assessment team is required to carry out some additional estimations, and their results are to be transferred to the macro-economic assessment team, since they may have a bearing on the macro-economic performance of the State or affected areas, and on the overall well-being of individuals and families affected by the disaster.

With regards to the macro-economic impact analysis this would include: first, the possible impact of production flow changes on GDP; second, on the balance of trade and payments and, third, on the fiscal budget, especially when the water and sanitation sector enterprises are government-owned or are privately-owned but receive subsidies from the government.

The impact of production flow losses on the government budget is to be estimated in terms of temporary increased operational costs and lower revenues. If the government directly owns the sector enterprises, losses will be sustained by the fiscal budget. In the case of a private sector enterprise that receives a government subsidy, the water and sanitation assessment team should ascertain whether the subsidy would remain uninterrupted and at the same level during the post-disaster recovery and reconstruction stages, or whether it may need to be temporarily increased, as indicated before.

For the damage assessment, estimates are to be included to ascertain the value of assets – including equipment, machinery parts, materials – that will require to be imported from abroad for the reconstruction stage when they are not produced in India, since this would have a negative impact on the balance of payments.

The above information is to be supplied by the water and sanitation assessment team to the separate team in charge of undertaking the overall, macro-economic impact analysis.

In order to ascertain disaster impact at the personal or household levels, the water and sanitation assessment team must estimate possible higher costs to obtain the sector´s services that would affect personal or household well-being, and deliver the results of such estimations to the separate assessment team in charge of estimating disaster impact on human development.

In the case of urban households, such higher service costs may occur due to an increase in monthly service charges and/or to the purchase of bottled water; in rural households, these may be in the form of longer times required by household members to fetch water from far-away sources, and through additional expenditures to purify water, deepen and clean wells and other similar expenditures. The values of these additional or higher household costs are to be delivered to the separate assessment team that is quantifying disaster impact on human development.

Furthermore, quantitative information on the post-disaster decline in water supply and sanitation service coverage and access for the population in the affected areas[37] is to be delivered by the water and sanitation team to the separate team in charge of estimating human development impact. Lastly, any quantifiable setbacks caused by the destruction of water and sanitation assets in the attainment of Millennium Development Goals (MDGs) are also to be delivered to the same team in charge of estimating human development impact.

e) Estimation of Post-Disaster Recovery and Reconstruction Requirements

Recovery is achieved at the time when the sector returns to normalcy, which is defined as being at a state that is at least equal to pre-disaster conditions. This would involve the provision of water and sanitation services to the population with the same coverage as before the disaster as well as in the same quantity and quality, and at the pre-disaster tariffs or rates. Recovery is not achieved until all destroyed assets have been rebuilt and are fully operational, hopefully under a building-back-better strategy that includes adoption of disaster-resilient standards.

The financial requirements or needs for institutional recovery of the water supply and sanitation services sector are defined as the amounts of financing required to ensure the returning of the sector to normalcy of operation after the disaster. They refer to the value of higher operational costs of the enterprises that provide the collective water supply and sanitation services in the affected area , from the time when the disaster occurred until full recovery and reconstruction has been achieved. If the assessment of post-disaster effects has been conducted correctly, the value of these recovery needs would already have been included as part of the estimated changes in production flows for the sector. However, the estimated value of recovery needs should be equal to the higher costs of operation caused by the disaster, minus any possible revenue-loss insurance proceeds that the utility enterprises may have had. Putting it differently, recovery needs would have a value lower than that of production flow changes.

It is to be noted that if government subsidies were already part of the regular financing of the water and sanitation services, a temporary increase in such subsidy may be required to assist the sector enterprises in recovery and to avoid transferring the higher operational costs to consumers through an increase in water and sanitation service tariffs.

The value of financing required for reconstruction of the destroyed components of the infrastructure or assets of the water supply and sanitation sector (reconstruction needs) is to be estimated by taking the estimated value of damage and increasing it by a certain percentage, whose magnitude depends on the degree of modernization, technological improvement and disaster-risk reduction that is required in the recovery and reconstruction strategy. That is to say, the value of reconstruction needs will be slightly higher than the value of damage.

Reconstruction needs should include – as was indicated for the estimation of the value of damage – both the reconstruction requirements of collective urban systems that may have sustained destruction and the requirements for individual household or community-based facilities that may have been destroyed in rural areas as well.

[37]This refers to the pre-disaster and post-disaster rates or percentages of persons or households that have access or have domestic connections to the water and sanitation systems in urban and rural areas, which are to be used in estimating changes in quality of life.

Experience acquired in the past forty years when post-disaster assessments have been conducted in many countries of the world reveals that the range of increase of the value of damage to obtain disaster-resilient reconstruction needs is between 10 to 25 per cent, depending on the possible risk reduction features that the infrastructure and assets had prior to the occurrence of the disaster. The exact figure to be adopted will have to be defined by civil or sanitary engineers that form part of the water supply and sanitation assessment team and who have had relevant experience in this type of work. Once the gross value of reconstruction needs has been estimated, the available amount of insurance-on-assets proceeds must be deducted to arrive at the net value of reconstruction requirements for the water and sanitation sector.

In the water supply and sanitation sector, human development recovery needs refer to the higher-than-normal costs of obtaining drinking water and wastewater and solid waste disposal services by individual households, in urban and rural areas, since these persons will require assistance to enable their access to such services during the post-disaster recovery and reconstruction stages. As was indicated before, such higher personal or household expenditures are not to be added to the estimated changes in production flows for the institutional water and sanitation sector, and should be estimated separately by the assessment team.

Such higher access costs incurred by households may include:

– Higher-than-normal household expenditures to purchase drinking water from private suppliers or to purchase of bottled water for urban household consumption, whenever households are unable to obtain it through the collective urban water-supply systems;

– Higher-than-normal expenditures made by households to purify water to ensure adequate quality of drinking water in urban and rural areas;

– Higher-than-normal expenditures made by mostly rural households that are unable to dispose of wastewater and solid waste through collective systems; and

– Possible opportunity costs incurred by rural families that must utilize more time of its members (mainly women and children) in collecting drinking water and thus are not able to temporarily continue with their normal productive and reproductive work after disasters.

These post-disaster higher household expenditures negatively impact the well-being or quality of life of affected families and represent a human development recovery need. It may be attended to through several alternatives, such as the setting up of special, temporary post-disaster state government assistance programs, aimed at providing the services of water supply and sanitation to affected households (in mostly rural but also in some urban cases) at no cost to the families; the provision of temporary cash grants to such affected families, over the time required for recovery and reconstruction of the water supply and sanitation systems; and/or, the setting up of “cash-for-work” programs to rehabilitate other infrastructure works and provide the affected population with the means to finance such post-disaster higher expenditures.

It cannot be over-emphasized that these human development recovery needs are not to be mistaken with the institutional economic recovery and reconstruction needs described in the preceding section of this chapter, and that they would apply only if the urban water supply enterprises are not able to provide full services and in the case of isolated, family systems of the rural areas.

Water Supply and Sanitation Sector

STANDARD PROCEDURES FOR SECTOR ASSESSMENT

Recommended Assessment Team

The composition of the sector assessment team may vary by the type of disaster and the extent of the likely damage and production flow changes.

Organization and Personnel	Role in the Sector Assessment

Personnel from:
• **State Department of Drinking Water Supply and Sanitation**
• **Department of Water Resources**
• **Local departments and offices in the disaster-affected area who are:**
  • Civil Engineer (Water / Waste)
  • Sanitary Engineer
  • Water Resources Engineer
  • Hydrologist
  • Water Supply Investment Specialist
  • Water Supply Economist
  • Water Supply Accountant
Goods/Equipment Buyer
	Lead and coordinate

Personnel from:
• **Ministry of Water Resources**
• **Central Water Commission (CWC)**
• **Ministry of Drinking Water Supply and Sanitation**
  • Civil Engineer (Water / Waste)
  • Sanitary Engineer
  • Water Resources Engineer
  • Hydrologist
  • Water Supply Investment Specialist
  • Water Supply Economist
  • Water Supply Accountant
  • Goods/Equipment Buyer
	Provide baseline information and facilitate the field assessment of damages and losses

Development partners (if active in the sector)	Participate and provide technical advice

Steps in conducting a PDNA in the water supply and sanitation sector

Step 1. Collect baseline information on sector assets and production flows

Baseline information must be compiled before the field assessment or, if possible, prior to the occurrence of disaster. The baseline data should be validated before the field visit to serve as the basis for the estimation of damages and losses for the disaster-affected area/s. This data can be compiled at the State/Regional office or at the Districts levels.The tables below can be used for the baseline information.

A. Water Collection, Treatment, and Supply

Table 1. Baseline information on assets in the urban or commercial water supply

Name of District:									
Name of Water Supply System:									
Population connected to system (%)									
Ownership	Public ( ) Private ( )								
Water Users and Supply	**Water Demand Forecast (Liters per year) and Rates (Rs. per Liter)**								
	Current year			**Year 1**			**Year 2**		
	Users	**Volume (L/Yr.)**	**Rate (Rs./L)**	**Users**	**Volume (L/Yr.)**	**Rate (Rs./L)**	**Users**	**Volume (L/ Yr.)**	**Rate (Rs./ L)**
Residential									
Commercial									
Industrial									
Others									

Water Supply Structures	**Water Supply Structures: Capacities and Costs**			
	Total Capacity (Liters)	**Operating cost (Rs./Liter)**	**Average Repair Cost (Rs.)**	**Average Replacement Cost (Rs.)**
Treatment Plants				
Storage				
Distribution				
Other sub-systems				

Equipment	**Equipment: Costs**	
	Average Replacement cost (Rs./Equipment)	**Unit Costs of Repair (Rs./Equipment)**

Notes for filling Table 1

- *It is possible that a water supply system located in one area serves the needs of other Districts or even the whole State. In such a case, the assets of the water supply system may be located in several Districts. The assessment team must be cautious about the possibility of double counting.*
- *For the structures and equipment, the table can be expanded to include all the types of structures or buildings and equipment, especially those that are vital in the operation of the water supply system.*
- *Year 1 and Year 2 refer to the estimated water demand after the current year.*
- *The same notes apply for Tables 3 and 4.*

B. Sewerage

Table 2: Baseline information on sewerage systems

Name of District:									
Name of Sewerage System:									
Population Connected to System (%)									
Ownership	Public ( ) Private ( )								
Sewerage Demands	**Sewerage Processing (Liters per year) and Rates (Rs. per Liter)**								
	Current year			**Year 1**			**Year 2**		
	Users	**Volume (L/Yr.)**	**Rate (Rs./L)**	**Users**	**Volume (L/Yr.)**	**Rate (Rs./L)**	**Users**	**Volume (L/Yr.)**	**Rate (Rs./L)**
Residential									
Commercial									
Industrial									
Others									

Sewerage Structures	**Sewerage Structures: Capacities and Costs**				
	Total Capacity (Liters)	**Operating cost (Rs./Liter)**	**Average Repair Cost (Rs.)**	**Average Replacement Cost (Rs.)**	
Sewerage Collection System					
Sewerage Treatment Plant					
Sewerage Disposal					
Other Sub-systems					

Equipment	Equipment: Costs	
	Average Replacement cost (Rs./Equipment)	Unit Costs of Repair (Rs./Equipment)

C. Waste Collection, Treatment and Disposal, Materials Recovery

Table 3: Baseline information on Solid Waste

Name of District:									
Name of Solid Waste System:									
Population Connected to System (%)									
Ownership	Public ( ) Private ( )								
Solid Waste Demands	**Solid Waste Processing (Tons per year) and Rates (Rs. per Ton)**								
	Current year			**Year 1**			**Year 2**		
	Users	**Volume (Tons/ Yr)**	**Rate (Rs./ Ton)**	**Users**	**Volume (Tons/ Yr)**	**Rate (Rs./ Ton)**	**Users**	**Volume (Tons/ Yr)**	**Rate (Rs./ Ton)**
Residential									
Commercial									
Industrial									
Others									

Solid Waste Assets	**Solid Waste: Capacities and Costs**			
	Capacity (Tons)	**Operating cost (Rs./Ton)**	**Average Repair Cost (Rs.)**	**Average Replacement Cost (Rs.)**
Waste Collection Trucks				
Individual Waste Containers				
Solid waste disposal sites				
Other Sub-systems				

Equipment	**Equipment: Costs**	
	Average Replacement cost (Rs/Equipment)	**Unit Costs of Repair (Rs/Equipment)**

D. Rural Water and Sanitation Systems

For the rural water supply system, sewerage, and solid waste systems, the following table can be used for the baseline information.

Table 4. Baseline information on rural water supply, sewerage, and solid waste systems in a district

Name of District:					
Rural Water and Sanitation Systems	Number by Ownership		Number of Users	Average Construction Cost	Average Repair Cost
	Public	Private	Families	(Rs. / unit)	(Rs. / unit)
Type of Water Supply System					
Open Well					
Closed Well with Hand Pump					
Closed Well with Storage & Electric Water Pump & Tap Stands					
Others					
Type of Sewerage System					
Septic Tanks					
Latrines					
Others					
Type of Solid Waste System					
Solid Waste Disposal Site					
Others					

Notes for filling Table 4

- *The number of each type of rural water supply, sewerage, and solid waste in a District should be identified whether public or private in ownership.*

Sources of Information

The sources of baseline information may vary by state. However, the critical list of the likely sources of information is provided below.

Ministry of Statistics and Programme Implementation	http://www.mospi.gov.in
The Registrar General & Census Commissioner, India	http://censusindia.gov.in
National Institution for Transforming India	http://niti.gov.in
Central Water Commission	http://www.cwc.nic.in
Open Government Data (OGD) Platform India	https://data.gov.in
Ministry of Drinking Water and Sanitation	http://www.mdws.gov.in
India Sanitation Portal	http://www.indiasanitationportal.org
Bhuvan, Indian Geo-Platform of ISRO	http://bhuvan.nrsc.gov.in

Note 1: Please use similar institutions at State level for baseline Information

Note 2: For Non-Government information sources, please search suitably

Step 2. Estimate value of damage and production flow changes

With the baseline information, field assessment should be undertaken in the affected Districts after a disaster. The assessment team from the State must work with their local counterparts in the Districts to ensure that the estimates for the damages and losses in the sector are accurate to the extent possible. Direct interviews with private contractors or government officials involved in the construction and repair of facilities can also be conducted during the field trip in order to validate unit costs of repair and reconstruction (which is already contained in the baseline data).

It should be noted that since there is a possibility that only one water/sanitation company provides services to a number of districts, caution should be exercised to avoid double counting. It is recommended that the assessment of damages and losses of the company should be accounted for in the district where the main office is located. However, if the main office is located outside the disaster area, the assessment team must account for the damages and losses of the company with an indication as to where such damages and losses occurred.

Step 2.1. Estimate the damages and losses to water/sanitation facilities

Repair and replacement costs should be estimated for the damaged components of water/sanitation companies. The time needed to reconstruct the damages should also be estimated. Aside from field visits to the disaster sites, the assessment team should interview the officers of the company/s to ascertain the extent and value of the damages and the estimated period before supply can be fully restored to the pre-disaster level. The officials and experts of the company/s can estimate the damages of their respective companies more accurately. Moreover, considering that some of the damages may cover a wide area that may be inaccessible to the assessment team, the people in the company/ies can get the data quicker from their colleagues in the field.

A. Water Collection, Treatment, and Supply

The value of totally and partially damaged assets can be summarized in the following table, which should be used in interviewing the officials of the water supply company/s as a questionnaire.

Table 5. Value of totally damaged assets and losses to water supply system

Name of Water Company	
Ownership	Public ( ) Private ( )
Location (District Name)	
Number of Clients Affected:	
Residential	
Commercial	
Industrial	
Others	
ESTIMATED DAMAGES	

Damage to Structures and Assets	Totally Destroyed		Partially Damaged		Total Damages (Rs.)	Average Time to Replace or Repair (Days)
	Number of Totally Destroyed	Average Replacement Cost (Rs.)	Number of Partially Damaged	Average Repair Cost (Rs.)		
	A	B	C	D	E	F
Water Treatment						
Structures						
a. Buildings						
b. Treatment Plants						
c. Others						
Equipment						
Machinery						
Others						
Storage						
Structures						
a. Buildings						
b. Storage tanks						
c. Others						
Equipment						
Machinery						
Others						
Distribution						
Structures						
a. Buildings						
b. Pipe systems						
c. Others						
Equipment						
Machinery						
Others						
TOTAL						
ESTIMATED LOSSES (Rs)						

Types of Losses	Disaster Year	Year 1	Year 2	Total (Rs.)
Foregone Income				
Cleaning up of Debris				
Higher Operating Costs				
Other Unexpected Expenses				
TOTAL				

Notes for filling Table 5

- *The company/ies should fill out information appropriate to their assets. There are various machineries and equipment in the water supply systems. They should be assessed especially those that are vital to the operation.*
- *'Average Replacement Cost' will be the average pre-disaster value of the structures and assets that were totally destroyed.*
- *'Average Repair Cost' will be the average cost of repair of the structures and assets that were partially damaged.*
- *In formula, the total damages will be (Column E) = (Column A) x (Column B) + (Column C) x (Column D).*
- *The same applies for the tables 6 and 7.*

A note on estimated losses:

Losses in the commercial water supply sub-sector will include the following:

- *Losses in revenues due to non-provision of water to the users during the period of rehabilitation and reconstruction.*
- *Foregone sales in water due to the decline in demand from consumers that have been affected by the disaster.*
- *Higher cost of chemicals and other inputs in ensuring the quality of drinking water.*
- *Higher water distribution costs when using tanker trucks to reach users.*
- *Higher cost due to more intensive operation of systems to compensate for water losses in damaged system components.*
- *Cost of cleaning of treatment plants and other sub-systems after flooding and removal of debris.*

B. Sewerage

The value of totally and partially damaged assets can be summarized in the following table, which should be used in interviewing the officials of the sewerage processing company/s as a questionnaire.

Table 6. Value of totally damaged assets and losses to sewerage system

Name of Sewerage-Processing Company	
Ownership	Public ( ) Private ( )
Location (District Name)	
Number of Clients Affected:	
Residential	
Commercial	
Industrial	
Others	

ESTIMATED DAMAGES						
Damage to Structures and Assets	Totally Destroyed		Partially Damaged		Total Damages (Rs)	Average Time to Replace or Repair (Days)
	Number of Totally Destroyed	Average Replace-ment Cost (Rs.)	Number of Partially Damaged	Average Repair Cost (Rs.)		
	A	B	C	D	E	F
Sewerage Collection System						
Structures						
a. Buildings						
b. Pipe systems						
c. Others						
Equipment						
Machinery						
Others						
Sewerage Treatment Plants						
Structures						
a. Buildings						
b. Storage tanks						
c. Others						
Equipment						
Machinery						
Others						
Sewerage Disposal						
Structures						
a. Buildings						
b. Disposal sites						
c. Others						
Equipment						
Machinery						
Others						
TOTAL						

ESTIMATED LOSSES (Rs)				
Types of Losses	**Disaster Year**	**Year 1**	**Year 2**	**Total (Rs.)**
Foregone Income				
Cleaning up of Debris				
Higher Operating Costs				
Other Unexpected Expenses				
TOTAL				

C. Solid Waste

The value of totally and partially damaged assets can be summarized in the following table, which should be used in interviewing the officials of the solid waste processing company/s as a questionnaire.

Table 7. Value of totally damaged assets and losses to solid waste

Name of Solid Waste Company						
Ownership	Public ( ) Private ( )					
Location (District Name)						
Number of Clients Affected:						
Residential						
Commercial						
Industrial						
Others						
ESTIMATED DAMAGES						
Damage to Structures and Assets	**Totally Destroyed**		**Partially Damaged**		**Total Damages (Rs.)**	**Average Time to Replace or Repair (Days)**
	Number of Totally Destroyed	**Average Replacement Cost (Rs.)**	**Number of Partially Damaged**	**Average Repair Cost (Rs.)**		
	A	**B**	**C**	**D**	**E**	**F**
Solid Waste Disposal						
Structures						
a. Buildings						
b. Treatment plants						
c. Others						
Waste Collection Trucks						
Equipment						
Machinery						
Others						
Others						
Structures						
a. Buildings						
b. Storage tanks						
c. Others						
Equipment						
Machinery						
Others						
TOTAL						

ESTIMATED LOSSES (Rs)				
Types of Losses	**Disaster Year**	**Year 1**	**Year 2**	**Total (Rs.)**
Foregone Income				
Cleaning up of Debris				
Higher Ooperating Costs				
Other Unexpected Expenses				
TOTAL				

D. Rural Water and Sanitation Systems

Rural water supply, sewerage, and solid waste systems, which are relatively simple should be assessed separately. The following table can be used.

Table 8. Damages and losses in the rural water supply, sewerage, and solid waste sub-sectors

Name of District:									
Rural Water and Sanitation Systems	**Totally Destroyed**			**Partially Damaged**			**Total Dam-ages (Rs.)**	**Total Losses (Rs.)**	**Number of Affected Users (Families)**
	Number of Totally Destroyed		**Average Replacement Cost (Rs.)**	**Number of Partially Damaged**		**Average Repair Cost (Rs.)**			
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
	Public	**Private**		**Public**	**Private**				
Type of Water Supply System									
Open Well									
Closed Well with Hand Pump									
Closed Well with Storage & Electric Water Pump & Tap Stands									
Others									
TOTAL									
Type of Sewerage System									
Septic Tanks									
Latrines									
Others									
TOTAL									

Type of Solid Waste System									
Solid Waste Disposal Site									
Others									
TOTAL									

Notes for filling Table 8

- *The 'Average Replacement Cost' and the 'Average Repair Cost' are in the baseline information.*
- *In formula, the total damages will be (Column G) = [(Column A +Column B) X (Column C)] + [(Column D + Column E) X (Column F)].*
- *Losses will be the additional cost of water that will be supplied by the government to the rural people.*
- *It must be noted that the losses may extend beyond the year that the disaster occurred.*

Step 2.2 Summarize the damages and losses in the sector in a District

Based on assessment of the commercial and rural water/sanitation facilities, the damages and losses in monetary terms can be summarized in the following table.

Table 9. Summary of damages and losses in a district

Name of District:								
A. WATER COLLECTION, TREATMENT, AND SUPPLY								
Number of Affected Clients of Commercial Water Supply:								
Residential								
Commercial								
Industrial								
Others								
Number of Affected Rural Water Supply Users: (Families)								
Open Well								
Closed Well with Hand Pump								
Closed Well with Storage & Electric Water Pump & Tap Stands								
Others								
Type of Water Supply System	**DAMAGES AND LOSSES (Rs)**							
	Within the Disaster Year				**Losses Beyond Disaster Year**			
	Damages		**Losses**		**Year 1**		**Year 2**	
	Public	**Private**	**Public**	**Private**	**Public**	**Private**	**Public**	**Private**
Commercial Water Supply								

Company 1								
Company n								
Total								
Rural Water Supply								
Open Well								
Closed Well with Hand Pump								
Closed Well with Storage & Electric Water Pump & Tap Stands								
Others								
Total								
B. SEWERAGE								
Number of Affected Clients of Commercial Sewerage:								
Residential								
Commercial								
Industrial								
Others								
Number of Affected Rural Sewerage Clients: (Families)								
Septic Tanks								
Latrines								
Others								
Type of Sewerage System	**DAMAGES AND LOSSES (Rs.)**							
	Within the Disaster Year				**Losses Beyond Disaster Year**			
	Damages		**Losses**		**Year 1**		**Year 2**	
	Public	**Private**	**Public**	**Private**	**Public**	**Private**	**Public**	**Private**
Commercial Sewerage System								
Company 1								
Company N								
Total								
Rural Sewerage								
Septic Tanks								
Latrines								
Others								
Total								
TOTAL								
C. SOLID WASTE								
Number of Affected Clients of Commercial Solid Waste:								
Residential								
Commercial								
Industrial								

Others								
Number of Affected Rural Solid Waste Clients: (Families)								
Solid Waste Disposal Site								
Others								
Type of Solid Waste System	**DAMAGES AND LOSSES (Rs.)**							
	Within the Disaster Year				**Losses Beyond Disaster Year**			
	Damages		**Losses**		**Year 1**		**Year 2**	
	Public	**Private**	**Public**	**Private**	**Public**	**Private**	**Public**	**Private**
Commercial Waste Disposal System								
Company 1								
Company N								
Total								
Rural Waste Disposal								
Solid Waste Disposal Site								
Others								
Total								
GRAND TOTAL								
Commercial System								
A. Water Collection, Treatment, and Supply								
B. Sewerage								
C. Solid Waste								
Rural System								
A. Water Supply								
B. Sewerage								
C. Solid Waste								

Step 2.3 Summarize damages and losses in the water and sanitation sector in the State

Once the summary table for each affected district has been filled out, the information should be used to summarize the damages and losses at the State level. The summary table below can be used.

Table 10. Summary of damages and losses in a State

Name of State:	
A. WATER COLLECTION, TREATMENT, AND SUPPLY	
Number of Affected Clients of Commercial Water Supply:	
Residential	
Commercial	
Industrial	

Others	
Number of Affected Rural Water Supply Users: (Families)	
Open Well	
Closed Well with Hand Pump	
Closed Well with Storage & Electric Water Pump & Tap Stands	
Others	

Type of Water Supply System	DAMAGES AND LOSSES (Rs.)							
	Within the Disaster Year				Losses Beyond Disaster Year			
	Damages		Losses		Year 1		Year 2	
	Public	Private	Public	Private	Public	Private	Public	Private
Commercial Water Supply								
Company 1								
Company N								
Total								
Rural Water Supply								
Open Well								
Closed Well with Hand Pump								
Closed Well with Storage & Electric Water Pump & Tap Stands								
Others								
Total								

B. SEWERAGE	
Number of Affected Clients of Commercial Sewerage:	
Residential	
Commercial	
Industrial	
Others	
Number of Affected Rural Sewerage Clients: (Families)	
Septic tanks	
Latrines	
Others	

Type of Sewerage System	DAMAGES AND LOSSES (Rs.)							
	Within the Disaster Year				Losses Beyond Disaster Year			
	Damages		Losses		Year 1		Year 2	
	Public	Private	Public	Private	Public	Private	Public	Private
Commercial Sewerage System								

Company 1								
Company N								
Total								
Rural Sewerage								
Septic Tanks								
Latrines								
Others								
Total								
TOTAL								
C. SOLID WASTE								
Number of Affected Clients of Commercial Solid Waste:								
Residential								
Commercial								
Industrial								
Others								
Number of Affected Rural Solid Waste Clients: (Families)								
Solid Waste Disposal Site								
Others								
Type of Solid Waste System	**DAMAGES AND LOSSES (Rs.)**							
	Within the Disaster Year				**Losses Beyond Disaster Year**			
	Damages		**Losses**		**Year 1**		**Year 2**	
	Public	**Private**	**Public**	**Private**	**Public**	**Private**	**Public**	**Private**
Commercial Waste Disposal System								
Company 1								
Company N								
Total								
Rural Waste Disposal								
Solid Waste Disposal Site								
Others								
Total								
GRAND TOTAL								
Commercial system								
a. Water Collection, Treatment, and Supply								
b. Sewerage								
c. Solid Waste								
Rural System								
a. Water Supply								
b. Sewerage								
a. Solid Waste								

Drought

Droughts can cause more losses than damages. Structures and equipment are seldom affected by droughts but losses in production happen. In cases of drought, losses will occur for the water companies when the reduction in the supply of water for treatment and distribution is greatly diminished. The impacts of droughts will, however, impact also on the other sectors that are dependent on water for manufacturing or rendering services. However, since drought can be predicted and does not occur suddenly (slow-onset phenomenon), its effects can be mitigated by advising the water companies beforehand to prepare contingency plans that will address a possible supply shortage due to the expected drought. Nevertheless, if and when drought occurs, the impacts to the people and the larger community and economy as enumerated and explained below, can be expected.

Step 3. Analyze the impacts of the damages and losses to affected population

The assessment teams of the DHUP and the MPH should analyze all potential impacts of the damages and losses of water supply sector and must answer the following questions:

- What are the possible effects on the health and sanitation of the people, social services (like hospital and school operations), productivity, government services, etc. if water supply is not restored immediately?
- Are there added costs to families if they will have to procure water from other sources?
- Will there be losses in employment from the water supply companies?
- What are the potential adverse impacts to the production and employment of other industries if water supply is not restored?

The following matrix can be used to express the social impacts of the damages and losses to the water supply sector.

Matrix 1. Social impacts of the damages and losses to the water supply sector

Area of Impacts	Expected Impacts						Brief Description of Impacts
	General Population			Women and Children			
	S	M	L	S	M	L	
Health and Sanitation							
Government Services							
Added Cost to Households							
Employment							
Economic Productivity							
Others (Specify)							

Notes for filling Matrix 1

- *The expected impacts are segregated into a) the impacts on the general population; and b) the impacts on women and children measured as severe (S), medium (M) or low (L). The assessment team should mark under the column whether the impacts are S, M or L.*
- *The impacts can be briefly described under the column "Brief Description of Impacts". For example, a brief description of a severe "impact on health and sanitation" can be the spread of diseases; the "added cost to households" can be described as the higher cost of bottled drinking water bought by the households; while the impact to "government services" can be the inability of hospitals to perform vital services to the people due to the absence of water supply.*

  The impacts on women and children may be different from the general population. For instance, women and children who collect water may have to walk longer distances if the available water supply is farther from home. On the other hand, if clinics or hospitals cannot provide pre-natal care or immunization, women and children will be more adversely affected.

Step 4. Identify the recovery strategies and estimate recovery and reconstruction needs

The post-disaster needs must be based on a framework where policies and strategies are likewise integrated. After analyzing the potential effects and impacts if no assistance will be provided to the sector, the aggregate needs of the sector must be estimated.

Step 4.1 Identify recovery and reconstruction strategies

After the consolidation of the field assessment, the assessment team must identify or recommend the policies and strategies for the recovery and reconstruction for the sector.

The following are some of the general policies and strategies that could be considered.

A. Policy measures

There are certain policies that can be adopted over a limited period, which can provide incentives to the private sector to reconstruct damaged assets with higher standards of resilience. Among them are:

1. Tax breaks for private companies such as:
   a. Temporary reduction or freeze or deferment in the collection of tax;
   b. Temporary freeze on basic service charges in the utilization of certain services over the time of the recovery phase;
   c. Non-collection of property taxes for the duration of the recovery period;
   d. Exemption from registration fees for replacements of the destroyed equipment and machinery over a certain period of time.
2. Subsidizing construction materials and equipment to be imported by private water companies during

the recovery and reconstruction phase through an exemption from paying customs duties and other levies.

3. Extending bank guarantees on loans by the government to enable the private sector to rebuild immediately.

B. Strategies

The following strategies can be adopted for the post-disaster recovery and reconstruction activities:

a. **Building Back Better (BBB)**. Recovery activities based on BBB principles will promote longer-term disaster risk reduction and management. BBB principle should look at the how to make infrastructure and facilities safer from future disasters like stronger engineering design, the advantages of resettlement of facilities in disaster-safe areas instead of rebuilding in the same disaster-prone areas, etc.

b. **Focus on the most vulnerable and socially disadvantaged groups such as children, women, and the disabled**. Recovery programming needs to give priority to the most vulnerable groups, including female-headed households, children and orphans, and the poor, and take into account those with special needs.

c. **Community Participation and Use of Local Knowledge and Skills**. The participation of the community in all process (identification, planning, design and implementation) of recovery activities will help ensure the acceptability of projects and optimize the use of local initiatives, resources and capacities.

d. **Secure development gains**. Recovery strategies, although may be a separate set of activities, must be supportive of existing development plans and must attempt to re-establish and secure previous development gains.

e. **Coordinated and coherent approaches to recovery**. Projects for disaster recovery must have the full and effective coordination among all involved agencies based on comprehensive information exchange, flexibility in administrative procedures, and uniformity of policies. In some instances, a special new agency may be needed to oversee, coordinate and monitor complex disaster recovery programs. Under this strategy, capacity building activities for the local public administration may be part of the recovery activities including a well-defined monitoring and evaluation system for the overall implementation of the recovery plan.

f. **Efficient use of financial resources**. The overall strategy should also include the identification of fund sources that are suited for the recovery activities. It should be clear how assistance to the recovery of the private sector will be delivered. Also, some cheaper source of funds from international donor partners should be initially identified for longer-term expensive projects.

g. **Transparency and accountability**. The overall plan and implementation of projects for recovery must be transparent, especially to those affected, through open and wide dissemination of information on all aspects of the recovery process. An effective monitoring system must be established.

Step 4.2 Estimate recovery needs

Recovery needs are intended to bring back normalcy in the sector as quick as possible.

In the water supply sector, quick recovery efforts must be undertaken especially as a great number of people and businesses depend on it for their activities.

Recovery activities should include those that will enable companies to resume their normal operations. Some of the possible recovery-related activities in the water sector can include:

- Soft-term credit for the repairs of the damages to the storage and distribution systems of commercial water supply systems, which are normally affected by strong winds and floods. Among the repairs that may be required are clogged or busted pipes among others.
- Clearing of debris that may have affected the various sub-systems of the sector.
- Assistance to water users in checking or repairing their individual installations to assure safety after the disaster.
- Urgent repairs of the damages to the rural water supply sector especially those that are used by the poor people in remote areas. This will prevent the spread of water-borne diseases and lessen the cost to the government of providing temporary water supply.

Step 4.3 Estimate reconstruction needs

Reconstruction needs are generally long-term in nature (3 years and more) and are intended to 'build back better' from the ruins of a disaster.

It is to be noted that reconstruction activities should include both public as well as private facilities and may require different types of financing strategies.

It is also important to note that since the commercial water supply companies are revenue-generating enterprises, financing their needs can come through soft-term credit schemes for the reconstruction and repair of their damaged assets.

Such schemes can be accompanied by technical assistance for improved disaster resilient standards of construction. Some possible reconstruction related activities in the sector can include the following:

- Long-term credit for the replacement or repair of affected structures under a building-back-better strategy to ensure future disaster resilience through the adoption of improved construction standards and/or for the procurement of equipment and machinery.
- Structural retro-fitting of undamaged or partially damaged structures so that they are not affected by disaster event in the future;
- Relocation of certain facilities to safe areas.; and
- Other mitigation measures such as construction of support infrastructure to prevent serious landslides and floods to the facilities.

Step 4.4 Prioritize identified projects for recovery

Among the projects identified, relative priorities can be set in order to determine which among them are the more important. Based on the broad strategies for recovery, the assessment team should select the priority projects/activities among the identified needs.

The prioritization can be made by using a set of impact indicators and the level by which the projects can achieve said impacts. Examples of the criteria that can be used are the following, among others:

a. **Economic impact**, which can be evaluated in terms of the relative cost to the government of not undertaking reconstruction or rehabilitation.

b. **Equity and social impact**, which can be in terms of the number of beneficiaries who are poor and destitute and who could not afford to rebuild on their own without outside support.

c. **Sustainability**, which can be in terms of the reduction of risks and vulnerability of the people and other economic assets to future disasters.

The criteria above can be placed in a matrix like the one below where the impacts are ranked according to low, medium or high. This matrix can show the relative benefits of proposed projects to the people in the affected areas, which, in turn, will inform and assist the government in determining the priority projects within the sector.

Matrix 2. Impacts of identified post-disaster projects

Name of Proposed Project	Expected Impacts on Recovery								
	Economic Impact			Equity and Social Impact			Sustainability		
	High	Medium	Low	High	Medium	Low	High	Medium	Low

Step 4.5 Summarize the estimated recovery and reconstruction needs and draft the implementation schedule

Based on the prioritized recovery and reconstruction needs, a summary should be created by the assessment team enumerating the post-disaster projects for the recovery and reconstruction.

The identified needs should have a rough schedule of implementation outlining at the very least the activities, timing and budget required for all the programs and projects. The following techniques can be considered:

1. Identify the specific projects according to their relative urgency or priority in relation to recovery.
2. Plot the timeline of activities of all the projects, with the urgent ones on top, in a Gantt chart with the corresponding funding requirement on an annual basis. This will assist the national government in programming the necessary funds over a certain time period, like on a quarterly or annual basis.
3. Identify and include in the list of projects that need further feasibility studies, which may be funded by foreign grants.
4. To the extent possible, a logical framework (log-frame) should be created for each of the project proposed for inclusion in the recovery plan. Log-frames are normally required by foreign donors to consider project proposals.

The recovery and reconstruction needs of the sector can be summarized in the table below showing the financing requirements over the years. Reconstruction needs mostly require long-term implementation periods. They normally require three or more years to complete.

Table 11. Summary of recovery and reconstruction needs in the water supply sector.

Name of Specific Projects	Annual Needed Amount of Assistance (Rs.)						Total Needs (Rs.)
	Disaster Year	Year 1	Year 2	Year 3	Year 4	Year 5	
Recovery Projects							
Total							
Reconstruction Projects							
Total							
GRAND TOTAL							

Note for filling Table 11

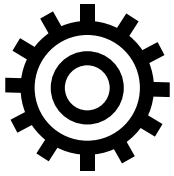
- *Project titles can be inserted under the column on recovery and reconstruction needs.*

Step 5. Draft the post-disaster damages, losses and needs (PDNA) report of the sector

With all the information gathered using the previous steps, a report can be drafted by the assessment team, which uses the inputs from all the sectors in the overall recovery and reconstruction plan. The following format may be considered:

1. Brief description of the sector in the disaster-affected areas.
2. Damages in the sector by areas and by types of assets affected.
3. Losses in the sector emphasizing the losses in income, increase in expenditures, estimated period before normalcy will be attained, etc.
4. Impact on the livelihood, individual households, vulnerable groups and the consequences to the greater community if no assistance for recovery will be provided.
5. Proposed strategies for recovery and reconstruction of the sector.
6. Needs of the sector, by priority, and the draft schedule of implementation with the estimated funds required for each project over time.

The draft sector report should be submitted to the State Disaster Management Office for consolidation.



Trade and Services Sector

This section contains the following contents – specific to this sector – in order to guide the user to successfully conduct post-disaster needs assessment in India:

1. **The Introduction to the Sector**
    a. Baseline information
    b. Post-disaster Situation and Performance
    c. Estimation of Disaster Effects
    d. Estimation of Disaster Impact
    e. Estimation of Post-Disaster Recovery and Reconstruction Requirements
2. **The Standard Procedure for the Sector Assessment**
    a. Recommended Assessment Team
    b. Steps in conducting a PDNA in the trade and services sector
        - Collect baseline information on sector assets and production flows
        - Estimate value of damage and production flow changes
        - Analyze the impacts of the damages and losses to affected population
        - Identify the recovery strategies and estimate recovery and reconstruction needs
        - Draft the post-disaster damages, losses and needs (PDNA) report of the sector

The user is advised to refer to:

a. *The "Introduction of the PDNA Manual" for a complete information of the concepts and definitions on the post-disaster needs assessment (PDNA);*
b. *The section on "Disaster Effects, Impact Assessment, Needs Estimation" for a more detailed discussion in identifying the possible impacts within and across sectors; and*
c. *The section on "Estimation of Post-Disaster Recovery and Reconstruction Needs" for a more detailed discussion on identifying and prioritizing post-disaster needs.*

Introduction

As defined in the worldwide System of National Accounts[40], the trade (commerce) sector includes wholesale trade, retail trade, sales, maintenance of vehicles, as well as hotel and restaurant services or tourism. Because of its relevance to development in India and its special characteristics, however, the case of tourism will be dealt with in a separate chapter. On the other hand, because of the close link between the trade and the services sector, and considering that they are under the purview of a single ministry, the assessment of both the trade and services sectors are integrated in this section. However, it is important for the macroeconomic assessment team to segregate it before plugging in the national system of accounts in India.

Again, it needs to be indicated that in India the commerce or trade sector as well as the services sector are not normally included in the assessment of disaster effects and impact, despite the fact that a sizable number of the population is engaged in formal and informal trade activities. Any destruction of the physical assets of the sector and the disruption of its sale activities would have a negative bearing on the employment and income of the many persons and households that depend on the sector for its livelihood.

The reason behind this exclusion probably lies in the fact that most of the trade or commerce and services activities are in the hands of the private sector as well as in the erroneous assumption that they have insurance that would take care of their post-disaster needs for recovery and reconstruction. As was indicated in the case of the manufacturing sector, the number of commercial establishments that have insurance is very limited in India, as in other developing countries. In fact, it has been found that only a limited number of such enterprises have insurance on their assets, and that an even lower number of trade companies have insurance on loss of sales. Again, the above facts are more evident in the case of the micro- and small-to-medium-sized commercial establishments, whose savings capacity and credit worthiness is very limited. Therefore, they have a high vulnerability to disasters and do not receive any assistance after disasters, thus leaving a sizable fraction of the population unattended for recovery and reconstruction. The result is evident: many traders may go broke and fall below the level of poverty after disasters.

The above statements are not made with a view to have the Central and State governments include the affected traders in the current post-disaster assistance programs. Instead, the intention is to highlight the fact that these trade individuals and companies also have recovery and reconstruction needs, which should be addressed by the development and private banking systems to ensure their adequate and prompt recovery after disasters. In case of micro-traders, it may be necessary to define special modalities of financing for recovery because they are not credit-worthy, have no savings, and cannot be expected to meet their post-disaster requirements through private credit.

Any post-disaster needs assessment should include the estimation of damage and sales decline in the trade sector, and its subsectors, to ascertain disaster impact on the traders and estimate their recovery and reconstruction requirements. Leaving them out of the assessment,accounts to leaving unattended a sizable fraction of the affected population, which would lose employment and income.

[40]See United Nations, International Standard Industrial Classification of All Economic Activities, Rev.4, New York, 2008. (http://unstats.org unsd/cr/registry/). According to the India System of National Accounts, this sector falls under “Trade, hotels and restaurants”.

The trade and services sectors may be affected by disasters of every kind, sustaining destruction of its physical assets (damage) and changes in the flows of sales. The latter may include both a decline in sales as well as higher costs of operation of the commercial establishments.

As is customary, damage in commerce and services establishments – including premises, furniture, equipment and stocks of goods – is measured initially in physical terms and subsequently converted into monetary terms by using the construction cost or replacement value of the destroyed physical assets, to the same quality and quantity standards they had prior to the disaster.[41]

Changes in the flows of sales in the sectors refer to temporary decline in sales of goods and to increases in operational costs that may arise after – and as a consequence of – the disaster. The decline in sales is usually caused by the destruction of the premises and furniture and of the stock of goods to be sold in each commercial establishment, as well as by the possible lack of key inputs such as electricity and water required for the operation of the shops, or by the temporary absence of labour who may be occupied attending to other, more urgent chores. Another possible limitation to sales may be the absence or inadequacy of credit or financing for the acquisition of goods to sell. Higher costs of operation may be faced by traders, when they have to temporarily rent alternative premises while repairs/reconstruction are being made to the damaged premises, when acquiring goods to sell from alternative, higher-cost sources, or when having to pay more for electricity and water supplies.

In cases of major disasters that may have caused widespread destruction, the affected population may not have the means to acquire goods in markets, and a decline in their demand may occur with corresponding lower sales of goods for the traders. Such cases of lower demand of goods would only be overcome when general recovery measures are put in place. On the other hand, during the post-disaster reconstruction stage, the demand for sales of construction materials and equipment may increase and compensate – and sometimes exceed – the losses in sales caused by the disaster. However, these are to be estimated and considered afterwards, and the initial estimation of disaster effects should not consider such positive indirect impact of post-disaster reconstruction.

The informal sector

One of the important phenomenon in the trade and services sector is the presence of informal sector. In general terms, the informal sector, informal economy, or grey economy is the part of an economy that is neither taxed, nor monitored by any form of government. Unlike the formal economy, activities of the informal economy are not included in the gross national product (GNP) and gross domestic product (GDP) of a country. The workers in the informal sector (informal workers) are mostly:

- self-employed or work for those who are self-employed;
- not subjected to registration and taxation;
- doing their businesses in unprotected and unsecured places;
- belonging to the lower income bracket; and
- engaged in micro-scale manufacturing (handicrafts, home-based food processing, etc.), selling or trading of goods (retail of assorted goods) and services (barbers, shoe-shine, repair, etc.).

[41]The possibility of reconstruction or replacement using improved, disaster-resilient standards, as part of a possible strategy of "building back better", would be considered at the time of estimating needs for recovery and reconstruction.

Due to the vulnerabilities of the informal sector and its workers, special consideration should be conducted to assess the potential adverse impacts to the workers and their families. The assessment of disaster effects for the trade and services sectors are more complex than in other sectors in view of the usually large number of existing businesses both formal and informal, with different types and size, which may exist in the disaster-affected areas. Therefore, surveys of affected establishments may be needed.

For the estimation of damage in this sector, civil engineers or architects are required to be part of the commerce assessment team, while economists are required for the estimation of sales flows changes.

a) Baseline Information

The following baseline information on the characteristics and capacity of the trade or commerce sector must be obtained to provide the quantitative basis required for the assessment:

- Number and size of commercial establishments, by type of business, existing in the affected area;
- Typical physical facilities in each of the above, including a description of the usual furniture, equipment and storage of goods to sell, as well as required for the provision of services;
- Information on the value of annual or monthly gross sales for each type of commercial establishment; and
- Quantitative information on the usual destination of sales, whether it is for domestic consumption and/or for export to other countries.

This type of information is normally available in the most recent commerce sector survey or census that the country may have undertaken, which may have been conducted either by the Ministry of Trade or Commerce and/or by the Central or State Statistical Office in the affected State. Further information may be obtained from the national accounts handled by the Central Statistical Office. Since this information may already be out of date at the time of the assessment, projections to the current year must be made based on recent growth rates for the sector.

Additional information may be obtained through direct contacts and close cooperation with private sector Chambers of Commerce representatives, which would normally have detailed information on the capacities and revenues of their associates. In fact, such private sector bodies should become partners in conducting the assessment, since they are normally very keen in defining post-disaster needs for recovery and reconstruction. Further quantitative baseline information may be obtained from the municipalities where the commerce or trade shops are located, since they usually submit reports of their stocks and facilities for tax payment purposes. Similar data may be available to insurance companies for the cases of the limited number of commerce or trade shops that carry infrastructure and/or sales insurance.

The assessment team for the commerce or trade and services sector should be aware that large commercial establishments make the highest percentage of sales in any given state or area, a fact that should facilitate planning for conducting field visits and sample surveys. However, micro-sized to medium sized commercial establishments are always more numerous and usually generate more employment of personnel, and their analysis would require special attention. The latter consideration is very relevant for the case of informal traders and service providers, which are usually the most affected by disasters and whose sales are not

necessarily included in the national accounts. In this case,, use may be made of special sample surveys that may be conducted in temporary shelter camps during the assessment.

On the basis of the previously listed information, a typology of commercial shops, under private or public ownership, should to be defined for purposes of the assessment.

b) Post-Disaster Situation and Performance

The trade and services sector assessment team should undertake field visits to determine the effects of the disaster in the affected commercial enterprises and shops; alternatively, it may rely on existing reports from qualified stakeholders that may have already visited the affected areas and establishments, no matter how preliminary those estimates are. In the latter case, however, the commerce sector assessment team should validate, homogenize and supplement the existing estimations, on the basis of their direct field observations.

In addition to the above – in a similar fashion as for the case of the manufacturing sector – a sample survey of affected typical commercial establishments should be conducted simultaneously to ascertain the average value of damage and estimate the possible changes in sales flows for the sector. This sample survey should cover an adequate number of all types and sizes of commerce shops in the affected area to obtain representative values of damage, losses in sales and requirements for post-disaster recovery and reconstruction for the sector.

The sector assessment team must use the available baseline information data, together with the results of the two separate sample surveys and of any existing preliminary disaster effects reports, to estimate the number of commercial establishments and shops of each pre-defined type, that may have sustained total or partial destruction and whose sales may have been disrupted directly or indirectly by the disaster, the time of sales stoppage or decline due to different reasons[42], and the likely requirements for recovery and reconstruction. During the same field visit, the sector assessment team must collect unit reconstruction and replacement costs for rebuilding physical assets as well as replacement of equipment and stock of goods, through direct interviews with traders. Any difficulties and limitations foreseen by the owners of such establishments – for instance, in terms of financial and credit requirements, availability of goods to sell, availability of labour, etcetera – are to be identified.

On the basis of the information thus collected and in combination with the baseline data on existing physical capacities and normal or non-disaster volume of sales, it will be possible for the commerce team to develop a scenario of how the sector will likely function after the disaster until full recovery and reconstruction is achieved. This would include developing separate calendars for the repair and reconstruction of buildings and other facilities, replacement of equipment and goods to sell and for the resumption of normal or non-disaster sales levels over time.

[42]Temporary business stoppage or decline may be due to several possible reasons, such as: destruction of premises, equipment and machinery, and goods to sell; temporary unavailability of inputs such as electricity and water; temporary unavailability of sufficient labor and of goods to sell, and lack of working capital.

c) Estimation of Disaster Effects

Destruction of premises, furniture, equipment and stock of goods to sell

The value of the destroyed assets (damage) in the trade and services sector is to be estimated on the basis of the cost to rebuild or repair the buildings and other associated premises that were totally or partially destroyed, as well as the replacement cost of the furniture, equipment and stocks of goods to sell that were destroyed, assuming that they are being replaced with the same capacity and quality they had prior to the disaster.[43]

Since it is likely that in the affected area there will exist a very large number, size and type of establishments, the damage assessment must rely on information obtained from the already-mentioned, parallel sample survey to define average values of damages of each type of business either totally or partially destroyed. Then, an extrapolation of the value of damage to cover the entire universe of trade establishments in the affected area or country must be made based on an assumed ratio of destroyed versus total number of shops[44]. The accuracy of this extrapolation of course is of paramount importance, and the assessment team should devote sufficient time in order to discuss and agree on such ratio, so that results are reliable.

In addition to the estimation of the value of damage, the sector assessment team must obtain the average age of the destroyed infrastructure, and deliver such data to the macroeconomic assessment team. Note, however, that the estimated value of destroyed assets is that of their replacement cost, and not that of their depreciated or "book value". Special care must be taken by the commerce sector team estimating damage to informal traders. Due to their special characteristics, it is likely that they faced destruction of premises (they usually operate from their own homes rather than from separate commerce buildings) and destruction of the stock of goods they normally sell, which in many cases would not represent more than a week´s worth of sales.

Disruption of businesses

The estimation of revenue flow changes must be made on the basis of several considerations, of which the time frame of their occurrence is paramount. Revenue flow changes will normally occur over the time period required to achieve full reconstruction of premises, replacement of destroyed furniture and equipment, and resumption of normal availability and flow of goods to sell. Therefore, revenue flow changes are likely to occur due to:

- Destruction of sector assets, in terms of destruction of buildings, equipment, furniture and stock of goods to sell;
- Temporary stoppage of sales due to lack of electricity or water;
- Temporary disruption of goods availability and inflow;

[43]The higher costs involved in building back to improved, disaster-resilient standards and in retrofitting existing structures are to be included as part of the subsequent estimation of needs in the assessment. If for some reason, the equipment and machinery that was destroyed can only be substituted by more modern and capable machinery, the additional costs involved should be taken into consideration during the estimation of needs.

[44]In more than one case, use has been made of the ratio of destroyed to existing housing units, for the estimation of the ratio of micro – and small-to-medium size trade shops, whenever an actual ratio has not been possible to obtain.

– Temporary unavailability or shortages of labour;
– Future unavailability of goods to sell that may be due to future losses expected in agriculture, livestock and fishery production;[45]
– Insufficiency or non-existence of working capital at the commercial enterprise; and
– Possible changes (decline or increase) in demand of the goods, that may arise from possible generalized income decline of the population and from anticipated or foreseen high demand for construction materials for the reconstruction, respectively.

Therefore, it is essential for the sector assessment team to develop a comprehensive calendar of how and when the above mentioned limiting factors would be overcome, giving due consideration to the availability of, and difficulties to, obtaining adequate financing for working capital. The change in revenue flows to be estimated should include both possible sales decline and operational cost increases. The value of possible sales decline is to be estimated on the basis of the expected time frames necessary to achieve normal or non-disaster levels of sales, after overcoming the possible problems described above. Increased operational costs may arise from the following possible reasons:

– Payment of overtime to staff to attend and solve most urgent problems immediately after the disaster occurs;
– Rental of alternative premises, furniture and equipment while the destroyed or damaged ones are being rebuilt or repaired;
– Temporary acquisition of electricity and water from alternative sources, such as renting or acquiring portable power generators; and
– Temporary acquisition of goods to sell from alternative sources that may be costlier and/or located in far-away locations including other countries.

The estimated figures of damage and changes in sales flows should be broken down according to ownership by private and public sector. In this regard, it should be recalled that some trade enterprises might be owned by public or private sector as well as in some cases they may be owned jointly.

d) Estimation of Disaster Impact

The trade or commerce sector assessment team must make additional estimations in this sector that may have an impact at both the macro-economic and personal or household levels, and deliver them to the appropriate assessment teams that are handling disaster impact analysis.

For the macro-economic impact analysis, the following values must be estimated by the trade and services sector assessment team and delivered to the macro-economic impact assessment team:

– The estimated value and calendar of changes in the flows of revenues (including lower sales levels, and possible higher cost of sales)[46], expressed in current value, to be used for the analysis of disaster impact on gross domestic product and growth;

[45]This refers to the case of food products obtained from the food processing industry, but also applicable for goods from other agro-industry enterprises that may face future shortages of raw materials due to future losses in primary agriculture, livestock and fishery production.

[46]These are in fact higher values of intermediate consumption.

– The estimated value of goods that will not be possible to export to other countries due to the shortages of production, and/or the estimated value of goods that may need to be imported due to shortages in their domestic or local production, since this would have a bearing on the balance of trade and payments of the country;

– The estimated imported component of the commerce sector reconstruction costs (including the items that are not produced locally in the affected country and that will have to be imported from abroad), expressed in percentage (%) terms of reconstruction needs once they have been assessed, to be used for the impact analysis on the balance of payments;

– Estimated values of tax revenues (sales taxes or value added taxes, depending on the national and State tax scheme) that will not be accrued by the government due to the decline in commerce sector sales, to be used for fiscal sector impact analysis; and

– Values of decline in sales and higher production costs arising from the disaster in the case of government-owned commerce enterprises, to be used in the analysis of disaster impact on the fiscal sector.

For the estimation of disaster impact on personal well-being and on human development the following values must be estimated by the trade sector assessment team and delivered to the human development impact assessment team:

– The estimated value of sales that will not be made by enterprises after the disaster, which may translate into possible employment and personal income losses of the commerce sector labour force; and

– The estimated value of informal-sector sales obtained from the separate sample survey of informal traders conducted in the shelter camps, which would translate into livelihood and income losses.

The assessment team for the trade sector should be aware that any losses in personal or household income are not to be added to the value of losses in trade sales; otherwise, double accounting of disaster effects would occur. Instead, the team should realize that these losses in personal or household income are disaster effects measured at a different level of analysis.

e) Estimation of Post-Disaster Recovery and Reconstruction Requirements

Financial requirements or needs to ensure the recovery of the commerce or trade sector are defined as the amounts of funding required to ensure returning the sector to its normal level of functioning and sales. In most cases, these needs would include the availability of financing to ensure the availability of sufficient working capital for the affected enterprises to re-start operations, including the possible need to refinance or reschedule non-performing loans arising from the disaster. Such financing may be channelled to the entrepreneurs through different ways, depending on their size and credit worthiness:

– Cash grants for micro-sized entrepreneurs, to avoid their resorting to use informal credits from loan sharks;

– Soft-term credit for small-to-medium sized enterprises (SMEs) channelled through the development or private bank systems, with lower-than-normal interest rates and longer repayment period.

– Large enterprises, that are usually at least partly insured, may require in some cases to receive temporary tax relief during recovery.

The amounts of financing required for these recovery schemes may be estimated by trade economists on the basis of the estimated value of disaster-induced sales decline for each type and level of trading enterprise, since they normally have a typical value of stocks to sell in their premises that may have been destroyed. Experience acquired in the past 40 years of disaster assessments has revealed that the usual range of such recovery needs ranges between 25 to 35 per cent of the value of losses in sales; the detailed results of the commerce sample survey, however, would provide information on which to more companyly define this range or working capital needs.

The above values are to be decreased by the amounts of possible insurance on sales proceeds that some of the commercial enterprises may actually have, in order to obtain the net amounts of financing that are to be channelled to disaster-affected enterprises.

Financial requirements or needs for reconstruction under a "building-back-better" strategy are estimated by taking the estimated value of replacement of destroyed assets and increasing it by a certain percentage whose magnitude depends on the degree of quality and technological improvement as well as disaster-risk reduction defined in the strategy for reconstruction. In other words, reconstruction requirements will always have a larger value than the estimated value of damage.

Experience acquired in the past 40 years of disaster assessment in many countries of the world shows that the range to increase the value of damage to obtain disaster-resilient reconstruction needs is between 10 to 25 per cent, depending on the degree of disaster resilient features that the destroyed infrastructure had prior to the disaster[47]. The exact increase to be adopted must be defined by civil and structural engineers that are part of the commerce sector assessment team, who have had relevant experience in this type of work. The estimated gross value of reconstruction requirements must be reduced by the expected amount of insurance-on-assets proceeds that are to be received by the commercial enterprises that had such type of insurance.

For the estimation of human development recovery needs, estimated values of commerce sector sales losses are to be delivered to the separate team in charge of estimating personal or household impact analysis, for the subsequent estimation of employment and personal or household income losses. This will in turn enable the estimation of requirements for the funding of temporary "cash-for-work" employment schemes.

In addition to the above, results of the sample survey of informal traders which had been conducted in temporary shelter camps to estimate their income losses due to the disaster should be delivered as well to the assessment team in charge of estimating human development impact, and for defining additional financial requirements in terms of possible cash grants or other assistance for informal male and female traders.

[47]See Jovel, Roberto, Damage, Loss and Needs Assessment Guidance Notes, Volume 3, Estimation of Post-Disaster Needs for Recovery and Reconstruction, Global Facility for Disaster Reduction and Recovery (GFDRR), The World Bank, Washington, D.C., 2010.

Trade and Services Sector

STANDARD PROCEDURES FOR SECTOR ASSESSMENT

Recommended Assessment Team

The composition of the sector assessment team may vary by the type of disaster and the extent of the likely damage and production flow changes.

Organization and Personnel	Role in the Sector Assessment

Personnel from:
• **State Department of Public Enterprises (DPE)**
• **Department of Micro, Small and Medium Enterprises**
• **Local departments and offices in the disaster-affected area who are:**
  • Civil Engineer
  • Architect
  • Private Sector Development Specialist
  • Commercial Insurance Advisor
  • Retail Specialist
  • Real Estate Specialist
  • Informal Sector Specialist
  • Business Finance Specialist
  • Commerce/Trade Economist
	Lead and coordinate

Personnel from:
• **Ministry of Heavy Industries and Public Enterprises**
• **Department of Public Enterprises (DPE)**
• **Ministry of Micro, Small and Medium Enterprises**
• **National Small Industries Corporation Limited (NSIC)**
  • Civil Engineer
  • Architect
  • Private Sector Development Specialist
  • Commercial Insurance Advisor
  • Retail Specialist
  • Real Estate Specialist
  • Informal Sector Specialist
  • Business Finance Specialist
  • Commerce/Trade Economist
	Provide baseline information and facilitate the field assessment of damages and losses

Development partners (if active in the sector)	Participate and provide technical advice

Steps in conducting a PDNA in the trade and services sector

Introduction

The trade and services sector have both formal and informal sectors, which should be included in the assessment. Although the informal sector may be difficult to assess due to its nature, they must be assessed since a large number of people depend on the micro-scale trading of goods and services for their livelihood. The inclusion of their assessment in the PDNA will provide the necessary information to the government on how the informal sector can be integrated in the post disaster recovery program.

Step 1. Collect baseline information on sector assets and production flows

Baseline information must be compiled before the field assessment or, if possible, prior to the occurrence of disaster. The baseline data should be validated before the field visit to serve as the basis for the estimation of damages and losses for the disaster-affected area/s. This data can be compiled at the State/Region office or at the District levels.

Again, it must be noted that because of the close link between the trade and the services sector, and considering that they are under the purview of a single ministry, the assessment of both the trade and services sectors are integrated in this section. The trade and services assessment team must provide the information to the macroeconomic assessment team accordingly to enable the latter to segregate the trade and services sectors before plugging in the national system of accounts in India. The tables below can be used for the baseline information.

Table 1. Baseline information of trade and services facilities in a District

Name of District:								
Type of Company in the Formal Sector	Number							
	Micro		Small		Medium		Large	
	Public	Private	Public	Private	Public	Private	Public	Private
A. Wholesale Trade								
Agricultural Products								
Food, Beverages, Tobacco								
Household Goods								
Machinery, Equipment, and Supplies								
Others (e.g. Fuels)								
B. Retail Trade								
Non-specialized Shops								

Food, Beverages, Tobacco								
Automotive Fuels								
ICT Equipment								
Household Equipment								
Recreation, Reading, Games								
Others								
C. Trade and Repair of Motor Vehicles								
Motor Vehicle Sale								
Motor Vehicle Repair/ Maintenance								
Others								
d. Other Services								
Financial Services								
Construction								
Restaurants								
Others								
TOTAL								

Type of Companies in the Informal Sector	**Micro**		**Small**	
	Number of Businesses	**Number of Employed**	**Number of Businesses**	**Number of Employed**
Retail Trade				
Repairs				
Restaurants				
Others				
TOTAL				

Notes for filling Table 1

- *The businesses included in the above table are those that are not included in the assessment of the other sectors. For example, airlines, buses, taxis etc. should not be included here since they are subsumed in the assessment of the transport sector. The restaurants included here are those that are not included in the Tourism sector. To avoid double counting, the assessment team must have knowledge of the coverage of the other sectors.*
- *Financial services will include businesses like banks, insurance, etc.*
- *The businesses in the informal sector must be included in the list.*
- *In the trade and services sectors, most of the companies are private in nature*

Sources of Information

The sources of baseline information may vary by state. However, the critical list of the likely sources of information is provided below.

Ministry of Statistics and Programme Implementation	http://www.mospi.gov.in
The Registrar General & Census Commissioner, India	http://censusindia.gov.in
National Institution for Transforming India	http://niti.gov.in
Ministry of Commerce and Industry	http://www.commerce.gov.in/DOC/index.aspx
Ministry of Micro, Small & Medium Enterprises	http://msme.gov.in/mob/home.aspx
Department Commissioner, Ministry of Micro, Small & Medium Enterprises	http://dcmsme.gov.in
Ministry of Statistics and Programme Implementation	http://mospi.nic.in
Labour Bureau	http://www.labourbureau.nic.in
Open Government Data (OGD) Platform India	https://data.gov.in
Make in India Initiatives	http://www.makeinindia.com
India Brand Equity Foundation	http://www.ibef.org/
An Analysis of the Informal Labour Market in India, Confederation of Indian Industry	http://www.ies.gov.in

Note 1: Please use similar institutions at State level for baseline Information

Note 2: For Non-Government information sources, please search suitably

Step 2. Estimate value of damage and production flow changes

With the baseline information, field assessment should be undertaken in the affected Districts after a disaster. The assessment team from the State must work with their local counterparts in the Districts to ensure that the estimates for the damages and losses in the sector are accurate to the extent possible. Direct interviews with private contractors or government officials involved in the construction and repair of facilities can also be conducted during the field trip in order to validate unit costs of repair and reconstruction.

It should be noted that since there is a possibility that only one company provides the service to a number of Districts and States, caution should be exercised to avoid double counting. It is recommended that the assessment of damages and losses of the company should be accounted for in the District where the main office of the company is located. However, if the main office is located outside the disaster area, the assessment team must account for the damages and losses of the company with an indication as to where such damages and losses occurred.

Step 2.1. Estimate the damages and losses to commerce in the formal sector

Repair and replacement costs should be estimated for the damages of the sector. The time needed to reconstruct the damages should also be estimated. During the field visits to the disaster sites, the assessment team should interview the officers of the company/ies to ascertain the extent and value of the damages and the estimated period before operations can be fully restored to the pre-disaster level.

To assess the value of damages and losses, the following can be done:

a) The assessment team can arrange a meeting with the owners of trading and services companies and require them to fill out the questionnaire below.

b) Consult with representatives from chambers of commerce and other organizations of specific businesses.

c) Consult with representatives of the informal sector in the trade and services sectors.

The following table should be used as a questionnaire in interviewing key informants.

Table 2. Questionnaire on the value of damages and losses of a company in the trade and services formal sector

Name of District:						
Name of Company						
Line of Business	Wholesale ( ) Retail ( ) Services ( ) Others ( )					
Description of business						
Category	Micro ( ) Small ( ) Medium ( ) Large ( )					
Ownership	Public ( ) Private ( ) Public-Private Joint Venture ( ) Public-Foreign Joint Venture ( ) Private-Foreign Joint Venture ( )					
Number of Employees	**Male**		**Female**			
ESTIMATED DAMAGES						
Damage to Structures and Assets	**Totally Destroyed**		**Partially Damaged**		**Total Damages (Rs.)**	**Average Time to Replace or Repair (Days)**
	Number of Totally Destroyed	**Average Replacement Cost (Rs.)**	**Number of Partially Damaged**	**Average Repair Cost (Rs.)**		
	A	**B**	**C**	**D**	**E**	**F**
Structures						
Equipment						
Stocks/Inventories						
Others (Specify)						
TOTAL						

ESTIMATED LOSSES (Rs.)				
Types of Losses	**Disaster Year**	**Year 1**	**Year 2**	**Total (Rs.)**
Foregone Income				
Cleaning up of Debris				
Higher Operating Costs				
Other Unexpected Expenses				
TOTAL				

Notes for filling Table 2 and 3

- *'Average Replacement Cost' will be the average pre-disaster value of the structures and assets that were totally destroyed while 'average repair cost' will be the estimated cost of repair of the partially damaged assets.*
- *In formula, the total damages of the companies surveyed will be (Column E) = (Column A) x (Column B) + (Column C) x (Column D).*
- *Years 1 to 2 are the years after the disaster.*

A note on estimated losses:

- *Losses in the sector will include the following:*
  - *Foregone income after the structures, equipment and machineries of businesses were damaged or destroyed by disasters.*
  - *Additional expenses to clean and rehabilitate the business site after destruction.*
  - *Possible higher cost of operation that may arise after the disaster, such as payment of higher rates of electricity from alternative sources, or acquiring raw materials from alternative sources, or renting temporary premises while repairing or rebuilding the original premises*
- *These losses would continue during the entire period of reconstruction and recovery and are expressed in monetary values at current prices.*

Step 2.2. Estimate the damages and losses to traders and service providers in the informal sector

To assess the value of damages and losses, the following can be done:

b) For the numerous small traders and vendors in the informal sector, the assessment team can interview with the head of their association to get the estimate of the number of vendors affected and the aggregate value of their damages and losses

Table 3. Questionnaire on the value of damages and losses of a trading or service provider company, informal sector

Name of District:						
Name of Company						
Line of Business	Retail ( ) Services ( ) Others ( )					
Description of Business						
Category	Micro ( ) Small ( )					
Ownership	(Private)					
Number of Employees	**Male**		**Female**			
Estimated Damages						
Damage to Structures and Assets	**Totally Destroyed**		**Partially damaged**		**Total Damages (Rs)**	**Average Time to Replace or Repair (Days)**
	Number of Totally Destroyed	**Average Replacement Cost (Rs.)**	**Number of Partially Damages**	**Average Repair Cost (Rs)**		
	A	**B**	**C**	**D**	**E**	**F**
Structures						
Equipment						
Stocks/Inventories						
Others (Specify)						
TOTAL						
Estimated Losses						
Types of Losses			**Disaster Year**	**Year 1**	**Year 2**	**Total (Rs.)**
Foregone Income						
Cleaning up of Debris						
Higher Operating Costs						
Other Unexpected Expenses						
TOTAL						

It should be noted that it might take a longer period for the informal sector to recover due to lack of capital and lower credit worthiness if they will avail of loans from the formal sector. As such, the assessment team must be conscious about how they can be assisted.

Step 2.3 Summarize the damages and losses in the sector in the District

Based on the survey of businesses, the damages and losses can be summarized in the following table.

Table 4. Summary of damages and losses in a District

Name of District:																
Total Number of Affected Workers in the Formal Sector									Male				Female			
Total Number of Affected Workers in the Informal Sector									Male				Female			
Formal Sector	Within the Disaster Year (Rs)								Losses Beyond Disaster Year (Rs)							
	Damages				Losses				Year 1				Year 2			
	Mi	S	Me	L	Mi	S	Me	L	Mi	S	Me	L	Mi	S	Me	L
A. Wholesale Trade																
Agricultural Products																
Food, Beverages, Tobacco																
Household Goods																
Machinery, Equipment, and Supplies																
Others (e.g. Fuels)																
B. Retail Trade																
Non-specialized Shops																
Food, Beverages, Tobacco																
Automotive Fuels																
ICT Equipment																
Household Equipment																
Recreation, Reading, Games																
Others																
C. Trade and Repair of Motor Vehicles																
Motor Vehicle Sale																
Motor Vehicle Repair/ Maintenance																
Others																
D. Other Services																
Financial Services																
Construction																
Restaurants																
Others																
Informal Sector																

Retail Trade																
Food Processing																
Repairs																
Restaurants																
Others																
TOTAL																

Notes for filling Table 4

- *The number of those in the informal sector and the estimated total value of their damages and losses are derived from the interview of the head of their associations. The informal sector is generally made of microbusinesses by category.*
- *"Mi" refers to micro enterprises*
- *"S" for small enterprises*
- *"Me" for medium enterprises*
- *"L" for large enterprises*
- *The value of damages and losses should be placed under the category to which the businesses belong. For example, the damages and losses of a medium-sized business should be placed under the Me column.*

Step 2.4 Summarize the damages and losses in the sector in the State

Once the summary table for each affected District has been filled out, the information should be used to summarize the damages and losses at the State level. The summary table below can be used.

Table 5. Summary of damages and losses in a State

Name of State:															
Total Number of Affected Workers in the Formal Sector								**Male**				**Female**			
Total Number of Affected Workers in the Informal Sector								**Male**				**Female**			
Formal Sector	**Within the Disaster Year (Rs.)**							**Losses Beyond Disaster Year (Rs.)**							
	Damages				**Losses**			**Year 1**				**Year 2**			
	Mi	**S**	**Me**	**L**	**Mi**	**S**	**L**	**Mi**	**S**	**Me**	**L**	**Mi**	**S**	**Me**	**L**
A. Wholesale Trade															
Agricultural Products															
Food, Beverages, Tobacco															
Household Goods															
Machinery, Equipment, and Supplies															

Others (e.g. Fuels)															
B. Retail Trade															
Non-specialized Shops															
Food, Beverages, Tobacco															
Automotive Fuels															
ICT Equipment															
Household Equipment															
Recreation, Reading, Games															
Others															
C. Trade and Repair of Motor Vehicles															
Motor Vehicle Sale															
Motor Vehicle Repair/ Maintenance															
Others															
D. Other Services															
Financial Services															
Construction															
Restaurants															
Others															
Informal Sector															
Retail Trade															
Food Processing															
Repairs															
Restaurants															
Others															
TOTAL															

Step 3. Analyze the impacts of the damages and losses to affected population

The assessment team should analyze all potential impacts of the damages and losses of the sector.A special focus should be given to the impacts on the poor informal sector workers to provide the necessary information on how they can be assisted by the government. The information on their damages and losses, which are in the assessments for the trade and services sector, should be used in assessing the impacts.

- Are there potential losses of employment in the formal sector? What will be the impacts on families, whose earners have lost their sources of income or worse, lost their lives?
- Is there a possible reduction in foreign currency earnings if the industry affected is exporting its products like cement, etc.?
- Are there potential losses of livelihood in the informal sector? When will the formal and informal workers regain their levels of income? How will indebtedness affect their recovery?

- What are the impacts on the quality of life of the affected population, especially the poor?

The following matrix can be used to express the social impacts of the damages and losses to the trade and services sector.

Matrix 1. Social impacts of the damages and losses to the trade and services sector

Area of Impacts	Expected Impacts						Brief Description of Impacts
	General Population			Women and Children			
	S	M	L	S	M	L	
Employment/Income							
Livelihood							
Poverty							
Others (Specify)							

Notes for filling Matrix 1

- *The expected impacts are segregated into a) the impacts on the general population; and b) the impacts on women and children measured as severe (S), moderate (M) or low (L). The assessment team should mark under the column whether the impacts are S, M or L.*
- *Severe impacts are very distinct and extensive change in the situation for more than 50% of the people in the sector, which will require outside assistance for more than 6 months to enable them to cope and recover.*
- *Moderate impacts are distinct changes in the situation affecting 20% to 50% of the people in the sector, which may require 3 to 6 months outside assistance to enable the people to cope and recover.*
- *Low impacts are distinct changes but less than 20% of the people and may not be widespread or only in limited areas, which may require less than 3 months of outside assistance before the people recover.*
- *The impacts can be briefly described under the column "Brief Description of Impacts". For example, a brief description of a severe "employment" impact can be a massive retrenchment of employees by damaged factories; the "livelihood" can be described as the number of micro entrepreneurs whose businesses were totally destroyed; while the impact to "poverty" can be the number of people whose living standards will go down in the poverty level.*
- *The impacts on women and children may be different from the general population. For instance, a large number of women may lose their livelihood if most of them are engage in small scale trading. The assessment must be able to identify some other issues.*

Step 4. Identify the recovery strategies and estimate recovery and reconstruction needs

The post-disaster needs must be based on a framework where policies and strategies are likewise integrated. After analyzing the potential effects and impacts if no assistance will be provided to the sector, the aggregate needs of the sector must be estimated.

Step 4.1 Identify recovery and reconstruction strategies

After the consolidation of the field assessment, the assessment team must identify or recommend the policies and strategies for the recovery and reconstruction for the sector.

The following are some of the general policies and strategies that could be considered.

A. Policy Measures

There are certain policies that can be adopted over a limited period, which can provide incentives to the private sector to reconstruct damaged assets with higher standards of resilience. Among them are:

1. Income tax breaks for private companies such as:
    a. Temporary reduction or freeze or deferment in the collection of tax;
    b. Temporary freeze on basic service charges in the utilization of certain services over the time of the recovery phase;
    c. Non-collection of property taxes for the duration of the recovery period;
    d. Exemption from registration fees for replacements of the destroyed equipment and machinery over a certain period of time;
2. Subsidizing construction materials and equipment to be imported by private companies during the recovery and reconstruction phase through an exemption from paying customs duties and other levies;
3. Extending bank guarantees on loans by the government to enable the private sector to rebuild immediately.

B. Strategies

The following strategies can be adopted for the post-disaster recovery and reconstruction activities:

a. **Building Back Better (BBB)**. Recovery activities based on BBB principles will promote longer-term disaster risk reduction and management. BBB principle should look at the how to make infrastructure and facilities safer from future disasters like stronger engineering design, the advantages of resettlement of facilities in disaster-safe areas instead of rebuilding in the same disaster-prone areas, etc.
b. **Focus on the most vulnerable and socially disadvantaged groups such as children, women, and the disabled.** Recovery programming needs to give priority to the most vulnerable groups, including female-headed households, children and orphans, and the poor, and take into account those with special needs.

c. **Community Participation and Use of Local Knowledge and Skills**. The participation of the community in all process (identification, planning, design and implementation) of recovery activities will help ensure the acceptability of projects and optimize the use of local initiatives, resources and capacities.

d. **Secure development gains**. Recovery strategies, although may be a separate set of activities, must be supportive of existing development plans and must attempt to re-establish and secure previous development gains.

e. **Coordinated and coherent approaches to recovery**. Projects for disaster recovery must have the full and effective coordination among all involved agencies based on comprehensive information exchange, flexibility in administrative procedures, and uniformity of policies. In some instances, a special new agency may be needed to oversee, coordinate and monitor complex disaster recovery programs. Under this strategy, capacity building activities for the local public administration may be part of the recovery activities including a well-defined monitoring and evaluation system for the overall implementation of the recovery plan.

f. **Efficient use of financial resources**. The overall strategy should also include the identification of fund sources that are suited for the recovery activities. It should be clear how assistance to the recovery of the private sector will be delivered. Also, some cheaper source of funds from international donor partners should be initially identified for longer-term expensive projects.

g. **Transparency and accountability**. The overall plan and implementation of projects for recovery must be transparent, especially to those affected, through open and wide dissemination of information on all aspects of the recovery process. An effective monitoring system must be established.

Step 4.2 Estimate recovery needs

Recovery needs are intended to bring back normalcy in the sector as quickly as possible. Recovery activities should include those that will enable companies to resume their normal operations. Some of the possible recovery-related activities in the sector can include:

- Repairs of the damages to structures, which were affected by strong winds and floods.
- Emergency procurement of vital equipment necessary to normalize operations.
- Clearing of debris that may have affected the sector.
- Emergency credit for re-capitalization.

Step 4.3 Estimate reconstruction needs

Reconstruction needs are generally long-term in nature (3 years and more) and are intended to 'build back better' from the ruins of a disaster. It is to be noted that reconstruction activities should include both public as well as private facilities and may require different types of financing strategies.

It is to be noted that since the companies in this sector are revenue-generating enterprises, financing their needs can come through soft-term credit schemes for the reconstruction and repair of their damaged assets. Such schemes can be accompanied by technical assistance for improved disaster resilient standards of construction.

Some possible reconstruction related activities in the sector can include the following:

- Soft-term credit for the replacement or reconstruction of affected structures under a 'building back better' strategy to ensure future disaster resilience through the adoption and enforcement of improved construction standards;
- Procurement of equipment and machinery;
- Cost of replacing furniture and equipment that were destroyed may be included within the needs for reconstruction, unless they have been covered under the recovery needs to provide temporary services for the affected area;
- Structural retro-fitting of undamaged or partially damaged structures so that they are not affected by disaster event in the future; and/or
- Relocation to safe areas.

Step 4.4 Prioritize identified projects for recovery

Among the projects identified, relative priorities can be set in order to determine which among them are the more important. Based on the broad strategies for recovery, the assessment team should select the priority projects/activities among the identified needs.

The prioritization can be made by using a set of impact indicators and the level by which the projects can achieve said impacts. Examples of the criteria that can be used are the following, among others:

a. **Economic impact,** which can be evaluated in terms of the relative cost to the government of not undertaking reconstruction or rehabilitation.

b. **Equity and social impact**, which can be in terms of the number of beneficiaries who are poor and destitute and who could not afford to rebuild on their own without outside support.

c. **Sustainability**, which can be in terms of the reduction of risks and vulnerability of the people and other economic assets to future disasters.

The criteria above can be placed in a matrix like the one below where the impacts are ranked according to low, medium or high.

This matrix can show the relative benefits of proposed projects to the people in the affected areas, which, in turn, will inform and assist the government in determining the priority projects within the sector.

Matrix 2. Impacts of identified post-disaster projects

Name of Proposed Project	Expected Impacts on Recovery								
	Economic impact			Equity and Social Impact			Sustainability		
	High	Medium	Low	High	Medium	Low	High	Medium	Low

The projects identified by the assessment team must be included in the above matrix.

Step 4.5 Summarize the estimated recovery and reconstruction needs and draft the implementation schedule

Based on the prioritized recovery and reconstruction needs, a summary should be created by the assessment team enumerating the post-disaster projects for the recovery and reconstruction.

The identified needs should have a rough schedule of implementation outlining at the very least the activities, timing and budget required for all the programs and projects. The following techniques can be considered:

1. Identify the specific projects according to their relative urgency or priority in relation to recovery.
2. Plot the timeline of activities of all the projects, with the urgent ones on top, in a Gantt chart with the corresponding funding requirement on an annual basis. This will assist the national government in programming the necessary funds over a certain time period, like on a quarterly or annual basis.
3. Identify and include in the list of projects that need further feasibility studies, which may be funded by foreign grants.
4. To the maximum extent possible, a logical framework (log-frame) should be created for each of the project proposed for inclusion in the recovery plan. Log-frames are normally required by foreign donors to consider project proposals.

The recovery and reconstruction needs of the sector can be summarized in the table below showing the financing requirements over the years.

Reconstruction needs mostly require long-term implementation periods. They normally require three or more years to complete.

Table 6. Summary of recovery and reconstruction needs in the sector.

Name of Specific Projects	Annual Needed Amount of Assistance (Rs.)						Total Needs
	Disaster Year	Year 1	Year 2	Year 3	Year 4	Year 5	(Rs.)
Recovery Projects							
Formal Sector							
d.							
e.							
Informal Sector							
c.							
d.							
Total							
Reconstruction Projects							
Formal Sector							
d.							
e.							
Informal Sector							

Total							
GRAND TOTAL							

Note for filling Table 6

- Project titles can be inserted under the column on recovery and reconstruction needs.

Step 5. Draft the post-disaster damages, losses and needs (PDNA) report of the sector

With all the information gathered using the previous steps, a report can be drafted by the assessment team, which will be the inputs of the sector in the overall recovery and reconstruction plan. The following format may be considered:

1. Brief description of the sector in the disaster-affected areas.
2. Damages in the sector by areas and by types of assets affected.
3. Losses in the sector emphasizing the losses in income, increase in expenditures, estimated period before normalcy will be attained, etc.
4. Impact on the livelihood, individual households, vulnerable groups and the consequences to the greater community if no assistance for recovery will be provided.
5. Proposed strategies for recovery and reconstruction of the sector.
6. Needs of the sector, by priority, and the draft schedule of implementation with the estimated funds required for each project over time.

The draft sector report should be submitted to the State Disaster Management Office for consolidation.

Tourism Sector

This section contains the following contents – specific to this sector – in order to guide the user to successfully conduct post-disaster needs assessment in India:

1. **The Introduction to the Sector**
    a. Baseline information
    b. Post-disaster Situation and Performance
    c. Estimation of Disaster Effects
    d. Estimation of Disaster Impact
    e. Estimation of Post-Disaster Recovery and Reconstruction Requirements
2. **The Standard Procedure for the Sector Assessment**
    a. Recommended Assessment Team
    b. Steps in conducting a PDNA in the tourism sector
        - Collect baseline information on sector assets and production flows
        - Estimate value of damage and production flow changes
        - Analyze the impacts of the damages and losses to affected population
        - Identify the recovery strategies and estimate recovery and reconstruction needs
        - Draft the post-disaster damages, losses and needs (PDNA) report of the sector

The user is advised to refer to:

a. *The "Introduction of the PDNA Manual" for a complete information of the concepts and definitions on the post-disaster needs assessment (PDNA);*
b. *The section on "Disaster Effects, Impact Assessment, Needs Estimation" for a more detailed discussion in identifying the possible impacts within and across sectors; and*
c. *The section on "Estimation of Post-Disaster Recovery and Reconstruction Needs" for a more detailed discussion on identifying and prioritizing post-disaster needs.*

Introduction

As explained in the trade and services sector, the system of national accounts includes tourism as a component or part of that sector[48]; and India is no exception to the rule[49]. However, due to its growing relevance to overall socio-economic development, as well as the differences to other components of commerce or trade, tourism is being addressed separately in this methodological handbook.

The fact that the tourism sector activities are not normally included in disaster assessments in India must be pointed out from the outset; in fact, in the most recent assessments conducted in the country, only a cursory mention is made to tourism, but no estimation of production losses is made[50]. However, any destruction of the physical assets of the sector and any disruption of its operation would produce a negative impact on the employment and income of the labour force and households whose livelihoods depend on tourism.

The reason behind such exclusion probably resides in the fact that most of tourism activities lie in the hands of private sector entities and persons and in the erroneous assumption that they have insurance that would provide the financing required for their recovery and reconstruction. Nevertheless, and as indicated in the case of the manufacturing and commerce sectors, the number of tourism establishments that have adequate insurance coverage on assets is very limited in India (and in other developing countries as well) and that an even lower number of them have insurance on interrupted revenues. Thus, it may be stated that tourism owners and operators have a high vulnerability to disasters, and that they receive no assistance for recovery and reconstruction after disasters.

Again, the above statement is not meant for the central or state government to include tourism owners and operators as recipients in the current Disaster Response Fund; rather, the intention is to highlight the fact that they also have post-disaster recovery and reconstruction needs which should be addressed by the development and private banking systems under appropriate terms and conditions, for which government intervention and representations are required.

The tourism sector can be affected by disasters of any kind: its physical durable assets may be destroyed and the flow of production may be disrupted. The latter may include a temporary decline in revenues from sales as well as temporary higher costs of operation of the facilities.

The value of damage in the case of this sector is estimated initially in physical terms and is subsequently converted into monetary value by using the unit repair, reconstruction or replacement costs of the affected sector assets, to the same quality and quantity standards they had prior to the disaster.

Changes in production flows in this sector refer to, on one hand, a decline in revenues that arise due to the temporary non-availability of destroyed assets and/or to the decline in arrival of foreign tourists; on the other

[48]See United Nations, International Standard Industrial Classification of All Economic Activities, Rev. 4, New York, 2008. (http://unstats.org/unsd/cr/registry).

[49]See National Account Statistics, 2013, Central Statistical Office, Ministry of Statistics and Programme Implementation, Government of India, New Delhi, 2013.According to the India System of National Accounts, this sector falls under “Trade, hotels and restaurants”.

[50]India Uttarakhand Disaster, June 2013, Joint Rapid Damage and Needs Assessment Report, Asian Development Bank (ADB), Government of Uttarakhand, and The World Bank, 2013.

hand, to possible higher costs of operation of the tourism facilities – such as the post-disaster temporary provision of water and electricity from alternative sources – as well as the unexpected costs of promotion to convince the tourists to come back after a disaster. The estimation of some of these losses may have a double impact in that they may not only decrease gross domestic production (GDP) but also negatively affect the balance of payments of the country, since a significant foreign exchange flow may be temporarily interrupted due to the disaster.[51]

In this sector again, a detailed assessment of all tourism facilities must be made, on a one-by-one basis, since the assets are usually very distinct from each other, and the approach of developing typical types of assets as used in the housing sector cannot be adopted. This will then involve visits by the tourism sector assessment team to all affected areas and tourism resorts and facilities, for which, assistance may be obtained from the existing hotel associations in the country. Of course, the tourism assessment team may take advantage of the availability of aerial or satellite imagery for its estimations on damage.

The composition of the tourism sector assessment team should involve the presence of architects and civil engineers for the estimation of the value of damage, and the availability of economists for the estimation of changes in the sector production flows.

a) Baseline Information

The following is a minimum of the quantitative baseline information required for the assessment of disaster effects on tourism activities:

- The number, size and location of all tourism assets that exist in the disaster-affected areas;
- Description and quantities of the typical furniture, equipment and other goods that are normally present in the affected assets;
- Statistical data on the arrival and seasonal variation of tourist arrivals, both domestic and foreign since they are likely to behave differently;
- Information on the average length of stay of tourists in the affected State, and on their average expenditures, for both domestic and foreign tourists; and
- Data on any fees or special taxes charged to foreign nationals, including visa fees, special tourism taxes, et cetera.

Most of the baseline information required for the assessment is available in the Central and State Statistical offices, since they normally keep data on the number and origin of domestic and foreign tourist arrivals, including their seasonal variation; these offices also have data on the average length of stay by foreign tourists and their estimated average expenditures in the country. Furthermore, any existing private sector association of tourist operators or entrepreneurs in the affected state is likely to have detailed information for the baseline and also be willing to cooperate in the assessment.

[51]As for any other sector, the possible repair, reconstruction or replacement of tourism assets using improved, disaster-resilient standards, as part of a "building back better" reconstruction strategy, are to be considered later on, at the time of the estimation of needs for recovery and reconstruction.

b) Post-Disaster Situation and Performance

The tourism sector assessment team should undertake detailed field visits to obtain first-hand knowledge about the effects of the disaster on the sector's infrastructure and facilities and to obtain information to estimate sectorial production flow changes. During these field visits, the assessment team should hold special interviews with hotel and restaurant owners and tourism operators to obtain their views and determine their special needs for recovery and reconstruction, and to ascertain whether insurance is available and whether it covers both infrastructure and/or revenue losses.

Any available reports from the emergency phase – no matter how partial in coverage – must be gathered and used to guide or orient the field visits by the tourism sector assessment team to ensure that all affected assets of the sector are visited and assessed. Very often hotel owners may commission assessments by private assessors and/or insurance companies that cover the assets may have done their own estimations. The tourism sector assessment team should make every effort to obtain access to such prior estimations.

The tourism sector assessment team should also visit private construction contractors operating in the affected area to obtain information on typical unit construction and repair costs prevailing at the time of the disaster so that it could be used in the estimation of damage, as well as learned opinions on the likely duration of the repair/reconstruction period.

During the field visits, the assessment team should also obtain directly from hotel owners and tourism operators data on actual post-disaster occupancy of bed capacity that may be used to compare to the "normal" or "non-disaster" trends and conditions.

Using this field information and in combination with the baseline data collected before, the tourism sector assessment team must prepare a calendar of how the sector's bed capacity will be restored over the time of reconstruction. Projections about recovery in tourist arrivals should also be made, dealing separately with domestic and foreign tourists, bearing in mind that reconstruction of bed capacity and demand for tourism services do not necessarily match. In view of the uncertainty of recovery in arrival of foreign tourists, use can be made of data on recovery from recent disasters in the past, and on the effectiveness of previous campaigns to adequately inform potential clients abroad.

The above-described estimations and projections should enable the preparation of a calendar of sector economic recovery over time, which can then be used for the subsequent estimation of production flow changes.

c) Estimation of Disaster Effects

Destruction of physical assets

The value of damage should be estimated as the cost to rebuild or repair each and all the buildings and associated sector facilities that were (totally or partially) destroyed by the disaster, together with the replacement value of the furniture, equipment and other goods that were contained in the buildings and

were destroyed, assuming in both cases that they are replaced or rebuilt using the same standards of quality and quantity they had prior to the disaster[52]. Needless to say, these costs are to be based on the actual unit costs of construction and repair obtained by the tourism sector assessment team after visiting reputable building contractors, and/or after revising insurance companies´ estimations when available.

It is to be noted that the estimated value of destroyed assets (damage) is not modified in the presence of partial or total insurance. Any existing insurance on assets is to be used subsequently in the estimation of reconstruction needs, as it would reduce the financial requirements for reconstruction instead.

In addition to the above, the tourism sector assessment team should ascertain information with regards to the age of destroyed buildings and equipment. This information is not to be used for the estimation of the value of damage but should be delivered to the assessment team in charge of macro-economic impact assessment, to utilize in the analysis of disaster impact on the capital account and in the estimation of global disaster impact.

As part of the damage assessment, a very clear definition of the time frame required for reconstruction and restoration of nominal bed capacity is to be made, which will be an essential input for the estimation of production flow changes.

In order to avoid double accounting in the assessment for the tourism sector, the team must make sure that damage to environmental assets and services that make tourism attractive to the users is duly included in the assessment of the environment sector. In addition, damage to roads leading to and within the premises of the hotels and damage to the services of water and sanitation, electricity and communications, is only included within the tourism sector in those cases where the roads and services are owned and operated by the hotels. Otherwise, they should be included in the assessment of the institutional sectors of transport, communications, water supply and sanitation, and electricity, respectively.

Disruption of sales and revenues

The tourism sector assessment team may assume initially that production flow changes would occur over the time required to reconstruct bed capacity; however, afterwards the team should carefully introduce, into the assumption, the most likely recovery pattern of foreign tourist arrivals until full recovery of tourism demand is achieved. In other words, production flow changes are to be estimated over a period of time, which is defined by the combination of:

– The time required to repair or rebuild the physical or environmental assets that were subject to damage; and/or

– The time required for overcoming the fear or lack of information by foreign tourists.

The assessment team should be aware of the possibility of tourist arrivals from abroad to decline for an entire tourism season, in view of the time required to rebuild assets and the need to design and effectively carry out information and promotion campaigns abroad to re-attract foreign customers. The timing of the disaster within the calendar year and the previous experience from past disasters should provide insights to define this time frame. The demand of domestic tourists is likely to follow a different and more positive

[52]If the adopted strategy of reconstruction is that of "building-back-better", any desired improvement in quality and quantity and for disaster-risk reduction is to be included in the subsequent estimation of post-disaster financial requirements or needs.

trend and timeframe, since the tourism operators may actually undertake special campaigns to attract more domestic visitors to partially offset the losses in the foreign market[53].

Summarizing, the tourism sector assessment team must develop the post-disaster schedule of sector performance, which combines a calendar of staged recovery of bed capacity (the supply side of the sector) with the schedule of possible recovery of domestic and foreign tourist arrivals, which covers the demand side. In turn, recovery of bed capacity would depend on the construction sector capacity of the affected state (since after a large disaster large numbers of housing units, schools, hospitals, roads and other infrastructure works would have to be rebuilt or repaired concurrently), the timing for availability of financing for reconstruction, and the existence and efficiency of bureaucratic requirements for reconstruction permits and licenses. Furthermore, the recovery of demand will depend on the opportunity and efficiency of information campaigns to regain the trust of the usual foreign target groups and/or to capture new foreign target groups, or to capture an increased number of domestic tourists.

In addition to losses in revenue, the tourism sector may also sustain higher costs of operation that must also be included in the assessment, as they would affect enterprise financial performance. This may include, among others, overtime payment to personnel, temporarily paying higher costs to obtain water (for instance bringing in tanker trucks) and electricity (renting portable power units) while the regular services are being repaired by the appropriate utilities, and many other possibilities that are impossible to list.

Should there exist any insurance on possible revenue losses in the case of some or all of the affected tourism facilities, the tourism sector assessment team should not use the estimated insurance proceeds to reduce the estimated value of revenue losses. Instead, the value of insurance proceeds on revenue losses should be used to define the value of economic recovery needs in terms of post-disaster working capital that the sector may require, as will be discussed later on.

d) Estimation of Disaster Impact

The tourism sector assessment team must carry out additional estimations in the sector that may have an impact at the macro-economic and personal or household levels, and transfer the data to the respective teams in charge of disaster impact analysis (the macro-economic impact analysis team and the human development impact analysis team).

For the case of the macro-economic impact analysis, the following items must be estimated by the tourism sector assessment team and be provided to the macro-economic assessment team:

- The estimated value and timeframe of decline in tourism services flows and of higher intermediate consumption or higher production costs, both expressed in current or nominal values, for use in the subsequent analysis of disaster impact on gross domestic product (GDP);
- The estimated corresponding values and time frame of foreign exchange losses due to the temporary non-arrival of foreign tourists, for use in balance of payment (BoP) analysis;
- The estimated value and timeframe of the information and promotion campaigns to regain foreign tourists trust, also for use in balance of payments analysis;

[53]That was the case followed by the Mexican tourism authorities in the case of the recent swine flu outbreak in 2009, and domestic tourists that took advantage of special tourism packages partially compensated the loss of foreign arrivals in some tourism resorts and locations.

– The estimated value of temporary decline in government revenues corresponding to the decline in foreign tourism arrivals, including tourism and sales taxes, tourist visas and permits, etcetera, for the analysis of fiscal impact;

– The cost of the possible share of the government in the financing of the information and promotion campaign, for fiscal sector impact analysis;

– The estimated value of imported assets (of both construction materials and equipment and furniture) that are not manufactured locally and that must be imported from abroad for the reconstruction program, for use in the analysis of balance of payments; and

– The estimated value of re-insurance proceeds that may be received in India after the local insurers request for reimbursement from foreign insurance companies, to be used in the analysis of balance of payments.

The tourism sector assessment team should deliver its estimation of the value and expected time frame of losses in tourism services revenues to the assessment team in charge of estimating disaster impact on employment and personal or household income. Based on the value of tourism sector revenue losses, that team should estimate possible losses in employment and personal income of the tourism-sector labour force.

e) Estimation of Post-Disaster Recovery and Reconstruction Requirements

The financial requirements to achieve recovery in the tourism sector are equal to the amounts of financing required to ensure the return of the services (in quantity and quality) to normal or non-disaster conditions. They may include some of the following activities:

– Provision of soft-term credit to finance working capital to tourism entrepreneurs and restaurant owners – channelled through the private banking system or the development banks – and/or to facilitate the rescheduling of disaster-induced non-performing loans, when the tourism enterprises were not sufficiently or adequately covered by insurance on revenues or sales;

– Provision of temporary tax relief for the above as an additional manner to alleviate financial difficulties arising from the disaster, when required; and

– Possible partial government financing in the cost of information campaigns to reach foreign visitors and convince them to return to the tourism facilities after the disaster effects have been overcome.

As for the commerce sector, the amounts required for working capital or to re-schedule loans in the tourism sector enterprises may be estimated as a fraction of the annual unearned revenues caused by the disaster. Experiences accumulated over the past forty years of conducting post-disaster needs assessments in different regions and countries of the world indicate that a range of between 20 to 35 per cent of the value of annual tourism revenue losses may be adequate to meet such economic recovery needs[54]. However,

[54]See Jovel, Roberto, Damage, Loss and Needs Assessment Guidance Notes, Volume 3, Estimation of Post-Disaster Needs for Recovery and Reconstruction, Global facility for Disaster Reduction and Recovery (GFDRR), The World Bank, Washington, D.C., 2010.

their exact value in each individual case of disaster is to be defined by the tourism sector assessment team on the basis of a detailed analysis of financial data obtained during the assessment, and after informal discussions are held with representatives of the different tourism establishments that were affected.

The cost of an information campaign to attract or re-attract foreign visitors after the disaster must be estimated on the basis of experience acquired in previous disaster events. The tourism sector assessment team needs to bear in mind that the cost of such information campaign is to be borne in foreign currency since the target groups of the campaign reside abroad. In cases, where special tourism packages are to be advertised for acceptance by domestic tourists, to increase their use of tourism facilities as a way to partially compensate for the loss of foreign visitors, the cost would, of course, be estimated on the basis of local currency requirements.

The value of insurance proceeds to compensate for tourism revenue losses, if such insurance was available, must be deducted from the estimated value of needs.

Financial requirements for reconstruction under disaster-resilient standards are normally estimated by taking the value of asset destruction or damage, and increasing it by a certain percentage to enable the introduction of quality improvement, technological modernization and adoption of disaster-risk reduction standards defined in a "building-back-better" reconstruction strategy. Experience acquired in conducting post-disaster needs assessments in many countries of the world in the past forty years indicates that the usual range to increase the value of estimated damage would be between 15 to 20 per cent[55]. In some cases, reconstruction requirements may include the cost of relocating the destroyed premises in safer places, and the cost of land acquisition and of provision of basic services must be added to the value of damage.

After coming up with a value of reconstruction requirements, the tourism sector assessment team must deduct the value of insurance-on-assets proceeds that the tourism enterprises may have had in order to come up with a net value of reconstruction requirements.

The tourism sector assessment team must deliver the estimated values of tourism flow changes or decline to the separate assessment team in charge of estimating disaster impact on human development, for them to estimate the possible decline in employment and personal or household income. On that basis, the human development assessment team will be able to ascertain whether the labour force of the tourism sector will need to be included in a possible, temporary "cash-for-work" post-disaster program, or whether other types of assistance are required.

[55]See again previous note.

Tourism Sector

STANDARD PROCEDURES FOR SECTOR ASSESSMENT

Recommended Assessment Team

The composition of the sector assessment team may vary by the type of disaster and the extent of the likely damage and production flow changes.

Organization and Personnel	Role in the Sector Assessment

Personnel from:
• **State tourism departments**
• **Local departments and offices in the disaster-affected area who are:**
  • Civil Engineer (Tourism)
  • Architect (Tourism)
  • Tourism Promotion/Development Specialist
  • Tourism Economist
  • Tourism Finance Specialist
	Lead and coordinate

Personnel from:
• **Ministry of Agriculture**
• **India Tourism Development Corporation**
  • Civil Engineer (Tourism)
  • Architect (Tourism)
  • Tourism Promotion/Development Specialist
  • Tourism Economist
  • Tourism Finance Specialist
	Provide baseline information and facilitate the field assessment of damages and losses

Development partners (if active in the sector)	Participate and provide technical advice

Steps in conducting a PDNA for the tourism sector

Step 1. Collect baseline information on sector assets and production flows

Baseline information must be compiled before the field assessment or, if possible, prior to the occurrence of disaster. The baseline data should be validated before the field visit to serve as the basis for the estimation of damages and losses for the disaster-affected area/s. This data can be compiled at the State/Regional office or at the District levels. The tables below can be used for the baseline information.

Table 1. Tourist arrivals in the District and average expenses per month

Tourist Arrivals and Expenses	Month											
Number of Tourists	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
International												
Local												
TOTAL												
Average expenses per tourist												
International ($)												
Local (Rs.)												

The number of tourist arrivals depends on the season. The baseline can be established to enable the PDNA team to have prior knowledge whether the disaster occurred in a peak tourism season.

Table 2. Baseline information of tourism facilities in a District

Name of District:							
Establishment	**Number of Establishments by Ownership**		**Type of Structure (in numbers)**				
		1 to 4 Floors			**5 and More Floors**		
	Private	**All Concrete Public**	**Concrete and Wood**	**Wood and Bamboo**	**All Concrete**	**Concrete and Wood**	
Accommodation							
Hotels							
Heritage Hotels							
Apartment Hotels							
Guest Houses							
Home Stay / Bed & Breakfast							

Spas							
Others							
TOTAL							
Tourist Restaurants							
Restaurants							
Mobile Food Service							
Event Catering							
Beverage Serving Service							
Others							
TOTAL							

Notes for filling Table 2

- *The above table will provide the assessment team with an overall picture of the tourism sector in the area – the location where tourists go, the number of accommodations available, restaurants, etc. - which they can use in post-disaster damage and loss assessment.*
- *Restaurants that are not catering to tourists (especially those in the informal sector) should be included in the trade and services sector.*
- *Note that natural and cultural sites are estimated in the Culture Sector assessment.*

Sources of Information

The sources of baseline information may vary by state. However, the critical list of the likely sources of information is provided below.

Ministry of Statistics and Programme Implementation	http://www.mospi.gov.in
The Registrar General & Census Commissioner, India	http://censusindia.gov.in
National Institution for Transforming India	http://niti.gov.in
Ministry of Tourism	http://tourism.gov.in
Make in India Initiatives	http://www.makeinindia.com
Open Government Data (OGD) Platform India	https://data.gov.in
India Brand Equity Foundation	http://www.ibef.org/
Bhuvan, Indian Geo-Platform of ISRO	http://bhuvan.nrsc.gov.in

Note 1: Please use similar institutions at State level for baseline Information

Note 2: For Non-Government information sources, please search suitably

Step 2. Estimate value of damage and production flow changes

With the baseline information, field assessment should be undertaken in the affected Districts after a disaster. The assessment team from the State must work with their local counterparts in the Districts to ensure that the estimates for the damages and losses in the sector are accurate to the maximum extent possible. Direct interviews with private contractors or government officials involved in the construction and repair of facilities can also be conducted during the field trip in order to validate unit costs of repair and reconstruction (which are already contained in the baseline data).

Step 2.1. Estimate the damages and losses to companies operating facilities

Repair and replacement costs should be estimated for the damaged components of the company/ies including the estimated time needed to reconstruct the damages. The tourism assessment team should interview the officers of the company/ies to ascertain the extent and value of the damages and the estimated period before operations can be fully restored to the pre-disaster level. The officials and experts in the company/ies can estimate their respective damages more accurately.

The value of damaged assets can be summarized in the following table, which should be used in interviewing the officials of the tourism company/s as a questionnaire.

Table 3. Value of damages and losses of a company in the tourism sector

Name of District:						
Name of Company						
Category	Hotels ( ) Heritage Hotels ( ) Apartment Hotels ( ) Guest Houses ( ) Homestay / Bed & Breakfast ( ) Spas ( ) Others (specify)_____ Restaurants ( ) Mobile Food Service ( ) Event Catering ( ) Beverage Serving Service ( ) Others (Specify) _____					
Capacity	Beds (Accommodation)		Seats (Restaurant)			
Ownership	Public ( ) Private ( )					
Number of Employees	**Male**		**Female**			
ESTIMATED DAMAGES						
Damage to Structures and Assets	**Totally Destroyed**		**Partially Damaged**		**Total Damages (Rs.)**	**Average Time to Replace or Repair (Days)**
	Number of Totally Destroyed	**Average Replacement Cost (Rs.)**	**Number of Partially Damaged**	**Average Repair Cost (Rs.)**		
	A	**B**	**C**	**D**	**E**	**F**
Structures						
Equipment						
Stocks/Inventories						

Others (Specify)						
TOTAL						

ESTIMATED LOSSES (Rs)				
Types of Losses	**Disaster Year**	**Year 1**	**Year 2**	**Total**
Foregone Income				
Cleaning up of Debris				
Higher Operating Costs				
Other Unexpected Expenses				
TOTAL				

Notes for filling Table 3

- *There are various types of structures, machineries and equipment which should be assessed, especially those that are vital to the operation.*
- *'Average Replacement Cost' will be the average pre-disaster value of the structures and assets that were totally destroyed while 'average repair cost' will be the estimated cost of repair of the partially damaged assets.*
- *In formula, the total damages of the companies surveyed will be (Column E) = (Column A) x (Column B) + (Column C) x (Column D).*
- *Years 1 to 2 are the years after the disaster.*

A note on estimated losses:

Losses in the tourism sector will include the following:

- *Foregone income from tourists and other related sources of income, which will last until the tourism facilities are repaired.*
- *Possible higher cost of operation that may arise after the disaster, such as payment of higher rates of electricity from alternative sources, or acquiring raw materials from alternative sources or renting temporary premises while repairing or rebuilding the original premises.*
- *Costs involved for the demolition or removal of debris, etc.*
- *Additional cost of tourism promotion after the disaster.*

Losses can continue during the entire period of recovery and reconstruction. It is expressed in monetary values at current prices.

Step 2.2 Summarize the damages and losses in the sector in a District

Once the assessment for each affected facility has been filled out, the information should be used to summarize the damages and losses at the district level. The summary table below can be used.

Table 4. Summary of damages and losses in a district

Name of District:								
Total number of people Employed by Tourism Companies:	**Male**		**Female**					
Assets	**Within the Disaster Year**				**Losses Beyond Disaster Year**			
	Damages		**Losses**		**Year 1**		**Year 2**	
	Public	**Private**	**Public**	**Private**	**Public**	**Private**	**Public**	**Private**
Accommodation								
Hotels								
Heritage Hotels								
Apartment Hotels								
Guest Houses								
Home Stay / Bed & Breakfast								
Spas								
Others								
Tourist restaurants								
Restaurants								
Mobile Food Service								
Event Catering								
Beverage Serving Service								
Others								
TOTAL								

Step 2.3 Summarize the damages and losses in the sector in the State

Once the summary table for each affected District has been filled out, the information should be used to summarize the damages and losses at the State level. The summary table below can be used.

Table 5. Summary of damages and losses in a State

Name of State:								
Total Number of People Employed by Tourism Companies:	Male		Female					
Assets	Within the Disaster Year				Losses Beyond Disaster Year			
	Damages		Losses		Year 1		Year 2	
	Public	Private	Public	Private	Public	Private	Public	Private
Accommodation								
Hotels								
Heritage Hotels								
Apartment Hotels								
Guest Houses								
Home Stay / Bed & Breakfast								
Spas								
Others								
Tourist Restaurants								
Restaurants								
Mobile Food Service								
Event catering								
Beverage Serving Service								
Others								
TOTAL								

Step 3. Analyze the impacts of the damages and losses to affected population

The assessment team of the sector should analyze all potential impacts of the damages and losses on the sector and must answer the following questions:

- Did the companies lay off workers,which has lead to massive unemployment?
- Were livelihoods lost, especially those who depend on the arrival of tourists like tourist guides and micro-entrepreneurs engaged in handicrafts for souvenirs?
- Will there be substantial reduction in foreign currency earnings due to the reduction of foreign tourist arrivals?
- What are the impacts of loss of cultural and historical sites?

The following matrix can be used to express the social impacts of the damages and losses to the tourism sector.

Matrix 1. Social impacts of the damages and losses to the tourism sector

Area of Impacts	Expected Impacts						Brief Description of Impacts
	General Population			Women and Children			
	S	M	L	S	M	L	
Employment							
Livelihoods							
Foreign Currency Earnings							
Culture							
Others (Specify)							

Notes for filling Matrix 1

- *The expected impacts are segregated into a) the impacts on the general population; and b) the impacts on women and children measured as severe (S), moderate (M) or low (L). The assessment team should mark under the column whether the impacts are S, M or L.*
- *Severe impacts are very distinct and extensive change in the situation for more than 50% of the people in the sector, which will require outside assistance for more than 6 months to enable them to cope and recover.*
- *Moderate impacts are distinct changes in the situation affecting 20% to 50% of the people in the sector, which may require 3 to 6 months outside assistance to enable the people to cope and recover.*
- *Low impacts are distinct changes but less than 20% of the people and may not be widespread or only in limited areas, which may require less than 3 months of outside assistance before the people recover.*
- *The impacts can be briefly described under the column "Brief Description of Impacts". For example, a brief description of a severe "employment" can be the massive laying off of workers from the hotels and resorts; the "livelihoods" can be described as the loss of businesses that are dependent on tourist arrivals; while the impact to "culture" can happen if religious sites of worship are destroyed.*
- *The impacts on women and children may be different from the general population. The assessment team must be able to observe any special issues or concerns that may affect women.*

Step 4. Identify the recovery strategies and estimate recovery and reconstruction needs

The post-disaster needs must be based on a framework where policies and strategies are likewise integrated. After analyzing the potential effects and impacts, if no assistance will be provided to the sector, the aggregate needs of the sector must be estimated.

Step 4.1 Identify recovery and reconstruction strategies

After the consolidation of the field assessment, the assessment team must identify or recommend the policies and strategies for the recovery and reconstruction for the sector. The following are some of the general policies and strategies that could be considered.

A. Policy measures

There are certain policies that can be adopted over a limited period, which can provide incentives to the private sector to reconstruct damaged assets with higher standards of resilience. Among them are:

1. Income tax breaks for private companies such as:
    a. Temporary reduction or freeze or deferment in the collection of tax;
    b. Temporary freeze on basic service charges in the utilization of certain services, over the time of the recovery phase;
    c. Non-collection of property taxes for the duration of the recovery period;
    d. Exemption from registration fees for replacement of the destroyed equipment and machinery over a certain period of time.
2. Subsidizing construction materials and equipment, to be imported by private companies during the recovery and reconstruction phase, through an exemption from paying customs duties and other levies.
3. Extending bank guarantees on loans by the government to enable the private sector to rebuild immediately.

B. Strategies

The following strategies can be adopted for the post-disaster recovery and reconstruction activities:

a. **Building Back Better (BBB)**. Recovery activities based on BBB principles will promote longer-term disaster risk reduction and management. BBB principle should look at the how to make infrastructure and facilities safer from future disasters like stronger engineering design, the advantages of resettlement of facilities in disaster-safe areas instead of rebuilding in the same disaster-prone areas, etc.

b. **Focus on the most vulnerable and socially disadvantaged groups such as children, women, and the disabled**. Recovery programming needs to give priority to the most vulnerable groups, including female-headed households, children and orphans, and the poor, and take into account those with special needs.

c. **Community Participation and Use of Local Knowledge and Skills**. The participation of the community in all process (identification, planning, design and implementation) of recovery activities will help ensure the acceptability of projects and optimize the use of local initiatives, resources and capacities.

d. **Secure development gains**. Recovery strategies, although may be a separate set of activities, must be supportive of existing development plans and must attempt to re-establish and secure previous development gains.

e. **Coordinated and coherent approaches to recovery**. Projects for disaster recovery must have the full and effective coordination among all involved agencies, based on comprehensive information exchange, flexibility in administrative procedures, and uniformity of policies. In some instances, a special new agency may be needed to oversee, coordinate and monitor complex disaster recovery programs. Under this strategy, capacity building activities for the local public administration may be part of the recovery activities, including a well-defined monitoring and evaluation system for the overall implementation of the recovery plan.

f. **Efficient use of financial resources**. The overall strategy should also include the identification of fund sources that are suited for the recovery activities. It should be clear how assistance to the recovery of the private sector would be delivered. Also, some cheaper source of funds from international donor partners should be initially identified for longer-term expensive projects.

g. **Transparency and accountability**. The overall plan and implementation of projects for recovery must be transparent, especially to those affected, through open and wide dissemination of information on all aspects of the recovery process. An effective monitoring system must be established.

Step 4.2 Estimate recovery needs

Recovery needs are intended to bring back normalcy in the sector as quickly as possible. Recovery activities should include those that will enable companies to resume their normal operations. Some of the possible recovery-related activities in the sector can include:

- Repairs of the damages to structures, which are normally affected by strong winds and floods and provide access to tourists.
- Emergency procurement of vital equipment necessary to normalize operations.
- Clearing of debris that mayff have affected the sector.

Step 4.3 Estimate reconstruction needs

Reconstruction needs are generally long-term in nature (3 years and more) and are intended to 'build back better' from the ruins of a disaster. It is to be noted that reconstruction activities should include both public as well as private facilities and may require different types of financing strategies. It is to be noted that since the organizations in this sector are revenue-generating enterprises, financing their needs can come through soft-term credit schemes for the reconstruction and repair of their damaged assets. Such schemes can be accompanied by technical assistance for improved disaster resilient standards of construction. Some possible reconstruction related activities in the sector could include the following:

- Soft-term credit for the replacement or reconstruction of affected structures, under a building-back-better strategy, to ensure future disaster resilience through the adoption and enforcement of improved construction standards;
- Procurement of equipment and machinery;
- Structural retro-fitting of undamaged or partially damaged structures so that they are not affected by disaster event in the future;

- Relocation of facilities to safer areas; and
- Other mitigation measures such as construction of support infrastructure to prevent serious landslides and floods.

Step 4.4 Prioritize identified projects for recovery

Among the projects identified, relative priorities can be set in order to determine which among them are the more important. Based on the broad strategies for recovery, the assessment team should select the priority projects/activities among the identified needs. The prioritization can be made by using a set of impact indicators and the level by which the projects can achieve said impacts. Examples of the criteria that can be used are the following, among others:

a. Economic impact, which can be evaluated in terms of the relative cost to the government of not undertaking reconstruction or rehabilitation.

b. Equity and social impact, which can be in terms of the number of beneficiaries who are poor and destitute and who could not afford to rebuild on their own without outside support.

c. Sustainability, which can be in terms of the reduction of risks and vulnerability of the people and other economic assets to future disasters.

The criteria above can be placed in a matrix like the one below where the impacts are ranked according to low, medium or high.

This matrix can show the relative benefits of proposed projects to the people in the affected areas, which, in turn, will inform and assist the government in determining the priority projects within the sector.

Matrix 2. Impacts of identified post-disaster projects

Name of Proposed Project	Expected Impacts on Recovery								
	Economic Impact			Equity and Social Impact			Sustainability		
	High	Medium	Low	High	Medium	Low	High	Medium	Low

The projects identified by the assessment team must be included in the above matrix.

Step 4.5 Summarize the estimated recovery and reconstruction needs and draft the implementation schedule

Based on the prioritized recovery and reconstruction needs, a summary should be created, by the assessment team, enumerating the post-disaster projects for the recovery and reconstruction. The identified needs should have a rough schedule of implementation, outlining at the very least the activities, timing and budget required for all the programs and projects. The following techniques can be considered:

1. Identify the specific projects according to their relative urgency or priority in relation to recovery.
2. Plot the timeline of activities of all the projects, with the urgent ones on top, in a Gantt chart with the corresponding funding requirement on an annual basis. This will assist the national government in programming the necessary funds over a certain time period, like on a quarterly or annual basis.
3. Identify and include in the list of projects that need further feasibility studies, which may be funded by foreign grants.
4. To the maximum extent possible, a logical framework (log-frame) should be created for each of the project proposed for inclusion in the recovery plan. Log-frames are normally required by foreign donors to consider project proposals.

The recovery and reconstruction needs of the sector can be summarized in the table 6 below, showing the financing requirements over the years.

Reconstruction needs mostly require long-term implementation periods, mostly three or more years. The following table can be used in plotting the implementation period of recovery and reconstruction needs.

Table 6. Summary of recovery and reconstruction needs of the sector.

Name of Projects	Annual Needed Amount of Assistance (Rs.)			Total Needs (Rs.)
	Disaster Year	Year 1	Year 2	
Recovery Projects				
Total				
Reconstruction Projects				
Total				
GRAND TOTAL				

Notes for filling Table 6

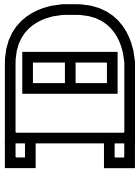
- *Project titles can be inserted under the column on recovery and reconstruction needs. Columns can be added to accommodate any additional reconstruction needs beyond Year 2.*

Step 5. Draft the post-disaster damages, losses and needs (PDNA) report of the sector

With all the information gathered using the previous steps, a report can be drafted by the assessment team, which will be the inputs of the sector in the overall recovery and reconstruction plan. The following format may be considered:

1. Brief description of the sector in the disaster-affected areas.
2. Damages in the sector by areas and by types of assets affected.
3. Losses in the sector emphasizing the losses in income, increase in expenditures, estimated period before normalcy will be attained, etc.
4. Impact on the livelihood, individual households, vulnerable groups and the consequences to the greater community if no assistance for recovery will be provided.
5. Proposed strategies for recovery and reconstruction of the sector.
6. Needs of the sector, by priority, and the draft schedule of implementation with the estimated funds required for each project over time.

The draft sector report should be submitted to the State Disaster Management Office for consolidation.



Transport Sector

This section contains the following contents – specific to this sector – in order to guide the user to successfully conduct post-disaster needs assessment in India:

1. **The Introduction to the Sector**
    a. Baseline information
    b. Post-disaster Situation and Performance
    c. Estimation of Disaster Effects
    d. Estimation of Disaster Impact
    e. Estimation of Post-Disaster Recovery and Reconstruction Requirements
2. **The Standard Procedure for the Sector Assessment**
    a. Recommended Assessment Team
    b. Steps in conducting a PDNA in the transport sector
        - Collect baseline information on sector assets and production flows
        - Estimate value of damage and production flow changes
        - Analyze the impacts of the damages and losses to affected population
        - Identify the recovery strategies and estimate recovery and reconstruction needs
        - Draft the post-disaster damages, losses and needs (PDNA) report of the sector

The user is advised to refer to:

a. *The "Introduction of the PDNA Manual" for a complete information of the concepts and definitions on the post-disaster needs assessment (PDNA);*
b. *The section on "Disaster Effects, Impact Assessment, Needs Estimation" for a more detailed discussion in identifying the possible impacts within and across sectors; and*
c. *The section on "Estimation of Post-Disaster Recovery and Reconstruction Needs" for a more detailed discussion on identifying and prioritizing post-disaster needs*

Introduction

The system of national accounts for India includes the following activities under the transport sector:[56]

- Railway Transport;
- Road Transport;
- Water Transport;
- Air Transport; and
- Services Incidental to Transport.

The transport sector is usually very complex due to the different modes of transport for people and cargo, and several ministries or departments are actually involved in the management and delivery of transport services.

After disasters, the transport sector may sustain destruction of its physical assets – infrastructure and vehicular stock – (damage) and changes in its production flows, which may include both decline in production and higher production costs.

As in the case of other sectors of socio-economic activity, the value of destroyed assets in the transport sector is estimated by first measuring the physical quantities that may have been destroyed and then multiplying them by the unit construction cost prevailing at the time of the disaster to replace the destroyed units with the same characteristics they had prior to the disaster event.

On the other hand, the value of production flow changes in the transport sector may include both a temporary decline in quantity and value of the transport services of persons and cargo as well as a possible temporary increase in the costs of transport. Very often, after a disaster occurs, traffic of people and cargo is not necessarily fully or permanently interrupted; instead, after a brief initial paralysis of traffic flows, part of the traffic may be delayed and another part may be re-routed via alternative roads or modes of transport. Therefore, the total gross value of transport service provision may not actually change very much, but its breakdown among sub-sectors or modes may be altered due to the disaster. However, when alternative routes are used – having different characteristics in comparison to those of the destroyed road – changes in the total value added of transport production, caused by changes in intermediate consumption (i.e. higher transport costs), may actually occur.

An example of higher transport costs in this sector refers to vehicular traffic that must utilize alternative, longer and lower-quality physical routes. Other higher costs are incurred upon when users are required to use alternative ports or airports that have higher operational costs than the ones used under normal conditions or which are located further away. In addition, transport production losses may be incurred upon when certain products cannot reach the intended markets opportunely due to damage in the normal routes

[56]See National Account Statistics, 2013, Central Statistical Office (CSO), Ministry of Statistics and Programme Implementation, New Delhi, 2013. According to the India System of National Accounts, this sector falls under "Transportation and communications".

of transport for the goods[57]; or when tolls or user fees are not collected because of damage to roads under concession.

Special care must be exercised therefore in separating disaster effects within the transport sector and those caused in other sectors that make use of the transport infrastructure and services.

To conduct a full assessment of the transport sector after disasters, the sectorial assessment team must include civil, transport and structural engineers for the estimation of the value of destruction (damage). Transport economists, with experience in the sector, must also participate in the estimation of changes in the production flows of transport services. This sectorial assessment team must have full knowledge of the possible modification of traffic flows that may arise after a disaster, the possible shift of cargo and people between transport modes or subsectors, and the manner to estimate the value of transport costs, which is an essential part of transport economics.

a) Baseline Information

The estimation of disaster effects and impact requires the availability and collection of the following baseline information on the transport sector, which is the first stage of the assessment:

- Location and capacities of each of the previously listed transport sub-sectors, and their main individual components;
- Number and capacities of the vehicular stock for each of the sub-sectors (e.g. rolling stock and locomotives for railways, vehicles for road transport, boats and docking facilities for water transport, airport terminals and airplanes for air transport);
- Most recent origin and destination surveys of traffic in the disaster-affected and nearby areas; and
- Marginal operating costs in each of the transport modes for different types of vehicles.

This type of information is normally available from the Central ministries or State departments of public works or transport; from private enterprises that operate roads, railways, ports and airports under concession arrangements; from building contractors and associations, civil defence institutions and – in some cases – insurance companies. Data on transport flows is usually available from the planning and operations units of ministry of public works and similar State departments, and may also be obtained from recent feasibility studies of new roads prepared by same government units at Central and State levels.

In view of the complexity and extension of the entire transport sector, details will be provided on the procedures to estimate disaster effects and impact on the road transport subsector only, in this manual. For the case of railways, air and water transport, the assessment procedures are similar, but special mention will be made of possible differences when required. In that respect, it must be noted that in India, the existing road transport network consists of about 330 lakh kilometers of roads, with the following breakdown:[58]

[57]That is the typical case of perishable agricultural and fishery products that do not reach the markets in time; however, these losses should be accounted under the primary production sector and not under transport.

[58]See Indian Road Network, National Highways Authority of India (NHAI), (http://www.nhai.org/roadnetwork.htm).

Type of Road	Length, Kilometers
Expressways	200
National Highways (NH)	92,851
State Highways (SH)	1,31,900
Major District Roads (MDR)	4,67,800
Rural and other Roads	26,50,000
Total	**33,42,714**

In the above table, national highways are those running through the breadth and length of the country and connect major ports, State capitals, and large industrial and tourism centers; State highways are arterial routes linking District headquarters and important cities within the State and connecting them with national highways and those of neighboring States; major District roads are those serving areas of production and markets and connecting those with each other or with main highways; rural and other roads are those that serve areas of production and provide outlets to market centers, Taluka headquarters, block development headquarters or other main roads.[59]

Furthermore, it is to be noted that in India road transport carries nearly 65 per cent of total cargo traffic in the country and about 80 per cent of passenger traffic; that national highways represent less than 2 per cent of the total road length but carry about 40 per cent of total road traffic; and that number of transport vehicles has been growing at an annual rate of 10.16 per cent in the past five years.

b) Post-Disaster Sector Situation and Performance

The transport sector assessment team should undertake any field visits to obtain first-hand information on the destruction caused by the disaster on the sector assets and to develop a clear idea of the manner in which the sector will temporarily function until full recovery and reconstruction is completed. For that purpose, it is very likely that the appropriate government units, responsible for the sector would have completed any emergency works to restore minimum traffic where feasible, including inter alia clearing landslides that impede traffic, setting up temporary bridges, or establishing alternative ways.[60]

Before undertaking such field visits, the transport sector assessment team should collect all existing reports on damage and traffic interruption or disruption that may have been prepared by the first responders for the sector, no matter how preliminary or partial the data may be, as it will provide the first quantitative information that is available for the assessment.

In order to define typical unit costs of repairs and reconstruction for the sector as well as probable time required for repair and reconstruction of the affected infrastructure, the transport sector assessment team should visit private contractors that may be involved in any transport projects under construction in the

[59]See Handbook on roads and bridges, Comptroller and Auditor General of India, New Delhi, 1999.

[60]Data on costs and expenditures to achieve such restoration of minimum traffic flows must be collected by the transport sector assessment team for use in the subsequent estimation of changes in flows for the sector.

affected area as well as the planning departments of the relevant transport of public works government offices. In addition, visits should be paid to local insurance companies that may have information on the type and coverage of insurance available for the damaged infrastructure and vehicular stock.

Whenever traffic has been interrupted or disrupted due to significant destruction of key infrastructure elements in any of the transport sub-sectors (such as destruction of bridges or of entire road sections) that require re-routing of traffic flows, the transport sector assessment team should interact with the local sector authorities to make preliminary field estimations of the changes in traffic flows, which will enable the estimation of temporary changes in transport costs.

On the basis of the information collected during these field visits, the transport sector assessment team should be able to develop a calendar of activities required to ensure reconstruction of the sector's infrastructure and full recovery of the sector's performance.

c) Estimation of Disaster Effects

Destruction of physical assets

As indicated before, procedures for the estimation of disaster effects in the road transport sector are described here; disaster effects on other transport sub-sectors may be estimated following similar procedures.

When undertaking the assessment, it must be remembered that elsewhere in the world transport is usually one of the most affected sectors in terms of disaster effects, whose value frequently exceed those of housing and agriculture. In addition, it must be borne in mind that destruction (damage) is not only sustained by road surfaces or structures, but by associated bridges, culverts and other drainage works. Furthermore, in cases of earthquakes, damage is caused not only by the initial earth tremor but by aftershocks as well. In addition, floods may cause both the collapse of structures and the erosion of road surfaces and earth fills. Landslides and mudslides may destroy the road carpeting and interrupt vehicular traffic, and result in higher costs of transport.

In general terms, the value of damage in this sector may be estimated as the cost required to replace the physical assets of the sector, assuming the same physical characteristics as they had prior to the disaster and the unit costs prevailing at the time of the disaster.

It is customary to breakdown the entire road transport sector into the following three main sector components to undertake the assessment: primary roads network, secondary roads network, and tertiary roads network. This is done due to different characteristics of the three types of roads, and also because different government level organizations usually undertake their construction, maintenance and operation. In India, the Ministry of Road Transport and Highways designs, builds and operates what is equivalent to primary roads; State governments take care of the equivalent to secondary roads, and Districts and Municipalities handle the equivalent to tertiary roads. Whenever roads under concession exist in the disaster-affected areas, they should be added as a fourth component, bearing in mind that their construction and operation may fall under ownership of the public or private sector.

During the field surveys, the transport assessment team must ascertain the following information:

- The extent and cost of rehabilitation or reconstruction of road transport works, based on the type and severity of destruction. To do that, the physical and traffic capacity characteristics of each affected component or road sections must be combined with the unit cost of rehabilitation or reconstruction.
- Unit costs for rehabilitation or reconstruction may be obtained from the Ministry of Road Transport and Highways, and from equivalent government departments at the State level and below. In the case where rehabilitation or reconstruction is to be entrusted to private contractors, unit costs may be obtained from such private companies involved in the sector.
- Destruction to vehicular stock – including automobiles, buses, trucks and other smaller vehicles – must also be estimated during the assessment for the transport sector.
- In addition, any damage to construction and maintenance equipment of the sector must be duly included.
- There are exceptions to the above general guideline: i) only vehicles used for collective transportation of people and of cargo are to be included in the transport sector; ii) destroyed household-owned vehicles for transport of family members are not usually included in the estimation of damage for the transport sector[61]; and iii) destroyed agricultural tractors and other equipment are included in the agricultural sector.
- The number of destroyed vehicles is usually estimated during the emergency phase or may be estimated through consultations with transport enterprise associations and insurance company representatives. Their monetary value may be estimated on the basis of information given in the Highway Design Model (HDM) used by the World Bank. When vehicles have only been partially destroyed, simple assumptions on their repair value must be made in comparison to their full value, to facilitate estimations; consultations with local repair shops may be required to ascertain typical unit costs under assumed conditions.
- The value of destroyed assets is required for the full replacement of destroyed infrastructure and equipment (including vehicles) and not that of the depreciated assets. However, the average age of the destroyed infrastructure or equipment should be delivered by the transport sector assessment team to the macro-economic impact assessment team for further utilization in their analysis of overall disaster impact.
- In the case of air transport, the value of destroyed air terminals, runways, associated facilities and equipment, as well as airplanes, which may limit the normal operations of the terminals, should be estimated.
- For railway transport, the value of destroyed locomotives and rail cars, as well as rail lines, train stations and associated buildings will be included.
- In the case of water transport, the value of destroyed docking and port facilities and equipment, together with boats and ships, that may limit the capacity of the subsector, should be estimated.

[61]The value of destroyed personal or family vehicles should be accounted for in the housing sector, as part of household goods, if the vehicles are destroyed while parked in the housing unit. Alternatively, the value of destroyed personal vehicles may be used by the human development team to ascertain decline in quality of life.

Disruption of transport flows

Disasters may induce disruptions in transport flows, which last over the entire time period required for recovery and reconstruction of transport systems. These disruptions may include: (i) the value of transport flows that are interrupted after the disaster, and (ii) temporary higher transport costs that may be incurred when longer alternate routes are necessary, and/or when alternate modes of transport are adopted after disasters. In many cases, the value of such disruptions may exceed the value of destroyed infrastructure; hence, the importance of their inclusion in post-disaster assessments.

The following three key elements are required to estimate the value of traffic flow disruptions: (i) the volume of traffic flows (ii) the ensuing higher unit operating costs of vehicles after the disaster, and (iii) the time required for rehabilitation or reconstruction to take place.

With regards to the time of rehabilitation and reconstruction, the usually accepted time periods in other countries of the world range from a minimum of three months for full rehabilitation, to about six months for the construction of alternate short road sections, through 1 to 5 years for full reconstruction (which may involve mitigation works through redesign and reinforcement) of entire road sections.

To estimate the flows of traffic that will be involved in the assessment of higher transport costs, the following information must be obtained:

- The traffic patterns and volumes under pre-disaster conditions., which can be collected directly from the local authorities through the appropriate unit of the Ministry of Road Transport and Highways and of the equivalent unit at State levels, using the most recent survey of origin and destination that might be available, duly updated when necessary.
- The post-disaster manual counts must be made of the expected temporary changes of flow brought about by the disaster in the disaster-affected road sections or areas. Post-disaster traffic flows must be rapidly measured in the field by the transport sector assessment team or by the pertinent national or State authorities.
- The marginal operating cost of vehicles varies depending on the type of vehicle, type of terrain and quality of road surface. They include different cost components, such as fuel, repairs, tires, depreciation, crew salaries, additional time of passengers, etcetera. Data on marginal cost of operation for vehicles is available in the planning units of the Ministry of Road Transport and Highways and in its State equivalent institutions; in addition, it is normally included in feasibility studies of new roads that are submitted for financing to international financial institutions.
- In order to estimate road transport flow changes, separate analyses are to be made of their possible components, and their total should be aggregated later on by the transport sector assessment team for delivery to the macro-economic assessment team:
  - Gross value of temporarily-interrupted transport of cargo and persons, when significant in comparison to the non-disaster annual amount;
  - Gross value of temporary decline in toll receipts in roads under concession agreements;
  - Urgent expenditures made to re-open transport traffic under at least minimum conditions, during the emergency stage, after the disaster has caused traffic interruptions; and

  - Higher cost of transport due to the temporary utilization of alternative (longer and lower quality) road sections, incurred by transport companies during the period of recovery and reconstruction, which in fact represents an increase in intermediate consumption for the sector in the analysis of macro-economic impact.
- When analyzing disaster effects on public and private enterprises that administer or manage airports, ports, and other transport terminals, the transport sector assessment team should estimate changes in transport flows that include:
  - Possible temporary decline in revenues earned by public and private transport enterprises caused by stoppage or slowdown of operations; and
  - Possible higher costs of operation of the enterprise caused by the disaster.

It is essential that the transport sector assessment team be fully aware that the estimations of disaster effects to be made, and subsequently delivered to the macro-economic assessment team for the estimation of disaster impact, should include only those effects (i.e. damage and transport flow changes) to collective transport systems, whether publicly or privately owned. In addition, any effects occurring in the transport flows of persons, using their family-owned vehicles, are not to be added to the total effects for the sector, since private and personal transport is not included in the road transport sector accounts.[62]

d) Estimation of Disaster Effects

After the estimation of the value of destroyed assets and of production flow changes for the sector has been completed, the transport sector assessment team is required to carry out additional estimations of possible impact at the macro level, and their results are to be delivered to the team in charge of the assessment of macroeconomic impact and to the team entrusted with analyzing disaster impact on human development.

First, additional estimations are to be made of the possible macro-economic disaster impact referring to the country's gross domestic product (GDP), on the balance of payments (BoP) and trade (BoT), and on the fiscal budget. These estimations are to be made regardless of whether the transport facilities and services are government owned or under concession to private enterprises. In that regard, the transport sector damage assessment should include the necessary breakdowns so that estimations can be made of the value of rehabilitation and reconstruction items that must be imported from abroad – including equipment, machinery, construction materials and skilled labor – due to absence of domestic production (the so called "imported component" of damage).

Furthermore, estimations must be made of the impact of transport flow changes on the country's balance of payments and trade, through the estimation of any significant amounts of increased imports or decreased exports of fuels for the transport sector arising from the disaster. In addition, the impact of losses on the government budget must be ascertained in terms of increased operational costs and lower revenues when the government directly owns transport enterprises and services.

[62]It is to be noted that estimations of the possible changes in private personal transport costs should be made by the transport sector assessment team, but used only to provide inputs to the assessment team in charge of estimating disaster impact on human development. The latter team will use such information to ascertain the aggregated impact of the disaster on human development, through analysis of household or personal income decline and of cost-of-living increases caused by the disaster.

Lastly, the transport assessment team should estimate the possible lower fiscal revenues arising as a result of the disaster due to temporary interruption of traffic flows and the corresponding decline of fees for the operation of transport facilities under the public sector domain, as well as the possible higher costs of vehicular fleet operations, for use in the estimation of fiscal impact.

The above information is to be delivered by the transport sector assessment team to the separate assessment team in charge of overall macro-economic impact analysis.

In addition to the previously described estimations, once the transport sector assessment team has completed the estimation of higher transport costs faced by households and individuals when using private transport means (i.e. their own vehicles) such additional costs are to be delivered to the assessment team in charge of analyzing disaster impact on human development.

e) Estimation of Post-Disaster Recovery and Reconstruction Requirements

In the transport sector, recovery needs are the amounts required to restore normal levels of operation of all transport subsectors after a disaster. Essentially, this refers to the reduction of higher costs of transport that have resulted from the effects of the disaster, and usually involve:

- Urgent removal of blockages or opening of alternative road sections to enable minimum vehicular traffic flows right after the disaster;
- Erecting of temporary bridges or construction of fords to enable vehicular traffic over road sections where bridges and major drainage works have been destroyed or damaged to the point where vehicular traffic is deemed not safe;
- Establishing temporary alternative schemes of transport when regular transport means have been destroyed or deemed unsafe for operation after the disaster;
- Setting up temporary government subsidies – or temporarily increasing existing ones – to the operation of collective transport systems in urban areas facing significantly higher transport costs after the disaster, and thus avoid possible widespread increases in transport fees charged to individual users; and
- Possible temporary tax relief schemes for private and public transport companies over the recovery period.

It is to be noted that recovery needs would span since the time of the disaster until full reconstruction of destroyed physical infrastructure and vehicular stocks have been rebuilt and replaced, respectively. Needless to say, the value of recovery needs may not exceed the estimated value of higher transport costs.

In cases where collective transport companies had insurance coverage on lost revenues, the amount of such proceeds is to be deducted from the value of recovery needs.

Reconstruction requirements are to be estimated by the transport assessment team by increasing the estimated value of damage to the sector assets to include disaster-risk reduction features, as required under a “build-back-better” post-disaster strategy. Very often, reconstruction of destroyed bridges and associated drainage works would require the adoption of different standards of design and construction

to ensure adequate flood discharge capacities or earthquake resistance, as well as the introduction of landslide and flood-protection works for specific road sections. However, the nominal transport design capacity of roads and other transport infrastructure and vehicular stock is not to be increased from the pre-disaster level.[63]

Experience obtained in the last forty years over which post-disaster assessments have been conducted reveals that an adequate increase in the value of damage to estimate reconstruction requirement ranges between 12 to 25 per cent[64]. Nevertheless, in each specific case of disaster it will be up to the experts comprising the transport sector assessment team to define the value of such increase, bearing in mind both the degree of disaster resilience required and the design standards prevailing when the destroyed assets were originally built.

The amount of possible insurance proceeds for destroyed transport assets should be deducted to ascertain the net value of reconstruction needs.

At the personal or household level, human development recovery needs address the amounts of financing which may be required by disaster-affected households to fulfil their transport-related needs over the recovery and reconstruction period for the sector without incurring into additional living expenditures.

As indicated before, such additional costs of living by families are not to be added to the value of disaster effects for the transport sector, as the institutional transport sector includes only collective transport functions. The higher costs of personal or family transport are to be kept separate from the transport sector disaster effects, and handed over by the transport sector team to the team in charge of estimating human development impact.

In any case, there are two possible types of higher transport costs to be faced at the personal or household level: (i) higher transport costs in collective systems, and (ii) higher fuel consumption and payment of higher toll costs,when using their own private vehicles. If these costs have been estimated, they may be met through temporary government subsidies of the collective system operation to avoid an increase in the tariff rates, and through a temporary scheme of providing subsidized fuel to the affected families. Should the decision be adopted for the Central or State government to enter into such subsidy arrangements, their implementation would have a negative impact on the fiscal position of the government, and the transport sector team should inform the macro-economic assessment team accordingly. In any case, the value of such human development recovery need should never be added to the estimated value of recovery and reconstruction needs, and kept separately to avoid double accounting of needs.

[63]Increasing the design traffic capacity of a road is a matter of normal socio-economic development and is not a matter arising as a result of the disaster.

[63]See Jovel, Roberto, Damage, Loss and Needs Assessment Guidance Notes, Volume 3, Estimation of Post-Disaster Needs for Recovery and Reconstruction, Global Facility for Disaster Reduction and Recovery (GFDRR), The World Bank, Washington, D.C., 2010.

Transport Sector

STANDARD PROCEDURES FOR SECTOR ASSESSMENT

Recommended Assessment Team

The composition of the sector assessment team may vary by the type of disaster and the extent of the likely damage and production flow changes. The following are recommended to members of the assessment team. Others areas of expertise can be added, depending on the sector coverage in the district to be assessed.

Organization and Personnel	Role in the Sector Assessment

Personnel from:
• **State department of Road Transport and Highways**
• **Department of Shipping**
• **Department of Civil Aviation**
• **Department of Railways**
• **Local departments and offices in the disaster-affected area who are:**
  • Civil Engineer (Road/Bridge/Airport/Ports)
  • Transport Engineer
  • Structural Engineer
  • Quantity Surveyor
  • Transport Economist
  • Goods/Equipment Buyer
	Lead and coordinate

Personnel from:
• **Ministry of Railways**
• **Ministry of Road Transport and Highways**
• **Ministry of Shipping**
• **Ministry of Civil Aviation**
  • Civil Engineer (Road/Bridge/Airport/Ports)
  • Transport Engineer
  • Structural Engineer
  • Quantity Surveyor
  • Transport Economist
  • Goods/Equipment Buyer
	Provide baseline information and facilitate the field assessment of damages and losses

Development partners (if active in the sector)	Participate and provide technical advice

Steps in conducting a PDNA in the transport sector

Step 1. Collect baseline information on sector assets and production flows

Baseline information must be compiled before the field assessment or, if possible, prior to the occurrence of disaster. The baseline data should be validated before the field visit to serve as the basis for the estimation of damages and losses for the disaster-affected area/s. This data can be compiled at the State/Region office or at the District levels. The tables below can be used for the baseline information.

1. Land Transportation

A. Roads and Bridges

- **Roads and bridges and related structures**. Roads and bridges should be directly assessed by the appropriate agency in coordination and consultation with the local engineers. Other structures related to roads and bridges like culverts, drainage systems, etc. should be assessed as part of the damages.
- **Equipment and other machinery**. There are various equipment like heavy equipment, computers, metal fabrication workshops, materials testing, vehicles, etc. that used in the land transportation sector, which should be assessed.
- **Buildings and other structures**. Office buildings and other structures used by the agency in charge of roads and bridges should be assessed as part of the sub-sector including the equipment that are part of the building itself, such as elevators, security equipment, air conditioning, internal communication systems, etc.
- **Materials and supplies**. The structures of agency normally have stocks such as cement, steel, paper, books, furniture, etc. Inventories of research, art works and other collections deposited in a given institution must also be included under this heading. Their value can be sufficiently high to warrant individual assessment.

The following table can be used as baseline information for roads and bridges.

Table 1. Baseline information for roads and bridges

Name of District:									
Type of Roads	Total Length by Classification (km)					Average Replacement Cost	Average Repair Cost	Average Number of Users per Month	
	1°		2°		3°				
	Exp.	N.H.	S.H.	M.D.R.	Rural	(Rs/Km)	(Rs/Km)	Persons	Vehicles
Water-Bound Macadam									
Black Top									
Cement Concrete									

Motorable									
Non-motorable									
Others									
	Number by Classification					Replacement Cost	Average Repair Cost	Average Number of Users per Month	
Type of Bridges	Exp.	N.H.	S.H.	M.D.R.	Rural	(Rs/m)	(Rs/m)	Persons	Vehicles
Steel									
Concrete									
Wood									
Others									

Notes for filling Table 1

- *The following are the types of roads/bridges:*
  - *Exp. means Express road or bridge*
  - *N.H. means National Highway or bridge*
  - *S.H. means State Highway or bridge*
  - *M.D.R. means Major District Road or bridge*
  - *Rural means rural or other road or bridge*
- *Replacement costs are the actual costs if and when a similar road or bridge will be reconstructed while repair costs are the average normal costs of repairs.*

B. Physical Structures

For all agencies in the transportation sector, the following tables can be used in the baseline information.

Table 2. Baseline information for the transportation-related government buildings and structures

Name of District:						
Types of structures		Average Replacement Cost (Rs/SqM)	Average Repair Cost (Rs/SqM)			
Types	Number of Buildings or Structures		Roof	Wall	Floor	Others
Single Floor						
2 to 5 Floors						
6 to 10 Floors						
Over 10 Floors						
Other Structures						

Notes for filling Table 2

- *Structures may include offices of the responsible agency like office buildings, warehouses, garages, etc. The responsible agency can specify their own structures.*
- *The average construction and repair costs of roofs, walls, and floors are expressed on a per square meter basis (Rs/SqM).*
- *The 'average repair cost' refers the value in Rs normally spent to repair the various parts of the structures. 'Others' may include the average repair cost of electrical and plumbing, etc. which can be based on previous costs.*
- *All costs should be based on the pre-disaster values.*

C. Equipment, machineries and supplies

The equipment, supplies and other assets of the agency can be summarized in the following table.

Table 3. Baseline information on the equipment and supplies

Name of District:			
Equipment and Supplies	**Average Acquisition Value Per Unit (Rs)**	**Average Replacement Cost Per Unit (Rs)**	**Average Repair Cost Per Unit (Rs)**
Heavy Equipment			
Bulldozers			
Graders			
Loaders			
Trucks			
Others (Specify)			
Other Equipment			
Communication			
Security			
Others (Specify)			
Materials and Supplies			
Furniture			
Computers			
Others (Specify)			

Notes for filling Table 3

- *The agencies must fill out the above table according to what they own.*
- *The average acquisition cost is the mean value when the assets were purchased.*
- *The average replacement cost is the mean value of the assets immediately before the disaster.*
- *The average repair cost is the mean value when the assets are repaired.*

D. Private and Public Modes of Transportation

The baseline information on other land transportation assets can be identified using the table below.

Table 4. General types of land transportation assets

Name of District:					
LandTransportation	Number (Units)		Average Replacement Cost (Rs/Unit)	Average Repair Cost (Rs/Unit)	Average Operating Cost (Rs/Km)
	Public	Private			
Private Transport					
Cars					
Motorcycles					
Bicycles					
Others					
Public Transport					
Buses					
Company 1					
Company 2					
Taxis					
Company 1					
Company 2					
Trucks					
Company 1					
Company 2					
Other Vehicles					

Notes for filling Table 4 and the following tables

- *The 'Average replacement cost', 'Average repair cost' and 'Average Operating Costs' refer to the types of assets at pre-disaster prices or values.*

2. Air Transportation

The baseline information on the air transportation sub-sector can be summarized in the following table.

Table 5. Assets in the air transportation sub-sector

Name of District:					
Air Transportation	**Number (units)**		**Average Replacement Cost (Rs/Unit)**	**Average Repair Cost (Rs/Unit)**	**Average Operating Cost (Rs/Km)**
	Public	**Private**			
Aircrafts					
Airplanes					
Helicopters					
Others					
Runway (m)					
Runway					
Others					
Structures					
Single Floor					
2 to 5 Floors					
6 to 10 Floors					
Over 10 Floors					
Other Structures					
Equipment and Machinery					
Navigation Equipment					
Baggage Handling					
Security Equipment					
Others (Specify)					
Materials and Supplies					
Furniture					
Computers					
Others (Specify)					
Other Assets					
Others (Specify)					

Notes for filling Table 5

- *It should be noted the above air transport assets do not include those if the military like the air force and the navy. The same applies for the other transport sub-sector assets.*

3. Water Transportation

The baseline information on the water transportation sub-sector can be summarized in the following table.

Table 6. Assets in the water transportation sub-sector

Name of District:					
Water Transportation	Number (units)		Average Replacement Cost (Rs/Unit)	Average Repair Cost (Rs/Unit)	Average Operating Cost (Rs/Km)
	Public	Private			
Watercrafts					
Ships					
Passenger Ferries					
Others					
Ports					
Ports					
Others (Specify)					
Approach Channels (km)					
Approach Channels					
Others					
Structures					
Single Floor					
2 to 5 Floors					
6 to 10 Floors					
Over 10 Floors					
Other Structures					
Equipment and Machinery					
Navigation Equipment					
Baggage Handling					
Security Equipment					
Others (Specify)					
Materials and Supplies					
Furniture					
Computers					
Others (Specify)					
Other Assets					
Others (Specify)					

4. Rail Transportation

The baseline information on the rail transportation sub-sector can be summarized in the following table.

Table 7. Assets in the rail transportation sub-sector

Name of District:					
Rail Transportation	**Number (Units)**		**Average Replacement Cost (Rs/Unit)**	**Average Repair Cost (Rs/Unit)**	**Average Operating Cost (Rs/Km)**
	Public	**Private**			
Rolling Stock					
Locomotive					
Passenger Carriage					
Cargo Wagon					
Other Rolling Stock					
Tracks (km)					
Tracks					
Others (Specify)					
Structures					
Single Floor					
2 to 5 Floors					
6 to 10 Floors					
Over 10 Floors					
Other Structures					
Equipment and Machinery					
Navigation Equipment					
Baggage Handling					
Security Equipment					
Others (Specify)					
Materials and Supplies					
Furniture					
Computers					
Others (Specify)					
Other Assets					
Others (Specify)					

Sources of Information

The sources of baseline information may vary by state. However, the critical list of the likely sources of information is provided below.

Ministry of Statistics and Programme Implementation	http://www.mospi.gov.in
The Registrar General & Census Commissioner, India	http://censusindia.gov.in
National Institution for Transforming India	http://niti.gov.in
Make in India Initiatives	http://www.makeinindia.com
Open Government Data (OGD) Platform India	https://data.gov.in
Ministry of Road Transport & Highway	http://morth.nic.in
India Brand Equity Foundation	http://www.ibef.org
Directorate General of Civil Aviation	http://www.dgca.nic.in
Indian Railways	http://www.indianrailways.gov.in
Inland Waterways Authority of India	http://iwai.nic.in

Note 1: Please use similar institutions at State level for baseline Information

Note 2: For Non-Government information sources, please search suitably

Step 2. Estimate value of damage and production flow changes

With the baseline information in hand, field assessment should be undertaken in the affected Districts after a disaster. *The assessment team from the State must work with their local counterparts in the Districts to ensure that the estimates for the damages and losses in the sector are accurate to the maximum extent possible*. Direct interviews with private contractors or government officials involved in the construction and repair of facilities can also be conducted during the field trip in order to validate unit costs of repair and reconstruction (which is already contained in the baseline data).

The following important points must be remembered in assessing the damages and losses in the transportation sector:

1. Assets in the sector like roads, aircrafts, sea crafts, trains and tracks usually cross geographical boundaries. Care must be exercised by the assessment team to avoid double counting.
2. Damages and losses of foreign-owned assets should not be included in the assessement. Only damages and losses that will accrue to national citizens and businesses should be included. For example, damages to foreign airlines should not be included but the loss of income of local employees of the airlines whose jobs were suspended due to the disaster should be considered.
3. It is normally difficult to assess the damages and losses of private businesses. As such, direct interviews with the owners of private companies can be conducted to determine their damages and losses.

Step 2.1. Estimate the damages and losses in each sub-sector

The post-disaster assessments can be conducted per sub-sector and district using the following tables.

1. Land Transportation

Public assets

The damages of the government land transportation sub-sector can be summarized in the following table.

Table 8. Damage and loss assessment of land transportation sub-sector (public)

Name of District:						
ESTIMATED DAMAGES						
Damaged Assets	Totally Destroyed		Partially Damaged		Total	Average Time to Repair
	Quantity	Total (Rs)	Quantity	Total (Rs)	(Rs)	Days
	A	B	C	D	E	F
Roads (kilometers, km)						
Water-Bound Macadam						
Black Top						
Cement Concrete						
Motorable						
Non-motorable						
Others						
Bridges (Meters, m)						
Steel						
Concrete						
Wood						
Others						
Structures (Units)						
Buildings						
Others						
Heavy Equipment (Units)						
Bulldozers						
Graders						
Loaders						
Trucks						
Others (Specify)						
Other Equipment (Units)						
Communication						
Security						
Others (Specify)						

Materials and Supplies (Units)						
Furniture						
Computers						
Others (Specify)						
Modes of Transport (Units)						
Cars						
Motorcycles						
Bicycles						
Taxis						
Buses						
Trucks						
Others						
TOTAL						

ESTIMATED LOSSES (Rs)				
Sources of Losses	**Disaster Year**	**Year 1**	**Year 2**	**Total (Rs.)**
Foregone Income				
Cleaning up of Debris				
Higher operating Costs				
Other Unexpected Expenses				
TOTAL				

Notes for filling Table 8

- *The values in the baseline information should be used in estimating damages. For example, if 20 square meters of the roof are damaged, the repair cost will be the cost of roofing per square meter multiplied by 20 square meters. On the other hand, if the whole structure is totally destroyed, the value of damage will be its replacement cost at post-disaster prices.*
- *The total for the totally destroyed (or partially damaged) assets will be the total number multiplied by the replacement cost (or average repair cost). The average replacement and repair costs are in the baseline information.*
  - *Column B = (Column A) x replacement cost*
  - *Column D = (Column C) x repair cost*
- *In formula, 'Total damages' Column E will be: = (Column B) + (Column D)*
- *The average time to repair refers to the time to restore the affected structures to their pre-disaster levels. This will give an indication on the number of days before normal services will be restored.*
- *The estimated losses will apply to the agencies which are revenue-generating like airports and ports*

A note on estimated losses:

In the transport sector, losses will include the following:

- *Urgent expenditures to re-establish traffic flows after transport assets have been affected like the cost of temporary Bailey-type bridges, detours, etc.;*
- *Higher cost of transport due to the use of alternative, longer and lower quality roads over the recovery and reconstruction period;*
- *Losses in revenue of the enterprises – public and private – that operate the transport services like bus companies, airlines, shipping lines, trains as well as airports and ports, among others.*
- *The cost of dredging river channels to enable vessels to dock; and*
- *Other unexpected expenditures that may arise due to the disaster like clearing of debris.*

Losses will take place during the entire period of recovery and reconstruction of the sector and may stretch even beyond the year that the disaster occurred. It is expressed in monetary value at current prices.

Private sector

The damages and losses of the private sector can be assessed through interviews of officials of bus and taxi companies among others. The following table can be filled out during the interview.

Table 9. Damage and loss assessment of land transportation sub-sector (private)

Name of District:						
ESTIMATED DAMAGES						
Damaged Assets	Totally Destroyed		Partially Damaged		Total	Average Time to Repair
	Quantity	Total (Rs.)	Quantity	Total (Rs.)	(Rs.)	Days
	A	B	C	D	E	F
Structures (Units)						
Buildings						
Others						
Heavy Equipment (Units)						
Bulldozers						
Graders						
Loaders						

Trucks						
Others (Specify)						
Other Equipment (Units)						
Communication						
Security						
Others (Specify)						
Materials and Supplies (Units)						
Furniture						
Computers						
Others (specify)						
Modes of Transport (Units)						
Cars						
Motorcycles						
Bicycles						
Taxis						
Buses						
Trucks						
Others						
TOTAL						

ESTIMATED LOSSES (Rs)				
Sources of Losses	**Disaster Year**	**Year 1**	**Year 2**	**Total (Rs.)**
Foregone Income				
Cleaning up of Debris				
Higher Operating Costs				
Other Unexpected Expenses				
TOTAL				

2. Air Transportation

The damages and losses for the air transportation sub-sector can be assessed using the following table.

Public assets

The assets of the public sector are generally facilities, equipment, etc. which are needed by the air transportation sub-sector. In most instances the government also owns the national airline, which must be assessed.

Table 10. Damage and loss assessment of air transportation sub-sector (public)

Name of District:						
ESTIMATED DAMAGES						
Damaged Assets	Totally Destroyed		Partially Damaged		Total	Average Time to Repair
	Quantity	Total (Rs.)	Quantity	Total (Rs.)	(Rs.)	Days
	A	B	C	D	E	F
Aircrafts (Units)						
Airplanes						
Helicopters						
Others						
Runway (Meters)						
Runway						
Others						
Structures (Units)						
Buildings						
Others						
Equipment and Machinery (Units)						
Navigation Equipment						
Baggage Handling						
Security Equipment						
Others (Specify)						
Materials and Supplies (Units)						
Furniture						
Computers						
Others (Specify)						
Other Assets (Units)						
Others (Specify)						
TOTAL						

ESTIMATED LOSSES (Rs.)				
Sources of Losses	**Disaster Year**	**Year 1**	**Year 2**	**Total (Rs.)**
Foregone Income				
Cleaning up of Debris				
Higher Operating Costs				
Other Unexpected Expenses				
TOTAL				

Private Sector

Private sector assets are mostly individual aircrafts or airlines. It must be noted, however, that foreign-owned airlines damaged by a disaster should not be included in the assessment of the sub-sector.

Table 11. Damage and loss assessment of air transportation sub-sector (private)

Name of District:						
ESTIMATED DAMAGES						
Damaged Assets	Totally Destroyed		Partially Damaged		Total	Average Time to Repair
	Quantity	Total (Rs.)	Quantity	Total (Rs.)	(Rs.)	Days
	A	B	C	D	E	F
Aircrafts (Units)						
Airplanes						
Helicopters						
Others						
Other Assets (Units)						
Others (Specify)						
TOTAL						

ESTIMATED LOSSES (Rs.)				
Sources of Losses	Disaster Year	Year 1	Year 2	Total (Rs.)
Foregone Income				
Cleaning up of Debris				
Higher Operating Costs				
Other Unexpected Expenses				
TOTAL				

3. Water Transportation

Public Assets

The assets of the public sector are generally facilities, equipment, etc. which are needed by the water transportation sub-sector. It must be noted that boats used for fishing should not be included in this sub-sector. They are included in the fisheries sub-sector of the agriculture sector. The damages and losses for the water transportation sub-sector can be assessed using the following table.

Table 12. Damage and loss assessment of water transportation sub-sector (public) Watercrafts (units)

Name of District:						
ESTIMATED DAMAGES						
Damaged Assets	Totally Destroyed		Partially Damaged		Total	Average Time to Repair
	Quantity	Total (Rs.)	Quantity	Total (Rs.)	(Rs.)	Days
	A	B	C	D	E	F
Watercrafts (Units)						
Ships						
Ferries						
Others						
Ports (Units)						
Ports						
Others						
Approach Channels (km)						
Approach Channels						
Others						
Structures (Units)						
Buildings						
Others						
Equipment and Machinery (Units)						
Navigation Equipment						
Baggage Handling						
Security Equipment						
Others (Specify)						
Materials and Supplies (Units)						
Furniture						
Computers						
Others (Specify)						
Other Assets (Units)						
Others (Specify)						

TOTAL						
ESTIMATED LOSSES (Rs.)						
Sources of Losses	**Disaster Year**		**Year 1**	**Year 2**		**Total (Rs.)**
Foregone Income						
Cleaning up of Debris						
Higher Operating Costs						
Other Unexpected Expenses						
TOTAL						

Private Sector

Private sector assets are mostly individual boats or shipping lines. It must be noted, however, that foreign-owned shipping lines damaged by a disaster should not be included in the assessment of the sub-sector.

Table 13. Damage and loss assessment of water transportation sub-sector (private)

Name of District:						
ESTIMATED DAMAGES						
Damaged Assets	**Totally Destroyed**		**Partially Damaged**		**Total**	**Average Time to Repair**
	Quantity	**Total (Rs.)**	**Quantity**	**Total (Rs.)**	**(Rs.)**	**Days**
	A	**B**	**C**	**D**	**E**	**F**
Watercrafts (Units)						
Ships						
Ferries						
Others						
TOTAL						
ESTIMATED LOSSES (Rs.)						
Sources of Losses	**Disaster Year**		**Year 1**	**Year 2**		**Total (Rs.)**
Foregone Income						
Cleaning up of Debris						
Higher Operating Costs						
Other Unexpected Expenses						
TOTAL						

4. Railways

The damages and losses of the public and private railroad sub-sector can be assessed using the table below.

Table 14. Damage and loss assessment of railways transportation sub-sector (public and private)

Name of District:								
ESTIMATED DAMAGES								
Damaged Assets	Totally Destroyed		Partially Damaged		Total	Ownership		Average Time to Repair
	Quantity	Total (Rs.)	Quantity	Total (Rs.)	(Rs.)	Public	Private	Days
	A	B	C	D	E	F	G	H
Rolling Stock (Units)								
Locomotive								
Passenger Carriage								
Cargo Wagon								
Other Rolling Stock								
Tracks (Kilometers, km)								
Tracks								
Others (Specify)								
Structures (Units)								
Buildings								
Others								
Equipment and Machinery (Units)								
Navigation Equipment								
Baggage Handling								
Security Equipment								
Others (Specify)								
Materials and Supplies (Units)								
Furniture								
Computers								
Others (Specify)								
Other Assets (Units)								
Others (Specify)								
TOTAL								

ESTIMATED LOSSES (Rs.)								
Sources of Losses		Disaster Year		Year 1		Year 2	Total (Rs.)	
	Public	Private	Public	Private	Public	Private	Public	Private
Foregone Income								
Cleaning up of Debris								
Higher Operating Costs								
Other Unexpected Expenses								
TOTAL								

Step 2.2 Summarize the damages and losses in the District

Based on the information gathered in the previous tables, the summary table below can show the magnitude and scope of damages and losses due to the disaster.

Table 15. Summary of damages and losses in a District

Name of District:								
ESTIMATED DAMAGES								
Type of Assets	Totally Destroyed			Partially Damaged			Total Damages	Average Time to Repair
	Kilometers		Total	Kilometers		Total		
Land Transport	Public	Private	(Rs.)	Public	Private	(Rs.)	(Rs.)	Days
Roads	A	B	C	D	E	F	G	H
Water-Bound Macadam								
Black Top								
Cement Concrete								
Motorable								
Non-motorable								
Others								
TOTAL								N.A.
Bridges	Totally Destroyed			Partially Damaged			Total Damages	Average Time to Repair
	Meters		Total	Meters		Total		
	Public	Private	(Rs.)	Public	Private	(Rs.)	(Rs.)	Days
	A	B	C	D	E	F	G	H
Steel								
Concrete								
Wood								
Others								
TOTAL								N.A.
Other Assets (sub-sectors)	Totally Destroyed			Partially Damaged				
	Units		Total (Rs.)	Units		Total (Rs.)	Total Damages (Rs.)	Average Time to Repair
	Public	Private		Public	Private			
	A	B	C	D	E	F	G	H
Land Transportation								
Structures								

Heavy Equipment							
Other Equipment							
Materials and Supplies							
Modes of Transport							
TOTAL							N.A.
Air Transportation							
Aircrafts							
Runway							
Structures							
Equipment and Machinery							
Materials and Supplies							
Other Assets							
TOTAL							N.A.
Water Transportation							
Watercrafts							
Ports							
Approach Channels							
Structures							
Equipment and Machinery							
Materials and Supplies							
Other Assets							
TOTAL							N.A.
Railways Transportation							
Rolling Stock							
Tracks							
Structures							
Equipment and Machinery							
Materials and Supplies							
Other Assets							

TOTAL							N.A.
GRAND TOTAL OF DAMAGES (in Rs.)							

ESTIMATED LOSSES (Rs.)							
Sub-sector	Disaster Year		Year 1		Year 2		Total
	Public	Private	Public	Private	Public	Private	
Land Transportation							
Foregone Income							
Cleaning up of Debris							
Higher Operating Costs							
Other Unexpected Expenses							
TOTAL							
Air Transportation							
Foregone Income							
Cleaning up of Debris							
Higher Operating Costs							
Other Unexpected Expenses							
TOTAL							
Water Transportation							
Foregone Income							
Cleaning up of Debris							
Higher Operating Costs							
Other Unexpected Expenses							
TOTAL							
Railways Transportation							
Foregone Income							
Cleaning up of Debris							
Higher Operating Costs							
Other Unexpected Expenses							
TOTAL							
GRAND TOTAL OF LOSSES (in Rs.)							

Note for filling Table 15

- *All the assets assessed, both public and private, should be included in the above table.*

Step 2.3 Summarize damages and losses in a State

Once the summary table for each affected District has been filled out, the information should be used to summarize the damages and losses at the district level. The summary table below can be used.

Table 16. Summary of damages and losses in a State

Name of State:								
ESTIMATED DAMAGES								
Type of Assets	Totally Destroyed			Partially Damaged			Total Damages	Average Time to Repair
	Kilometers		Total	Kilometers		Total		
Land Transport	Public	Private	(Rs.)	Public	Private	(Rs.)	(Rs.)	Days
Roads	A	B	C	D	E	F	G	H
Water-Bound Macadam								
Black Top								
Cement Concrete								
Motorable								
Non-motorable								
Others								
TOTAL								N.A.
Bridges	Totally Destroyed			Partially Damaged			Total Damages	Average Time to Repair
	Meters		Total	Meters		Total		
	Public	Private	(Rs.)	Public	Private	(Rs.)	(Rs.)	Days
	A	B	C	D	E	F	G	H
Steel								
Concrete								
Wood								
Others								
TOTAL								N.A.
Other Assets (Sub-sectors)	Totally Destroyed			Partially Damaged				
	Units		Total (Rs)	Units		Total (Rs)	Total Damages (Rs.)	Average Time to Repair
	Public	Private		Public	Private			
	A	B	C	D	E	F	G	H
Land Transportation								
Structures								
Heavy Equipment								

Other Equipment								
Materials and Supplies								
Modes of Transport								
TOTAL								N.A.
Air Transportation								
Aircrafts								
Runway								
Structures								
Equipment and Machinery								
Materials and Supplies								
Other Assets								
TOTAL								N.A.
Water Transportation								
Watercrafts								
Ports								
Approach Channels								
Structures								
Equipment and Machinery								
Materials and Supplies								
Other Assets								
TOTAL								N.A.
Railways Transportation								
Rolling Stock								
Tracks								
Structures								
Equipment and Machinery								
Materials and Supplies								
Other Assets								
TOTAL								N.A.
GRAND TOTAL OF DAMAGES (in Rs.)								

ESTIMATED LOSSES (Rs.)							
Sub-sector	Disaster Year		Year 1		Year 2		Total
	Public	Private	Public	Private	Public	Private	
Land Transportation							
Foregone Income							
Cleaning up of Debris							
Higher Operating Costs							
Other Unexpected Expenses							
TOTAL							
Air Transportation							
Foregone Income							
Cleaning up of Debris							
Higher Operating Costs							
Other Unexpected Expenses							
TOTAL							
Water Transportation							
Foregone Income							
Cleaning up of Debris							
Higher Operating Costs							
Other Unexpected Expenses							
TOTAL							
Railways Transportation							
Foregone Income							
Cleaning up of Debris							
Higher Operating Costs							
Other Unexpected Expenses							
TOTAL							
GRAND TOTAL OF LOSSES (in Rs.)							

Step 3. Analyze the impacts of the damages and losses to affected population

The assessment team must be able to analyze potential impacts of the damages and losses of the transport sector to the people and the economy, among others. The assessment team of the sector must answer the following questions:

- What are the possible effects on the productivity, government services, on the people, etc. if transportation services are not restored immediately? Will people be able to access health and educational services? Will there be hardships and increased dangers in commuting for persons with disabilities, women, children and the elderly, etc.?
- Are there added transportation costs to families if they will have to travel using alternative routes?
- Will food supply be affected if transport services are not restored immediately? What will be the potential impacts to vulnerable groups (women, children, elderly, etc.) if food supply will be affected?
- Are there expected reductions in employment (whether temporary or permanent) if transportation services are not restored immediately?

The following matrix can be used to express the social impacts of the damages and losses to the transportation sector.

Matrix 1. Social impacts of the damages and losses to the transportation sector

Area of Impacts	Expected Impacts						Brief Description of Impacts
	General Population			Women and Children			
	S	M	L	S	M	L	
Health							
Education							
Food Supply							
Government Services							
Added Cost to Households							
Employment							
Economic Productivity							
Others (Specify)							

Notes for filling Matrix 1

- *The expected impacts are segregated into a) the impacts on the general population; and b) the impacts on women and children measured as severe (S), moderate (M) or low (L). The assessment team should mark under the column whether the impacts are S, M or L.*
- *The impacts can be briefly described under the column "Brief Description of Impacts". For example, a brief description of a severe "impact on health" and "education" can be the loss of access to health centers and schools; the "added cost to households" can be described as the higher cost of transportation if re-routing will cost more in terms of fares; while the impact to "employment" can be the temporary loss of jobs due to the inability of the transportation sector to bring in tourists. The distribution of food supply and other emergency relief goods may also be hampered if access to affected areas is totally cut off.*

- *The impacts on women and children may be different from the general population. For instance, women and children will be more affected if transportation in the disaster-affected area/s is totally cut and people may have to walk longer distances.*

Step 4. Identify the recovery strategies and estimate recovery and reconstruction needs

The post-disaster needs must be based on a framework where policies and strategies are likewise integrated. After analyzing the potential effects and impacts, if no assistance will be provided to the sector, the aggregate needs of the sector must be estimated.

Step 4.1 Identify recovery and reconstruction strategies

After the consolidation of the field assessment, the assessment team must identify or recommend the policies and strategies for the recovery and reconstruction for the sector.

The following are some of the general policies and strategies that could be considered.

A. Policy measures

There are certain policies that can be adopted which can provide incentives to the private sector to reconstruct damaged assets and facilities with higher standards. Among them are:

1. **Tax breaks to transport companies.** Exempting companies from paying certain taxes for a certain period, say 2 years, will give an incentive for the companies to reconstruct expeditiously and enable them to finance repairs immediately since they are assured that they will have savings from such exemptions. Some of the specific options are:
    - o Temporary reduction or freeze in the collection of value-added tax, building permits and other related fees;
    - o Temporary elimination of import duties on essential items required as inputs to operations;
    - o Temporary freeze on certain charges in the utilization of goods and services, like rent on government land where installations are located;
    - o Non-collection of property taxes or equipment registration fees to those that may have been destroyed by the disaster, especially those that were not insured, until they have been repaired or replaced.
2. **Credit.** A credit scheme with soft terms, like low interest rate with longer repayment periods, can provide companies the resources to buy machinery and equipment that will normalize operations. Credit can be channelled through existing government programs or through the private banking system with a government guarantee. Again, this scheme can be implemented through a policy directive, which will not need any monetary outlay from the government except for the liability associated with the guarantee.
3. **Equity.** In some special cases, the government may opt to provide equity in private companies instead of subsidy or credit or tax exemptions.

B. Strategies

The following strategies can be adopted for the post-disaster recovery and reconstruction activities:

a. **Building Back Better (BBB)**. Recovery activities based on BBB principles will promote longer-term disaster risk reduction and management. BBB principle should look at the how to make infrastructure and facilities safer from future disasters like stronger engineering design, the advantages of resettlement of facilities in disaster-safe areas instead of rebuilding in the same disaster-prone areas, etc.

b. **Focus on the most vulnerable and socially disadvantaged groups such as children, women, and the disabled**. Recovery programming needs to give priority to those that will benefit the most vulnerable groups, including women, female-headed households, children, the poor, and take into account those with special needs, to avoid their being overlooked. For instance, farm-to-market roads and bridges, which are vital to farmers or those that connect employees to their place of employment can be given special emphasis.

c. **Community Participation and Use of Local Knowledge and Skills**. The participation of the community in all process (identification, planning, design and implementation) of recovery activities will help ensure the acceptability of projects and optimize the use of local initiatives, resources and capacities.

d. **Secure development gains**. Recovery strategies, although may be a separate set of activities, must be supportive of existing development plans and must attempt to re-establish and secure previous development gains.

e. **Coordinated and coherent approaches to recovery**. Projects for disaster recovery must have the full and effective coordination among all involved agencies based on comprehensive information exchange, flexibility in administrative procedures, and uniformity of policies. In some instances, a special new agency may be needed to oversee, coordinate and monitor complex disaster recovery programs. Under this strategy, capacity building activities for the local public administration may be part of the recovery activities including a well-defined monitoring and evaluation system for the overall implementation of the recovery plan.

f. **Efficient use of financial resources**. The overall strategy should also include the identification of fund sources that are suited for the recovery activities. It should be clear how assistance to the recovery of the private sector will be delivered. Also, some cheaper source of funds from international donor partners should be initially identified for longer-term expensive projects.

g. **Transparency and accountability**. The overall plan and implementation of projects for recovery must be transparent, especially to those affected, through open and wide dissemination of information on all aspects of the recovery process. An effective monitoring system must be established.

Step 4.2 Estimate recovery needs

Recovery needs are intended to bring back normalcy to all affected areas and sectors as soon as possible and the transportation sector is one of the very important sectors that will expedite a quick recovery. Considering that a greater number of people are dependent on transportation for their livelihood, it is one of the sectors that should be prioritized. Some of the possible recovery related activities are:

- Urgent restoration of at least minimum traffic flows through destroyed road sections and the acquisition and installation of Bailey-type bridges, in which cash-for-work schemes may play a very important role.
- Dredging of port and river navigation channels, to ensure a minimum of access and traffic flow after floods or other similar disasters.
- Urgent repairs of airports and the provision of vital needs like navigational aids and other safety-related equipment, among others.
- Procurement of important equipment and machinery needed for urgent repairs and restorations.
- Cash assistance for clearing of debris and for overtime pay, as necessary.

The repair of structures must be in accordance with the 'building back better' principle in the recovery and reconstruction strategy.

Step 4.3 Estimate reconstruction needs

Reconstruction needs are generally long-term in nature (3 years or more) and are intended to 'build back better' from the ruins of a disaster.

It is to be noted that reconstruction activities should include both public as well as private transport businesses and may require different types of financing strategy. Possible reconstruction related activities in the transport sector could include the following:

- Reconstruction and repair of public roads, bridges, airports, ports and land transport stations under a building-back-better strategy to ensure future disaster resilience through the adoption and enforcement of improved construction standards.
- Structural retro-fitting of undamaged or partially damaged transport facilities to improve or restore their structural integrity to mitigate disaster effects in the future.
- Relocation of vital transport facilities to safe areas, as necessary. In this case, the additional costs land acquisition, and basic services provision (water, sanitation, electricity, etc.) should be included.
- Soft-term credit for reconstruction and repair of private transport businesses. Such schemes can be accompanied by technical assistance for improved disaster resilient standards of construction.

Step 4.4 Prioritize identified projects for recovery

Among the projects identified, relative priorities can be set in order to determine which among them are the more important. Based on the broad strategies for recovery, the assessment team should select the priority projects/activities among the identified needs.

The prioritization can be made by using a set of impact indicators and the level by which the projects can achieve said impacts. Examples of the criteria that can be used are the following, among others:

a. Economic impact, which can be evaluated in terms of the relative cost to the government of not undertaking reconstruction or rehabilitation.

b. Equity and social impact, which can be in terms of the number of beneficiaries who are poor and destitute and who could not afford to rebuild on their own without outside support.

c. Sustainability, which can be in terms of the reduction of risks and vulnerability of the people and other economic assets to future disasters.

The criteria above can be placed in a matrix like the one below where the impacts are ranked according to low, medium or high.

This matrix can show the relative benefits of proposed projects to the people in the affected areas which, in turn, will inform and assist the government in determining the priority projects within the sector.

Matrix 2. Impacts of identified post-disaster projects

Name of Proposed Project	Expected Impacts on Recovery								
	Economic Impact			Equity and Social Impact			Sustainability		
	High	Medium	Low	High	Medium	Low	High	Medium	Low

Step 4.5 Summarize the estimated recovery and reconstruction needs and draft the implementation schedule

Based on the prioritized recovery and reconstruction needs, a summary should be created by the assessment team enumerating the post-disaster projects for the recovery and reconstruction. The identified needs should have a rough schedule of implementation outlining at the very least the activities, timing and budget required for all the programs and projects.

The following techniques can be considered:

1. Identify the specific projects according to their relative urgency or priority in relation to recovery.
2. Plot the timeline of activities of all the projects, with the urgent ones on top, in a Gantt chart with the corresponding funding requirement on an annual basis. This will assist the national government in programming the necessary funds over a certain time period, like on a quarterly or annual basis.
3. Identify and include in the list of projects that need further feasibility studies which may be funded by foreign grants.
4. To the extent possible, a logical framework (log-frame) should be created for each of the project proposed for inclusion in the recovery plan. Log-frames are normally required by foreign donors to consider project proposals.

The recovery and reconstruction needs of the sector can be summarized in the table below showing the financing requirements over the years. Reconstruction needs mostly require long-term implementation periods. They normally require three or more years to complete.

Table 17. Summary of recovery and reconstruction needs in the water supply sector.

Name of Specific Projects	Annual Needed Amount of Assistance (Rs.)						Total Needs (Rs.)
	Disaster Year	Year 1	Year 2	Year 3	Year 4	Year 5	
Recovery Projects							
Total							
Reconstruction Projects							
Total							
GRAND TOTAL							

Note for filling Table 16

- *Project titles can be inserted under the column on recovery and reconstruction needs.*

Step 5. Draft the post-disaster damages, losses and needs (PDNA) report of the sector

With all the information gathered using the previous steps, a report can be drafted by the assessment team, which will be the inputs of the sector in the overall recovery and reconstruction plan. The following format may be considered:

1. Brief description of the sector in the disaster-affected areas.
2. Damages in the sector by areas and by types of assets affected.
3. Losses in the sector emphasizing the losses in income, increase in expenditures, estimated period before normalcy will be attained, etc.
4. Impact on the livelihood, individual households, vulnerable groups and the consequences to the greater community if no assistance for recovery will be provided.
5. Proposed strategies for recovery and reconstruction of the sector.
6. Needs of the sector, by priority, and the draft schedule of implementation with the estimated funds required for each project over time.

The draft sector report should be submitted to the State Disaster Management Office for consolidation.

Communications Sector

This section contains the following contents – specific to this sector – in order to guide the user to successfully conduct post-disaster needs assessment in India:

1. **The Introduction to the Sector**
   a. Baseline information
   b. Post-disaster Situation and Performance
   c. Estimation of Disaster Effects
   d. Estimation of Disaster Impact
   e. Estimation of Post-Disaster Recovery and Reconstruction Requirements

2. **The Standard Procedure for the Sector Assessment**
   a. Recommended Assessment Team
   b. Steps in conducting a PDNA in the communications sector
      - Collect baseline information on sector assets and production flows
      - Estimate value of damage and production flow changes
      - Analyze the impacts of the damages and losses to affected population
      - Identify the recovery strategies and estimate recovery and reconstruction needs
      - Draft the post-disaster damages, losses and needs (PDNA) report of the sector

The user is advised to refer to:

a. *The "Introduction of the PDNA Manual" for a complete information of the concepts and definitions on the post-disaster needs assessment (PDNA);*
b. *The section on "Disaster Effects, Impact Assessment, Needs Estimation" for a more detailed discussion in identifying the possible impacts within and across sectors; and*
c. *The section on "Estimation of Post-Disaster Recovery and Reconstruction Needs" for a more detailed discussion on identifying and prioritizing post-disaster needs.*

Introduction

The India system of national accounts includes the following activities under the sector of communications:

– Postal services;

– Telecommunications; and

– Miscellaneous communications.

The relative importance of each of these activities within the communications sector is illustrated by the fact that in 2011 telecommunications provided nearly 97 per cent of the total value added for the sector, while postal services accounted for less than 2 per cent, and miscellaneous communications represented less than one per cent.[65] It is to be pointed out that the annual growth of telecommunications in the past five years in India has been over 12 per cent, surpassing that of overall economic growth, while that of postal services has been very limited, which fact provides an insight of the trends of development for the sector.

In addition to the above, it must be mentioned that the telecommunications sector development in India is very advanced; there were 93.3 crore telephone connections – of which 80.4 crore or 97 per cent are of the wireless type – in the country as of March 2014, and the network is only second to China in the world. Ownership of the telephone services falls within the private sector (87 per cent) and the public sector (13 per cent).

The Department of Telecommunications in the Ministry of Communications and Information Technology is responsible for the development of telecommunications in the country, while the Telecom Regulatory Authority of India (TRAI) oversees and regulates the participation of private companies in the sector.[66] The Department of Posts (India Post) is also under the same Ministry of Communications and Information Technology and is responsible for the development of the subsector of postal services.

In view of the relative importance of telecommunications, a detailed description of the procedure for estimating disaster effects, impact and needs will be shown here, without going into full details for the case of postal services.

The communications sector, as any other infrastructure sector, may sustain negative effects after the occurrence of disasters. On one hand, its physical assets – including premises, equipment, antennas, telephone lines and switchboards – may face destruction (damage); on the other, it may face temporary disruptions in its production flows, including possible revenue decline and/or increases in its costs of operations. Enterprises that operate in the sector may be either publicly or privately owned.

The value of estimated damage to assets in this sector is to be estimated first combining the number of physical items that may have been destroyed and their respective unit replacement or reconstruction costs prevailing at the time the disaster occurred, and assuming that their characteristics are to remain

[65]According to the India System of National Accounts, this sector falls under "Transportation and communications".See National Account Statistics, 2013, Central Statistical Office (CSO), Ministry of Statistics and Programme Implementation, New Delhi, 2013.

[66]See http://www.dot.gov.in/

unchanged. In view of the fast evolution of specialized telecommunications equipment, it is possible that destroyed equipment may have to be replaced with more technologically advanced technologies and higher unit costs; in this situation, the higher costs involved should be introduced when estimating reconstruction needs, and the value of damage should refer to the original cost of the destroyed equipment.

Production flow changes caused by the disaster in the sector may include a decline in the revenues collected from consumers due to the temporary unavailability of the services, and a possible temporary increase in operational costs of the systems. Very often after a disaster, the flow of communications is briefly interrupted over a limited period of time, to be promptly restored after urgent repairs and replacement of key components are made by the sector enterprises on wireless telephone systems, for which a typical example is the case of dis-alignment of antennas for cellular phone systems caused by winds and earthquakes. In the case of fixed landline systems, communications may be suspended over longer periods while the damaged equipment and lines are replaced or repaired (such as in the case of flooding of switchboards and/or the breaking of poles and aerial telephone lines by winds and earthquakes).

The communications sector assessment team should be aware that the temporary decline in sector revenues is usually followed by a period of increased demand for communications after the system assets have been restored or replaced, in view of the higher demand for communications involved in the emergency phase after disasters.

In addition to the above, the communications sector assessment team members need to be aware of the fact that due to the temporary unavailability of communication services after a disaster, production losses may be sustained by the consumers of these services – both individual families and enterprises – but that those production losses are to be estimated and accounted for in the sector where the individual persons or enterprises operate (such as under agriculture, industry, etcetera), and not in the communications sector.

The composition of the communications sector assessment team, in order to fully analyze and estimate disaster effects, impacts and needs for recovery and reconstruction should include civil and electronic engineers for the estimation of the value of damage, as well as economists with experience in the sector operation for the estimation of production losses and higher costs of operation.

a) Baseline Information

To enable the estimation of disaster effects, impacts and needs, it is essential for the communications sector assessment team to ensure the availability and collection of the following baseline information, at the very start of the assessment:

- The geographical location and capacities of each communication services (postal, wireless and wired communications, satellite stations, etcetera) within the disaster-affected area, including possible redundancy capacities for the provision of services;
- Quantitative information on the evolution of communication services (postal, wireless and wired communications, satellite communications, etcetera) and of the differential rates charged to each type of consumer over the past five years; and
- Annual reports to shareholders in privately-owned communications enterprises that include details on their finances (volume and value of revenues, and costs of operations).

Such baseline information is available at the central or national level in the Department of Telecommunications of the Ministry of Communications and Information Technology as well as in the Telecom Regulatory Authority of India (TRAI), and in the corresponding departments at State level. Baseline with regards to the postal services is held under India Post, a department under the same Ministry of Communications and Information Technology. Baseline information may also be obtained from the annual reports to shareholders, issued by the private telecommunications service providers.

b) Post-Disaster Sector Situation and Performance

The assessment team for the communications sector should carry out field visits to obtain information on the post-disaster situation, after collecting and analyzing all baseline data. These field visits will enable the team to estimate the extent and value of destroyed components of the communications systems as well as the manner in which the sector will temporarily operate until full recovery and reconstruction is achieved. The communications assessment team should also collect and analyze any reports on damage and disruption of operation on the systems that may have been prepared by the communications service enterprises, no matter how preliminary they may be.It also might help to include data on the urgent repairs required to restore minimum communications in the systems after the disaster.

The communications sector assessment team should also collect, from the communications service provider companies, the cost involved in urgent repairs conducted during the emergency stage as well as unit costs of individual equipment and materials used for the same repairs as well to replace damaged units to restore service. In this regard, it is to be noted that communications companies usually carry in stock many of the equipment and materials that are usually damaged or otherwise affected during disasters, which can actually facilitate and expedite the repairs and reconstruction required.

The sector assessment team should ascertain during the field visits whether the damaged communications enterprises or service providers had insurance on possible destruction of assets and on interruption of normal operations, through meetings with both service providers and local insurance companies.

On the basis of the information collected during the field visits, the communications assessment team should be able to develop calendars of activities required for the sector to rebuild or replace destroyed assets and for the sector to return to normal level of operations.

c) Estimation of Disaster Effects

Destruction of physical assets

After disasters, the premises and equipment (including transport vehicles for distribution of mail) usually sustain damages including destruction of telecommunications facilities and equipment, thereby interrupting the communication services. The latter are vulnerable to the action of hydro-meteorological events (rain, winds, flooding) and of earthquakes; however, telecommunications enterprises usually have in stock equipment and materials that enable the prompt replacement of damaged assets to promptly restore communications. These companies also have information on the unit replacement costs of such equipment and materials, which are required for the estimation of the value of total damage.

When estimating the value of destroyed goods or damage, the communications sector team should separately estimate the destroyed components of each sub-sector: i.e. fixed-line communications, wireless systems, satellite communications, and postal services. This is due to the different times required for their restoration after a disaster. It is also essential to separate the value of damage sustained in private and public enterprises.

In addition, special note should be taken of any equipment and materials that may not be available in the warehouses of the communications enterprises, and which may need to be imported from other countries. This fact would affect the time period required for reconstruction and restoration of the services, and may have an impact on the balance of payments at the macro-economic level.

While the value of damage is equivalent to the replacement value of the destroyed equipment, the communications sector assessment team should also ascertain the age of the destroyed goods, and deliver such information to the macro-economic impact assessment team to estimate disaster impact on the capital account. Another point to be considered is that in certain cases, technological advances make it necessary for the replacement of destroyed equipment with more advanced models that may have a higher cost than the original ones; in those cases, the value of damage should be estimated on the basis of the destroyed assets, and the value of the more advanced equipment should be used for the estimation of reconstruction needs, which will be higher than that of damage.

The communications sector assessment team should inquire whether the disaster-affected communications enterprises had insurance on their assets, and the possible proceeds from such insurance policies to cover the value of destroyed assets. For this purpose, special meetings should be held with both the commercial units of the communications enterprises and with local insurance companies.

Disruption of communications service flows

In order to estimate any disruption of communications services flows, the communications sector assessment team should make a comparison of the normal performance of the sector vis a vis the more limited post-disaster sector performance, until recovery and reconstruction is achieved. Normally, each communications enterprise and/or the regulating telecommunications body have projections of their normal performance, which may be used by the communications sector team to develop such comparison.

The communications sector assessment team must estimate the value of the losses in sales of services arising from the disaster that the sector enterprises will sustain until full recovery and reconstruction is achieved. In order to accomplish that, the team must first estimate the time of complete service interruption in each subsector, the time and costs involved in the temporary partial operation of the damaged systems during recovery and reconstruction, and the lost revenues by each enterprise. It is also possible – in cases of widespread destruction as caused by earthquakes in urban areas – that the consumers of the communications services may have sustained significant destruction of their premises and production processes, which may result in a lower demand for communications. Should that be the case, the communications sector assessment team should interact with the separate consumer sector assessment teams – such as industry, commerce, etcetera – to ascertain the time they require to recover and rebuild, which will provide the time required for communications demand to recover.

The communications sector assessment team should keep in mind for the estimation of sectorial flow changes that wind and earthquakes often cause dis-alignment of antennas in wireless systems which may

partially or totally impede communications, but which may be promptly repaired in a few hours' time. In the case of flooding of land-based communications system, service restoration may actually take much longer – from days to months – in view of the damage caused in electronic equipment, and the time for recovery and reconstruction would be significantly longer.

In addition to possible decline in revenues, the communication enterprises may temporarily face higher costs of operation, when resorting to utilize alternative systems of higher unit costs while repairing the damaged ones, or when having to acquire electricity from the usual sources. Such higher costs of operation in fact result in lower value added for the sector, and should be reported to the macro-economic impact assessment team.

In summary, the total changes in communications service flows should be obtained by adding up the following cost components:

- Temporary losses in revenues due to the interruption of communications across the board, until repairs and replacement of damaged equipment and lines has been completed;
- Possible occurrence of an increase in revenues of communications enterprises arising from higher demands of communications during the emergency stage;
- Possible decline in demand for communications from consumers that have sustained significant damage in their premises and productive processes, in cases of major, destructive disasters;
- Possible higher costs of operations caused by temporary utilization of alternative, higher-unit-cost systems while undertaking repairs and replacement of damaged systems; and
- Possible higher costs of operation caused by temporary use of alternative electricity sources, when the electricity sector has sustained major damage and service interruption.

The communications assessment team should ascertain whether some or all of the disaster-affected communications enterprises had insurance on loss of income or revenues, and the possible amount of insurance proceeds due to these enterprises after the disaster. Visits to local insurance companies should be held for this purpose, and also to ascertain whether these local insurers had re-insurance abroad, whose amounts must also be estimated for purposes of determining a possible positive impact on the balance of payments.

d) Estimation of Disaster Impact

The communications sector assessment team, after completing the estimation of the value of destroyed physical assets and of the disruption of communication flows, must undertake further estimations of disaster impact at macro-economic and individual or household levels for delivery to the assessment teams in charge of such impact assessment.

In the case of the macro-economic impact, the communications sector team must estimate the relevant amounts to ascertain the possible decline in growth of gross domestic product at the State level (GSDP), the possible changes to the balance of trade (BoT), and the possible deterioration of the State fiscal position. In that respect, the communications sector assessment team must estimate and deliver to the macro-economic impact assessment team the following information:

- Possible decline in revenues of the communications enterprises – both publicly and privately owned

companies – arising after the disaster, and the possible increase in their operational costs which are in fact an increase in intermediate consumption, arising from the disaster, for use in the analysis of impact on overall economic growth;

- The estimated value of the imported component of recovery and reconstruction requirements, including the equipment and construction materials that are not produced in India and must be imported from abroad, for use in the analysis of the impact on the balance of trade;
- Any possible losses in foreign exchange earnings that may arise when damage to the communications system impedes or slows down the international flow of communications, for use in the analysis of disaster impact on the balance of trade;
- Possible temporary lower revenues and higher costs of operations faced by government-owned communications enterprises as a result of the disaster, that may have a negative impact on the fiscal position; and
- Possible lower tax revenues arising as a result of lower sales of communications revenues and possible temporary increase of any government subsidies required during recovery and reconstruction in lieu of an increase in communications tariffs and charges, to be used in the analysis of the fiscal position.

In addition to the above, the communications sector team must estimate information on any required increase in the tariffs and rates charged to consumers arising from the higher costs of operation of the communications system as a result of the disaster, and deliver such costs to the separate human development impact assessment team.

e) Estimation of Post-Disaster Recovery and Reconstruction Requirements

The recovery requirements to restore the functionality of the communications sector may include the following activities, whose costs or financial requirements are to be estimated by the communications sector assessment team:

- Urgent repair and realignment of wireless antennas and equipment that may have been lightly affected, to restore the flow of minimum communications after the disaster;
- Setting up of portable or mobile alternative communications facilities and equipment to enable temporary communication flows while repairs and replacement are made of destroyed equipment and facilities;
- -- Provision of soft-term credit lines (under lower interest rates and longer repayment periods, in view of the special circumstance caused by the disaster) and facilities to communications enterprises, through the development and private banking system, to ensure adequate availability of working capital and the rescheduling of non-performing loans arising due to the disaster;
- Possible temporary increase of existing government subsidies to communication enterprises, or possible increase in communications service tariffs and rates charged to customers, to meet post-disaster higher costs of system operations;
- Possible temporary tax relief schemes to assist in the recovery of the financial governance of privately-owned communications enterprises.

Should any insurance coverage on revenue losses be available to the communications service enterprises, such amounts should be deducted from the value of recovery needs.

Reconstruction requirements – to achieve physical assets recovery after the disaster – are to be estimated by the communications assessment team by taking the estimated value of destroyed assets and increasing it to cover for any additional costs to ensure an increased resilience against future disasters, as a way to reduce disaster risk. Results of many assessments conducted in other countries in the past, indicate that an increase of between 15 to 25 per cent over the value of damage is typically required to ensure risk reduction.[67] Despite the above, the communications sector assessment team should define, in each specific case of disaster, the value of such increase, on the basis of the desired degree of disaster resilience and of the prevailing design standards at the time when the assets were originally built.

Another consideration for the estimation of reconstruction requirements is the possibility that at the time of reconstruction, some equipment and materials may not be available with the same characteristics as in the destroyed units, and which require replacement using more advanced and costly models. Should that be the case, the reconstruction needs should adopt the cost of such improved versions of the equipment.

Furthermore, it is also possible that – at least in the case of fixed-line communication systems – the adopted reconstruction strategy may involve resorting to the use of subterranean cabling to substitute the more vulnerable aerial land-lines, or to the utilization of more-resistant poles and cables. Another possibility is that antennas or other vulnerable key equipment need to be relocated to safer sites, and require additional investments. Whenever those situations arise, reconstruction requirements would have to be increased accordingly.

After the communications team has estimated such total reconstruction requirements, a deduction should be made of the available insurance proceeds that were identified during the visit to local insurance companies, in order to arrive at the net value of reconstruction requirements.

Human development recovery needs refer to the higher costs that individual persons and households may have to pay to meet their communications requirements after a disaster. Such needs may occur whenever the communications enterprises need to meet higher costs of operation in their systems and a decision is adopted to transfer such costs to the consumers, which in addition to sustaining lower income may also have to meet higher cost-of-living expenditures. This situation would result in a decline in the quality of life of the affected population.

In other countries, after significant disasters, governments have elected to assist the affected population by temporarily subsidizing the communications enterprises operations, and thus avoid increasing the population´s post-disaster burden.[68] Another alternative way of assisting the affected population would be to issue cash grants to the affected population.

In any case, the communications sector assessment team should deliver the information on the higher costs of communication services to the assessment team in charge of estimating disaster impact at the personal or household level, for their subsequent consideration. Nevertheless, care should be exercised to ensure that the higher costs of communications are not counted twice as a recovery requirement (i.e. both as a need for the institutional sector of communications and for human development recovery).

[67]In that regard, see Jovel, Roberto, Damage, Loss and Needs Assessment Guidance Notes, Volume 3, Estimation of Post-Disaster Needs for Recovery and Reconstruction, Global Facility for Disaster Reduction and Recovery (GFDRR), The World Bank, Washington, D.C., 2010.

[68]After the Mexico City earthquake in 1985, the Government of that country elected to provide free telecommunications services to the affected population.

Communications Sector

STANDARD PROCEDURES FOR SECTOR ASSESSMENT

Recommended Assessment Team

The composition of the sector assessment team may vary by the type of disaster and the extent of the likely damage and production flow changes.

Organization and Personnel	Role in the Sector Assessment

Personnel from:
• **State department of communications and information technology**
• **Local departments and offices in the disaster-affected area who are:**
  • Civil Engineer (Communications Infrastructure)
  • Electronic Engineer
  • Electrical Engineer
  • Mechanical Engineer
  • Communications Infrastructure Economist
  • Goods/Equipment Buyer
	Lead and coordinate

Personnel from:
• **Ministry of Communications and Information Technology who are:**
  • Civil Engineer (Communications Infrastructure)
  • Electronic Engineer
  • Electrical Engineer
  • Mechanical Engineer
  • Communications Infrastructure Economist
  • Goods/Equipment Buyer
	Provide baseline information and facilitate the field assessment of damages and losses

Development partners (if active in the sector)	Participate and provide technical advice

Steps in conducting a PDNA in the communications sector

Step 1. Collect baseline information on sector assets and production flows

Baseline information must be compiled before the field assessment or, if possible, prior to the occurrence of disaster. The baseline data should be validated before the field visit to serve as the basis for the estimation of damages and losses for the disaster-affected area/s. This data can be compiled at the State/Region office or at the District levels. The tables below can be used for the baseline information.

Table 1: Baseline information on communication companies

Name of District:						
Name of Company	Ownership		Services provided			
	Public	Private	Postal Services	Land Telecommunication	Wireless Telecommunication	Other Systems
Company 1						
Company 2						
Company N						
TOTAL						

Notes for filling Table 1

- *"Postal services" includes all types of postal services by land, water, and air.*
- *"Land telecommunication" refers to cabled services such as terrestrial TV, landline telephones, cable internet etc.*
- *"Wireless telecommunication" refers to wireless services such as mobile telephone, radio, satellite internet, satellite TV etc.*
- *"Other Systems" refers to specific satellite stations etc.*
- *The names of all the companies operating in the area should all be included.*
- *For "Services provided", this only requires a 'tick' in the box, not details of the service.*
- *If the companies cover more than one district or city, they should only be assessed as part of the district where their main offices are located to avoid double counting.*
- *If the is a joint venture between the government and a private corporation, it can be considered a public for the purpose of PDNA.*

Sources of Information

The sources of baseline information may vary by state. However, the critical list of the likely sources of information is provided below.

Ministry of Statistics and Programme Implementation	http://www.mospi.gov.in
The Registrar General & Census Commissioner, India	http://censusindia.gov.in
National Institution for Transforming India	http://niti.gov.in
Department of Telecommunications	http://www.dot.gov.in
Telecom Regulatory Authority of India	http://www.trai.gov.in
Open Government Data (OGD) Platform India	https://data.gov.in
India Brand Equity Foundation	http://www.ibef.org

Note 1: Please use similar institutions at State level for baseline Information

Note 2: For Non-Government information sources, please search suitably

Step 2. Estimate value of damage and production flow changes

With the baseline information, field assessment should be undertaken in the affected Districts after a disaster. The assessment team from the State must work with their local counterparts in the Districts to ensure that the estimates for the damages and losses in the sector are accurate to the extent possible. Direct interviews with private contractors or government officials involved in the construction and repair of facilities can also be conducted during the field trip in order to validate unit costs of repair and reconstruction (which is already contained in the baseline data).

It should be noted that since there is a possibility that only one company provides the service to a number of Districts or States, caution should be exercised to avoid double counting. It is recommended that the assessment of damages and losses of the company should be accounted for in the district where the main office of the company is located. However, if the main office is located outside the disaster area, the assessment team must account for the damages and losses of the company with an indication as to where such damages and losses occurred.

Step 2.1. Estimate the damages and losses to communications companies

Repair and replacement costs should be estimated for the damaged components of the company/ies. The time needed to reconstruct the damages should also be estimated. Aside from field visits to the disaster sites, the assessment team should interview the officers of the company/ies to ascertain the extent and value of the damages and the estimated period before operations can be fully restored to the pre-disaster level. The officials and experts in the company/ies can estimate their respective damages more accurately. Moreover, considering that some of the damages may cover a wide area that may be inaccessible to the assessment team, the people in the company/ies can get the data quicker from their colleagues in the field.

The value of totally damaged assets can be summarized in the following table, which should be used in interviewing the officials of the telecommunications company/ies as a questionnaire.

Table 2. Damages and losses of communication companies

Name of Company				
Location (District)				
Services Provided	Postal Services ( ) Land Telecommunication ( ) Wireless Telecommunication ( ) Other Systems ( ) Others (Specify)			
Ownership	Public ( ) Private ( )			
Number of Employees	**Male**		**Female**	
Number of Clients				

ESTIMATED DAMAGES						
Damage to Structures and Assets	**Totally Destroyed**		**Partially Damaged**		**Total Damages (Rs.)**	**Average Time to Replace or Repair (Days)**
	Number of Totally Destroyed	**Average Replacement Cost (Rs.)**	**Number of Partially Damaged**	**Average Repair Cost (Rs.)**		
	A	**B**	**C**	**D**	**E**	**F**
Structures						
Towers						
Office Buildings						
Others						
Equipment						
Antennae						
Computers						
Others						
Machinery						
Generators						
Others						
Vehicles						
Service Vehicles						
Others						
Other Assets						
Others						
TOTAL						

ESTIMATED LOSSES				
Types of Losses	**Disaster Year**	**Year 1**	**Year 2**	**Total (Rs.)**
Foregone Income				
Cleaning up of Debris				
Higher Operating Costs				
Other Unexpected Expenses				
TOTAL				

Notes for filling Table 2

- *The company/ies should fill out information appropriate to their assets. There are various machineries and equipment in the sector, which should be assessed especially those that are vital to the operation.*
- *'Average Replacement Cost' will be the average pre-disaster value of the structures and assets that were totally destroyed.*
- *'Average Repair Cost' will be the average cost of repair of the structures and assets that were partially damaged.*
- *In formula, the total damages will be (Column E) = (Column A) x (Column B) + (Column C) x (Column D).*

A note on estimated losses:

Losses in the sector will include the following:

- *Foregone sales due to the shut-down of the telecommunication system while the system is under repair or reconstructed after a disaster. This can include both short-term shut-down for repairs and longer-term shut-down due to reconstruction.*
- *Lower sales due to the decline in demand from consumers (households or companies) that have been affected by the disaster.*
- *Higher cost of operation which occurs when damaged systems are substituted by alternative sources have a higher unit cost of production like when electricity has to be generated from expensive generators.*
- *Additional expenses to clean up the debris.*

In this sector losses occur until full capacity and supply have been re-established in all system components and user demand (in all sectors) has been restored to pre-disaster levels. Losses are expressed in monetary value at current values. It should be noted that it is possible for this sector to experience losses even if they have only minimal damages. This can occur if power supply is affected which can cause the stoppage of telecommunications operations.

Step 2.2 Summarize the damages and losses in the sector in a District

Based on the survey of companies or companies, the damages and losses can be summarized in the following table.

Table 3. Summary of damages and losses in a District

Name of District:								
Number of Clients Affected								
Number of Employees Affected	Male			Female				
Name of Companies	Within the Disaster Year				Losses Beyond Disaster Year			
	Damages		Losses		Year 1		Year 2	
	Public	Private	Public	Private	Public	Private	Public	Private
Company 1								
Company 2								
Company N								
TOTAL								

Notes for filling Table 3

- 'Public' and 'private' refers to the ownership of the communications company.
- The damages and losses should be accounted for under the type of ownership of the company.

Step 2.3 Summarize damages and losses of the sector in a State

Once the summary table for each affected District has been filled out, the information should be used to summarize the damages and losses at the State level. The summary table below can be used.

Table 4. Summary of damages and losses in the State

Name of State:								
Number of Clients Affected								
Number of Employees Affected	Male				Female			
Name of Companies	Within the Disaster Year				Losses Beyond Disaster Year			
	Damages		Losses		Year 1		Year 2	
	Public	Private	Public	Private	Public	Private	Public	Private
District A:								
Company 1								
Company N								
District B:								
Company 1								
Company N								
District C:								
Company 1								
Company N								
TOTAL								

Step 3. Analyze the impacts of the damages and losses to affected population

The assessment team should analyze all potential impacts of the damages and losses on the sector and must answer the following questions:

- Will there be employment losses for the telecommunications companies?
- What are the potential adverse impacts to the production and employment of other industries if telecommunication services are not restored?
- What are the possible impacts to government services?
- Are there local traditional modes of communications that were adversely affected? How will they affect the local communities?

The following matrix can be used to express the social impacts of the damages and losses to the telecommunications sector.

Matrix 1. Social impacts of the damages and losses to the telecommunications sector

Area of Impacts	Expected Impacts						Brief Description of Impacts
	General Population			Women and Children			
	S	M	L	S	M	L	
Government Services							
Employment							
Economic Productivity							
Others (Specify)							

Notes for filling Matrix 1

- *The expected impacts are segregated into a) the impacts on the general population; and b) the impacts on women and children measured as severe (S), moderate (M) or low (L). The assessment team should mark under the column whether the impacts are S, M or L.*
- *Severe impacts are very distinct and extensive change in the situation for more than 50% of the people in the sector, which will require outside assistance for more than 6 months to enable them to cope and recover.*
- *Moderate impacts are distinct changes in the situation affecting 20% to 50% of the people in the sector, which may require 3 to 6 months outside assistance to enable the people to cope and recover.*
- *Low impacts are distinct changes but affecting less than 20% of the people and may not be widespread or only in limited areas, which may require less than 3 months of outside assistance before the people recover.*

- The impacts can be briefly described under the column "Brief Description of Impacts". For example, a brief description of a severe impact on "government services" can be the slow reaction time of police and fire services if the communication system is down; the impact on "employment" can be the termination of workers; while the impact to "economic productivity" can be the inability of other factories to accept delivery orders due to the absence of telecommunications.
- The impacts on women and children may be different from the general population. The assessment team must identify some specific adverse impacts on women.

Step 4. Identify the recovery strategies and estimate recovery and reconstruction needs

The post-disaster needs must be based on a framework where policies and strategies are likewise integrated. After analyzing the potential effects and impacts, if no assistance will be provided to the sector, the aggregate needs of the sector must be estimated.

Step 4.1 Identify recovery and reconstruction strategies

After the consolidation of the field assessment, the assessment team must identify or recommend the policies and strategies to be followed for recovery and reconstruction of the sector. The following are some of the general policies and strategies that could be considered.

A. Policy Measures

There are certain policies that can be adopted over a limited period, which can provide incentives to the private sector to reconstruct damaged assets with higher standards of resilience. Among them are:

1. Income tax breaks for private companies such as:
    a. Temporary reduction or freeze or deferment in the collection of tax;
    b. Temporary freeze on basic service charges in the utilization of certain services over the time of the recovery phase;
    c. Non-collection of property taxes for the duration of the recovery period;
    d. Exemption from registration fees for replacement of the destroyed equipment and machinery over a certain period of time.
2. Subsidizing construction materials and equipment to be imported by private companies during the recovery and reconstruction phase through an exemption from paying customs duties and other levies.
3. Extending bank guarantees on loans by the government to enable the private sector to rebuild immediately.

B. Strategies

The following strategies can be adopted for the post-disaster recovery and reconstruction activities:

a. **Building Back Better (BBB)**. Recovery activities based on BBB principles will promote longer-term

disaster risk reduction and management. BBB principle should look at the how to make infrastructure and facilities safer from future disasters like stronger engineering design, the advantages of resettlement of facilities in disaster-safe areas instead of rebuilding in the same disaster-prone areas, etc.

b. **Focus on the most vulnerable and socially disadvantaged groups such as children, women, and the disabled**. Recovery programming needs to give priority to the most vulnerable groups, including female-headed households, children and orphans, and the poor, and take into account those with special needs.

c. **Community Participation and Use of Local Knowledge and Skills**. The participation of the community in all process (identification, planning, design and implementation) of recovery activities will help ensure the acceptability of projects and optimize the use of local initiatives, resources and capacities.

d. **Secure development gains**. Recovery strategies, although may be a separate set of activities, must be supportive of existing development plans and must attempt to re-establish and secure previous development gains.

e. **Coordinated and coherent approaches to recovery**. Projects for disaster recovery must have the full and effective coordination among all involved agencies based on comprehensive information exchange, flexibility in administrative procedures, and uniformity of policies. In some instances, a special new agency may be needed to oversee, coordinate and monitor complex disaster recovery programs. Under this strategy, capacity building activities for the local public administration may be part of the recovery activities including a well-defined monitoring and evaluation system for the overall implementation of the recovery plan.

f. **Efficient use of financial resources**. The overall strategy should also include the identification of funding sources that are suited for the recovery activities. It should be clear how assistance to the recovery of the private sector would be delivered. Also, some cheaper source of funds from international donor partners should be initially identified for longer-term expensive projects.

g. **Transparency and accountability**. The overall plan and implementation of projects for recovery must be transparent, especially to those affected, through open and wide dissemination of information on all aspects of the recovery process. An effective monitoring system must be established.

Step 4.2 Estimate recovery needs

Recovery needs are intended to bring back normalcy in the sector as quick as possible. In the telecommunications sector, quick recovery efforts must be undertaken since a great number of people and businesses depend on it for their economic activities.

Recovery activities should include those that will enable companies to resume their normal operations. Some of the possible recovery-related activities in the sector can include:

- Repairs of the damages to structures, which are normally affected by strong winds and floods.
- Emergency procurement of vital equipment necessary to normalize operations.
- Clearing of debris that may have affected the sector.

Step 4.3 Estimate reconstruction needs

Reconstruction needs are generally long-term in nature (3 years and more) and are intended to 'build back better' from the ruins of a disaster. It is to be noted that reconstruction activities should include both public as well as private facilities and may require different types of financing strategies.

It is to be noted that since the companies in this sector are revenue-generating enterprises, financing their needs can come through soft-term credit schemes for the reconstruction and repair of their damaged assets. Such schemes can be accompanied by technical assistance for improved disaster resilient standards of construction.

Some possible reconstruction related activities in the sector could include the following:

- Soft-term credit for the replacement or reconstruction of affected structures under a building-back-better strategy to ensure future disaster resilience through the adoption and enforcement of improved construction standards;
- Procurement of equipment and machinery
- Cost of replacing furniture and equipment that were destroyed may be included within the needs for reconstruction, unless they have been covered under the recovery needs to provide temporary services for the affected area;
- Structural retro-fitting of undamaged or partially damaged structures so that they are not affected by disaster event in the future;
- Relocation of facilities to safer areas; and
- Other mitigation measures such as construction of support infrastructure to prevent serious landslides and floods to energy facilities.

Step 4.4. Prioritize identified projects for recovery

Among the projects identified, relative priorities can be set in order to determine which among them are the more important. Based on the broad strategies for recovery, the assessment team should select the priority projects/activities among the identified needs.

The prioritization can be made by using a set of impact indicators and the level by which the projects can achieve said impacts. Examples of the criteria that can be used are the following, among others:

a. Economic impact, which can be evaluated in terms of the relative cost to the government of not undertaking reconstruction or rehabilitation.

b. Equity and social impact, which can be evaluated in terms of the number of beneficiaries who are poor and destitute and who could not afford to rebuild on their own without outside support.

c. Sustainability, which can be evaluated in terms of the reduction of risks and vulnerability of the people and other economic assets to future disasters.

The criteria above can be placed in a matrix like the one below where the impacts are ranked according to low, medium or high. This matrix can show the relative benefits of proposed projects to the people in the affected areas, which, in turn, will inform and assist the government in determining the priority projects within the sector.

Matrix 2. Impacts of identified post-disaster projects

Name of Proposed Project	Expected Impacts on Recovery								
	Economic Impact			Equity and Social Impact			Sustainability		
	High	Medium	Low	High	Medium	Low	High	Medium	Low

The projects identified by the assessment team must be included in the above matrix.

Step 4.5 Summarize the estimated recovery and reconstruction needs and draft the implementation schedule

Based on the prioritized recovery and reconstruction needs, a summary should be created by the assessment team enumerating the post-disaster projects for the recovery and reconstruction. The identified needs should have a rough schedule of implementation outlining at the very least the activities, timing and budget required for all the programs and projects. The following techniques can be considered:

1. Identify the specific projects according to their relative urgency or priority in relation to recovery.
2. Plot the timeline of activities of all the projects, with the urgent ones on top, in a Gantt chart with the corresponding funding requirement on an annual basis. This will assist the national government in programming the necessary funds over a certain time period, like on a quarterly or annual basis.
3. Identify and include in the list of projects that need further feasibility studies, which may be funded by foreign grants.
4. To the maximum extent possible, a logical framework (logframe) should be created for each of the project proposed for inclusion in the recovery plan. Logframes are normally required by foreign donors to consider project proposals.

The recovery and reconstruction needs of the sector can be summarized in the table below showing the financing requirements over the years. Reconstruction needs mostly require long-term implementation periods. They normally require three or more years to complete.

Table 5. Summary of recovery and reconstruction needs of the telecommunications sector.

Name of Specific Projects	Annual Needed Amount of Assistance (Rs.)			Total Needs (Rs.)
	Disaster Year	Year 1	Year 2	
Recovery Projects				
Total				
Reconstruction Projects				
Total				
GRAND TOTAL				

Step 5. Draft the post-disaster damages, losses and needs (PDNA) report of the sector

With all the information gathered using the previous steps, a report can be drafted by the assessment team, which will be the inputs of the sector in the overall recovery and reconstruction plan. The following format may be considered:

1. Brief description of the sector in the disaster-affected areas.
2. Damages in the sector by areas and by types of assets affected.
3. Losses in the sector emphasizing the losses in income, increase in expenditures, estimated period before normalcy will be attained, etc.
4. Impact on the livelihood, individual households, vulnerable groups and the consequences to the greater community if no assistance for recovery will be provided.
5. Proposed strategies for recovery and reconstruction of the sector.
6. Needs of the sector, by priority, and the draft schedule of implementation with the estimated funds required for each project over time.

The draft sector report should be submitted to the State Disaster Management Office for consolidation.

Housing Sector

This section contains the following contents – specific to this sector – in order to guide the user to successfully conduct post-disaster needs assessment in India:

1. **The Introduction to the Sector**
    a. Baseline information
    b. Post-disaster Situation and Performance
    c. Estimation of Disaster Effects
    d. Estimation of Disaster Impact
    e. Estimation of Post-Disaster Recovery and Reconstruction Requirements
2. **The Standard Procedure for the Sector Assessment**
    a. Recommended Assessment Team
    b. Steps in conducting a PDNA in the housing sector
        - Collect baseline information on sector assets and production flows
        - Estimate value of damage and production flow changes
        - Analyze the impacts of the damages and losses to affected population
        - Identify the recovery strategies and estimate recovery and reconstruction needs
        - Draft the post-disaster damages, losses and needs (PDNA) report of the sector

The user is advised to refer to:

a. *The "Introduction of the PDNA Manual" for a complete information of the concepts and definitions on the post-disaster needs assessment (PDNA);*
b. *The section on "Disaster Effects, Impact Assessment, Needs Estimation" for a more detailed discussion in identifying the possible impacts within and across sectors; and*
c. *The section on "Estimation of Post-Disaster Recovery and Reconstruction Needs" for a more detailed discussion on identifying and prioritizing post-disaster needs.*

Introduction

Housing is often that sector of the society, which sustains the most severe destruction to its physical infrastructure and assets (damage) as a result of a disaster (barring the case of slow onset disasters such as drought or disasters, which are a result of health epidemics such as the Ebola outbreak as experienced in West Africa or SARS as was experienced in Asia in 2003).

Different types of events may result in different types of effects, but that is not the only explanation of the difference in the effects of an event to the housing sector.[69] The earthquake that occurred in 2001 in Gujarat State resulted in some one million houses being totally or partially destroyed[70]. The Report on the Kosi Floods in 2008 indicated that nearly 60,000 houses sustained total or partial damage as a result of the event[71]. The Uttarakhand Disaster, caused by heavy rains and landslides in 2013, saw just over 3,000 houses affected in both the rural and urban areas.[72] The tropical cyclone in the State of Odisha in 2013 saw nearly 200,000 homes being totally or partially destroyed as a result of the disaster.[73]

The difference in the quality of housing is also a factor. Table 1 provides data on the level of damage sustained by different types of houses as a result of the Kosi floods of 2008.

Table 1. Distribution of houses by intensity of damage suffered in survey villages following 2008 Kosi floods

House type	Households %			Total Number of Houses
	Severely or Completely Damaged	Partially Damaged	Not Damaged	
Kutcha	64.6	32.1	3.3	4,280
Pukka	0.3	23.9	75.8	3,348
Semi Pukka	9.3	34.8	55.9	9,281
Thatched	53.1	33.7	13.2	42,387
Total	**37.0**	**40.4**	**22.6**	**59,746**

Source: Table 4.8 (page 67) Kosi Floods 2008, UNDP

[69]According to the India System of National Accounts, this sector falls under "Financing, insurance, real estate and business services".
[70]India: Gujarat Earthquake Recovery Programme Assessment Report 2001, The World Bank and the Asian Development Bank (ADB), 15 March 2001.

[71]Kosi Floods 2008, United Nations Development Programme, India, 2009.

[72]India Uttrakhand Disaster 2013, Joint Rapid Damage and Needs Assessment Report, August 2013. Government of Uttrakhand, India, WB and ADB.

[73]Phailin and the Subsequent Flood. Government of Odisha. Special Relief Commissioner. 2013.

a) Baseline Information

In order to conduct an assessment of an event in the housing sector, it is important to know the number of dwellings that existed at sub-national level before the disaster occurred. Information on the types of dwellings categorized by materials used in the construction of outer walls and roofs and the size of the dwelling is essential. The ownership structure is also important, defining privately or publicly owned and the headship of the owner by the sex of the owner (female or male). Where traditional ownership patterns exist, they should be described as well as any peculiar traditional building customs that may differ according to ethnicity, sex, religion or any other significant demographic characteristic. Is the dwelling used for income earning purposes or is it owner-occupied? All of these characteristics need to be described.

A quick review of the institutional construction sector is important to undertake, with information regarding how many houses are built in any given year in the State, the imported content in the sector (if all materials are sourced locally or what proportion are imported); how skilled is the labor force in the sector and is the sector guided by a building code, how current is it and is it enforced or complied with. Information on the housing deficit gap, both in quantitative and qualitative terms, with regard to the proportion of the households that are seeking housing and the numbers built in any given year, is important information to gather.

The sources of data for the pre-disaster situation in the housing sector and its characteristics is most usually found in the Population and Housing Census, more recent household surveys, academic studies on the housing sector and other National and State reports. It is worthwhile to note that information on the contents of household goods can also be gathered from the same reports and studies, such as poverty assessment reports and household surveys and this too should be described.

Table 2 in the following page presents data on households in India based on the Population and Housing Census conducted in 2011, by materials used in the construction of walls. It allows us to see the difference in construction materials used between the rural and urban households and the changes that have occurred in the use of building materials between the 2001 and 2011 census period.

Table 2. Households by materials of walls in India, 2001 and 2011NA

Material	Households %					
	Rural			Urban		
	2001	2011	Change	2001	2011	Change
Grass/Thatch/Bamboo	12.6	11.9	-0.7	3.9	2.7	-1.2
Mud/Unburnt Bricks	39.7	30.5	-9.2	12.8	9.3	-3.5
Stone	10.5	13.0	3.1	6.7	15.0	8.3
- Packed with Mortar						
- Not Packed with Mortar	NA	10.0	NA	NA	12.3	NA
	NA	3.6	NA	NA	2.7	NA
Burnt Brick	34.2	40.0	5.8	68.5	63.5	-4.5
Others	3.0	3.9	0.9	9.5	9.5	0.9

Source: DR. C. CHANDRAMOULI Registrar General & Census Commissioner, India 2011

The Uttrakhand Report categorised the housing structures in the State into three typologies: (i) kutcha structures consisting of semi-permanent houses made with stone walls and with roofs of slate or other local materials; (ii) pucca structures or houses made with reinforced cement concrete with reinforced concrete roofs or in brick/stone masonry with reinforced concrete cement roofs; and (iii) multi storied structures.[74]

The purpose of such a rich description is to be able to inform the gap analysis, which will take place in the assessment of the effects of the event on the sector and to enable the sector specialists to truly assess the impact of the event and make realistic recommendations for recovery and reconstruction.

b) Post-Disaster Situation and Performance

Estimating the effects of the event on the housing sector requires the collection of data on the number, size and type of dwellings and their contents that have been partially or totally destroyed as a result of the event. The dwellings include peripheral structures such as toilet facilities, fences, garage, swimming pools or any other structure that forms part of the dwelling compound. The contents of the dwellings have to be taken into consideration including, furniture, appliances, antiques, paintings, computer equipment, books, etc. Both the affected dwellings and their contents are to be reported as the effect of damage to the physical infrastructure and assets of the sector.

Losses in the sector will be due to foregone income from rent, clearing of debris and other unexpected expenses including the cost of temporary shelters. These effects should always be presented according to the types, geographic location, indicating whether private or public.

c) Estimation of Disaster Effects

Estimating the effects of the event on the housing sector requires the collection of data on the number, size (sq. meters) and type of houses partially or totally destroyed, the contents therein and any other peripheral buildings that form part of the dwelling. This is reported as the effects of the damage to the physical infrastructure and assets of the sector. This should always be presented according to the geographic location of the affected houses. Many methods have been used to collect this data following an event, from self-reporting by the affected households, to systematic collection of data by Government appointed teams from the national or sub national levels and/ or reliance of the data collected by first responders. The verification of the data initially collected is always essential and is the work of the team of assessors. Where data gaps exist, the housing sector team may make recommendations as to how such data may be collected, through quick surveys or field visits. They may be supported by use of geo-spatial imagery of the before and after images of the particular community in which the event has occurred.

It would be important to ascertain the average age of the houses that have been affected.[75]

[74]India: Uttrakhand Disaster June 2013. Report page 26

[75]This information is to be transmitted to the macro-economic assessment team for use in estimating disaster impact on the capital account. It is not to be used by the housing sector assessment team to estimate the depreciated value of destroyed houses.

Once the effects of the event are satisfactorily captured, to the best of the ability of the assessors and within the time constraints of the assessment, then the estimation of the economic value of the effects can be carried out. Economic value should be estimated at current market prices at the level of the unit,that is, the construction cost of a house of a particular size, utilising particular materials, or,in the case of partial destruction, the replacement cost of a roof, repairs to floors, windows or doors. These values can be supplied based on estimates by the Government's own Ministry of Works or Housing or from private developers and contractors. The value of the contents of the houses are also to be valued at market prices and should match as fairly as possible, the economic status of the affected communities as described in most recent State or national Household Surveys.

These values would provide an estimation of the economic value of the damage to the sector. Following the Kosi floods in 2008, the World Bank, based on a request by the Government of India, State of Bihar, undertook a Needs Assessment to ascertain the extent of damage and the cost of recovery. The Report, as detailed in Table 3, indicated that the value of damage to the housing sector amounted to some Rs 990 crore, based on an average unit cost of some Rs 63,000 per unit.

Table 3. Estimate of economic value of totally destroyed houses in the State of Bihar as an outcome of the Kosi flooding in 2008

	Number	Unit Cost	Total
Fully Damaged Houses	1,57,428	63,000	Rs. 990 crore (US$ 225 million)

Source: Bihar, Kosi Flood 2008, Needs Assessment Report pg. 18

There are other costs also incurred as a result of an event. Before repairs or construction can begin, the debris and mud, which have been left behind by the event, will have to be cleared and this cost should be estimated. It is unplanned and an additional expenditure, either absorbed by the home-owner or by the Government and so is represented as a change in economic flow for the sector. So too are additional expenditures utilised in the construction of temporary shelter for persons displaced as a result of the event. There is also the loss of income to the home-owners from those properties that were rented and this can be estimated by current market rental value and the data available in the Population and Housing Census, which usually indicates the proportion of rental properties at the various national and sub-national levels.

If Government's ability to properly coordinate or manage the sector has been disrupted as a result of the event, the additional costs, which will be incurred, should be identified. These may manifest themselves as costs to hire additional administrative personnel. Costs incurred to reduce risk or vulnerabilities such as through the hiring of security personnel to safeguard women and children in shelters or in temporary housing schemes, should also be identified.

All these economic values combine to provide the total effects of the event on the housing sector.

Table 4 presents the economic value of the effects in the social sectors following the Gujarat earthquake of 2001. It can be noted that the housing sector accounted for some 85% of the value of the total effects on the social sectors combined. Changes in economic flows (or losses) in the sub sector were not identified at that time since the assessment team was not fully acquainted with the assessment methodology, thus resulting in an under-estimated economic value of effects and impacts of the event to the sector.

Table 4. Assessment of damage and losses in the 2001 Gujarat Earthquake, (Million US$)

Sectors	Total	Damage	Losses
Social Sectors			
Housing	1,110.97	1,110.97	0
Health	47.1	47.1	0
Education	144.09	144.09	0
Sector Total	**1,302.16**	**1,302.16**	**0**

Source: WB

d) Estimation of Disaster Impact

How has the event impacted the sector,, is one of the critical questions which the Government wants answered as an outcome of the assessment. The results of the impact assessment should be presented concisely and clearly.

It should provide an understanding of the scale or magnitude of the event to the sector. One way to do so is to examine the proportion of houses of the national housing stock that has been either destroyed and/ or partially damaged. Another is to present the number of households that require temporary shelter and for how long. The change in economic flows collected, as part of the assessment, should be presented so that they can be taken into account in the examination of the overall economic impact. It may be found that Government's unexpected expenditure to safeguard the well-being of the population, who have been displaced as a result of the effects of the event on the housing sector, may affect the Government's fiscal position.[76]

The amount of the content that was imported for construction in the housing sector and thus the likely impact of the construction requirements for new building materials on the country's net import earnings should also be examined.

It would be important to ascertain the age of the houses totally or partially destroyed as this may have an impact on the capital account, which is to be analyzed by the macro-economic team.

The impact on the construction sector, which supports the housing sector, should be considered. The realistic capacity of the construction sector to meet the additional demands of the construction of the temporary shelters, filling the housing gap or deficit that has been created by the destruction of already existing houses and the demand for reconstruction from other sectors, whose assets have been destroyed as well, while engaging in their normal construction activities, needs to be evaluated. Are there enough skills available and capable, in the sector, to meet the higher overall post-disaster demand or is additional capacity required? Where homeowners are involved in the construction of their own homes, community-

[76]The government of India provides an initial gratuitous relief ranging from Rs 2, 000 to Rs 25, 000 to households who have suffered total or partial damage to housing as a result of an event. As was noted following the Kosi flooding report by the WB, this grant should not be considered as a viable reconstruction cost, since it is far below the actual cost of damage and reconstruction and may lead to poor quality housing and increase vulnerabilities in the future.

based skills training to impart risk reduction techniques should be considered and its cost estimated. The impact analysis should speak to the adherence and or relevance of the country's building codes to the future risk in the sector.

It should answer whether or not the private owners will require Governmental support to rebuild or if their costs of rebuilding will be adequately met, and from which sources. Can the level of insurance in the sector meet it? In the case of India, the lowest income sectors are without insurance, suggesting that when a disaster occurs, private homeowners look to Government for support in the rebuilding efforts or they rebuild on their own using inadequate standards. Government has supported the rebuilding efforts through the disbursement of an initial gratuitous relief. Unfortunately, as was noted earlier, because such grants have not always been tied to robust estimation of the disaster effects in the sector, the rebuilding efforts may have led to continued and even higher inherent risks and vulnerabilities.

e) Estimation of Post-Disaster Recovery and Reconstruction Requirements

Arising from the impact analysis and in consultation with the affected population and key stakeholders, the sector team experts should develop recommendations for a recovery strategy. The Government may have its own goals for the sector so it is important to review recent development plans or budget statements.

Among the key questions which the Government wants answered is, what is an indicative cost of recovery in the sector and how long is recovery estimated to take.

To arrive at the cost of recovery it is important to take into consideration the cost of reconstruction and to consider what is required to reduce future risk. In other words "how can the sector build back better" is the important question to ask.

It should be noted that recovery in the sector not only addresses the reconstruction of the physical assets damaged as a result of the event but the identification of the measures which hasten the recovery process or support households in meeting the financial and technical requirements for rebuilding.

If households have to be relocated for safety and to reduce risk, then this cost of relocation, such as the acquiring of land, its preparation for housing in addition to the construction of temporary shelters (discussed previously), will have to be identified and included.

The cost of recovery, therefore, is equal to the cost of reconstruction plus the cost of building back with resilience to future events. In the case of repairs to existing structures, recovery costs should include the costs of retrofitting those structures to withstand further events of a similar nature. Some households may need temporary Government assistance to meet their shelter requirements during reconstruction, either through provision of temporary housing and/or rental subsidies. These costs should be included in the recovery costs. In addition, homeowners may need temporary tax relief during the same period of reconstruction, which would have a negative impact on fiscal budget.

State and central governments in India may wish to make the necessary representations to the private and development banks to establish special, soft-term credit lines for housing reconstruction of credit-worthy individuals, in order to avoid increased disaster risk and financial overburden to households.

How long recovery may take, is a factor of not only the measures for financing for recovery but the capacity in the construction sector.

With regards to the financing of the rebuilding of homes, a number of issues may be considered. Can private homeowners rebuild on their own through savings, insurance payments or with the assistance of family and friends, such as through the receipt of remittances? If not, how can financial resources be made available to private homeowners to rebuild. How will the funding be met- through small grants, low interest loans etc.? Should institutions be created to facilitate such processes or are there adequate institutions already in existence that may be persuaded to create special windows for the new measures? Should special concessions be granted, to importers of the building materials, to meet the needs of the construction sector?

With regards to the capacity in the construction sector, recommendations will need to consider if the available skills in the sector can meet the demands or if they need strengthening? Where homeowners rebuild their homes themselves, serious consideration has to be given as to how to transfer news skills to such persons so that the result will be more resilient dwellings.

When all of these and other measures are taken into account then a realistic time frame can be provided to answer how soon recovery may take place in the sector.

Housing Sector

STANDARD PROCEDURES FOR SECTOR ASSESSMENT

Recommended Assessment Team

The composition of the sector assessment team may vary by the type of disaster and the extent of the likely damage and production flow changes.

Organization and Personnel	Role in the Sector Assessment

Personnel from:
• **State Department of Housing and Urban Poverty Alleviation**
• **State Building Organization**
• **Local offices in the disaster-affected area:**
  • Civil Engineer (Housing)
  • Housing Construction Specialist
  • Land Administration Specialist
  • Quantity Surveyor
  • Goods/Equipment Buyer
	Lead and coordinate

Personnel from:
• **Ministry of Housing and Urban Poverty Alleviation**
• **Building Materials and Technology Promotion Council (BMTPC)**
• **National Building Organization (NBO)**
  • Civil Engineer (Housing)
  • Housing Construction Specialist
  • Land Administration Specialist
  • Quantity Surveyor
  • Goods/Equipment Buyer
	Provide baseline information and facilitate the field assessment of damages and losses

Development partners (if active in the sector)	Participate and provide technical advice

Steps in conducting a PDNA in the housing sector

Step 1. Collect baseline information on sector assets and production flows

Baseline information must be compiled before the field assessment or, if possible, prior to the occurrence of disaster. The types of existing housing units can be grouped according to the types of materials used in construction and number of floors. The baseline data should be validated before the field visit to serve as the basis for the estimation of damages and losses for each of the disaster-affected area/s. This data can be compiled at the State/Region office or at the District levels. The tables below can be used for the baseline information.

Table 1. Baseline information of housing types in a District

Name of District:							
Housing typology		Number of Houses	Number of Houses for Rent	Household Head/ Ownership (%)		Average number of Occupants	
Types	Description			Female	Male	Female	Male
Type 1	Grass/Thatch/Bamboo etc.						
Type 2	Plastic/Polythene						
Type 3	Mud/Unburnt Brick						
Type 4	Wood						
Type 5	Stone not Packed with Mortar						
Type 6	Stone Packed with Mortar						
Type 7	G.I./Metal/Asbestos Sheets						
Type 8	Burnt Brick						
Type 9	Concrete						
Type 10	Others						
TOTAL							

Notes for filling Table 1

- *Housing types will vary from state to state. Each concerned state should indicate the common types of dwellings or houses existing in the districts. These types should include the lowest types of dwellings up to the high-end types like condominiums.*
- *The 'Houses for rent' refers to the number of houses (as part of the total number) that are rented out.*
- *The 'Average number of occupants' refers to the number of people who live in each type of housing unit by sex.*
- *Others will refer to any type of housing unit in a district which is not included in the list.*

Table 2. Baseline information for the related costs of various types of housing units

Name of District:										
Particulars	**Values (in Rs) of Various Types of Housing**									
	Type 1	**Type 2**	**Type 3**	**Type 4**	**Type 5**	**Type 6**	**Type 7**	**Type 8**	**Type 9**	**Type 10**
Average Replacement Cost of:										
Structure										
Roofing per Square Meter										
Wall per Square Meter										
Flooring per Square Meter										
Electrical Installation										
Plumbing										
Average Repair Cost of:										
Structure										
Roofing per Square Meter										
Wall per Square Meter										
Flooring per Square Meter										
Electrical Installation										
Plumbing										
Average Contents / Rent										
Average Value of Contents										
Average Rent Per Month										
Construction / Repair Time:	**In Days**									
Average Construction Period										
Average Repair Period										

Notes for filling Table 2

- *The 'average repair cost' refers the value (in Rs) normally spent to repair the various parts of the housing units. 'Others' may include the average repair cost of latrines (if separate from the house), electrical and plumbing, etc. which should can based on previous costs.*

- *The 'Average Value of Contents' is a rough estimation of the value of the assets inside each type of the housing unit.*
- *All costs should be based on the pre-disaster existing values.*

Sources of Information

The sources of baseline information may vary by state. However, the critical list of the likely sources of information is provided below.

Ministry of Statistics and Programme Implementation	http://www.mospi.gov.in
The Registrar General & Census Commissioner, India	http://censusindia.gov.in
National Institution for Transforming India	http://niti.gov.in
Ministry of Housing and Urban Poverty Alleviation	http://www.mhupa.gov.in
Open Government Data (OGD) Platform India	https://data.gov.in
Housing Info India	http://www.housingindia.info

Note 1: Please use similar institutions at State level for baseline Information

Note 2: For Non-Government information sources, please search suitably

Step 2. Estimate value of damage and production flow changes

With the baseline information, field assessment should be undertaken in the affected Districts after a disaster. The assessment team from the State must work with their local counterparts in the Districts to ensure that the estimates for the damages and losses in the sector are accurate to the extent possible. Direct interviews with private contractors or government officials involved in the construction and repair of housing units can also be conducted during the field trip in order to validate unit costs of repair and reconstruction (which is already contained in the baseline data).

Step 2.1. Estimate the damages and losses to housing units

The post disaster assessment of housing units should be done on a per District basis, which can later be totaled to create a State assessment. This can be done by undertaking the following:

a. Counting broadly the number of houses damages according to type; and

b. General assessment of the parts of the houses which were damaged like the roof, walls, fences, electrical installations, plumbing, etc.

With the baseline information, the assessment team can use the following table in assessing the damages and losses of the housing sector in a given District.

Table 3. Damage and loss assessment of the housing sector (private housing)

Name of District:									
ESTIMATED DAMAGES (Rs)									
Housing Types	Totally Destroyed				Partially Damaged				Grand Total
	Quantity	Average Value of House Replacement (Rs.)	Average Value of House Contents Destroyed (Rs.)	Total	Quantity	Average Value of House Repair (Rs.)	Average Value of House Contents Damaged (Rs.)	Total	
	A	B	C	D	E	F	G	H	I
Type 1									
Type 2									
Type 3									
Type 4									
Type 5									
Type 6									
Type 7									
Type 8									
Type 9									
Type 10									
TOTAL									

ESTIMATED LOSSES (Rs.)	
Types of Losses	Total (Rs.)
Foregone Income	
Cleaning up of Debris	
Other Unexpected Expenses	
TOTAL	

Notes for filling Table 3

- *The values in the baseline information should be used in estimating damages. For example, if 20 square meters of the roof are damaged, the repair cost will be the cost of roofing per square meter multiplied by 20 square meters. On the other hand, if the whole structure is totally destroyed, the value of damage will be its replacement cost at post-disaster prices.*
- *The total value of damages from totally destroyed (or partially destroyed) houses will be the quantity of totally destroyed (or partially destroyed) houses multiplied by the average replacement cost (or average repair cost) plus the value of the destroyed (or damaged) house contents. The values for the average replacement and repair costs are in the baseline information.*
- *The total damages (Column I) will be: = Column D + Column H, where:*

Column D = (Column A x Column B) + (Column A x Column C) and

Column H = (Column E x Column F) + (Column E x Column G)

- *For the losses, foregone income will be losses from the non-payment of rent for the houses that were destroyed. These can be derived by estimating the average rent of houses multiplied by the number of houses for rent that were damaged or unusable after the disaster multiplied by the number of months before they can be used and rented out again.*
- *The cleaning up of debris is usually done by household owners, especially after flooding. The cost of government clearing operations outside the houses should not be included here.*

Generally, housing units are privately owned. However, if there are housing units in the affected District, owned by the government, they should be assessed in the same manner. They should be segregated later as public damages and losses in the summary of damages and losses.

Table 4. Damage and loss assessment of the housing sector (government housing)

Name of District:									
ESTIMATED DAMAGES (Rs.)									
Housing Types	Totally Destroyed				Partially Damaged				Grand Total
	Quantity	Average Value of House Replacement (Rs.)	Average Value of House Contents Destroyed (Rs.)	Total	Quantity	Average Value of House Repair (Rs.)	Average Value of House Contents Damaged (Rs.)	Total	
	A	B	C	D	E	F	G	H	I
Type 1									
Type 2									
Type 3									
Type 4									
Type 5									
Type 6									
Type 7									
Type 8									
Type 9									
Type 10									
TOTAL									
ESTIMATED LOSSES (Rs.)									
Types of Losses							Total (Rs)		

Foregone Income	
Cleaning up of Debris	
Other Unexpected Expenses	
TOTAL	

The number of houses affected in terms of ownership and number of occupants by male or female can be estimated using the information on Baseline Table No.1.

Step 2.2 Summarize damages and losses of the sector at State level

Once the table for each affected District has been filled out, the information should be used to summarize the damages and losses at the State level like the table below.

Table 5. Summary of damage and losses in the housing sector

Name of State:						
District	**Types of Damages to Houses**				**Total Damages (Rs.)**	**Total Losses (Rs.)**
	Totally destroyed		**Partially damaged**			
	Quantity	**Total Value (Rs.)**	**Quantity**	**Total Value (Rs.)**		
District A:						
Private Housing						
Public (Government Housing)						
District B:						
Private Housing						
Public (Government Housing)						
District N:						
Private Housing						
Public (Government Housing)						
TOTAL						

Notes for filling Table 5

- *The total values should include both the cost of replacement (or repair) of the houses and their contents which are from Tables 3 and 4.*

Step 3. Analyze the impacts of the damages and losses to affected population

The assessment team of the sector must be able to analyze potential impacts of the damages and losses on the people. A simple assessment must be able to at least answer the following questions:

- What are the possible impacts on the safety of the population who lost their houses especially the vulnerable groups like women in general, special groups like pregnant women, lactating mothers, children, the elderly, indigenous people, etc.
- What are the potential vulnerabilities of the people who lost their houses?
- Are there additional costs to families if they have to stay in temporary shelters or rent temporary houses?
- What will be the impact on employment? Are people able to go to work if their houses are damaged or destroyed?

The following matrix can be used to express the social impacts of the damages and losses to the housing sector.

Matrix 1. Social impacts of the damages and losses to the housing sector

Area of Impacts	Expected Impacts						Brief Description of Impacts
	General Population			Women and Children			
	S	M	L	S	M	L	
Health and Sanitation							
Government Services							
Added Cost to Households							
Employment							
Economic Productivity							
Others (Specify)							

Notes for filling Matrix 1

- *The expected impacts are segregated into a) the impacts on the general population; and b) the impacts on women and children measured as severe (S), moderate (M) or low (L). The assessment team should mark under the column whether the impacts are S, M or L.*
- *The impacts can be briefly described under the column "Brief Description of Impacts". For example, a brief description of a severe "impact on health and sanitation" can be the spread of diseases if many people are living in evacuation centers or tent cities; the "added cost to households" can be described as the higher cost of rent for those who are renting temporary housing units; while the impact to "government services" can be the inability of public services like schools or administrative governance to function well if school buildings and other facilities are used as evacuation centers .*
- *The impacts on women and children may be different from the general population. For instance, women and children may be more vulnerable to abuse or violence if they are living the unsafe evacuation centers.*

Step 4. Identify the recovery strategies and estimate recovery and reconstruction needs

The post-disaster needs must be based on a framework where policies and strategies are likewise integrated. After analyzing the potential effects and impacts, if no assistance will be provided to the housing sector, the aggregate needs of the sector must be estimated.

Step 4.1 Identify recovery and reconstruction strategies

After the consolidation of the field assessment, the assessment team must identify or recommend the policies and strategies for the recovery and reconstruction for the sector.

The following are some of the general policies and strategies that could be considered for the sector.

A. Policy measures

There are certain policies that can be adopted which can provide incentives to the private sector to reconstruct damaged housing units with higher standards of resilience over a limited period. Among them are:

1. Tax breaks for private builders and home owners like real estate and other taxes;
2. Exemption from payment of building permits and other related fees;
3. Duty-free importation of construction materials and equipment during the recovery and reconstruction phase; and
4. Restructuring of the amortization of the payment of disaster-affected housing loans.
5. Extending bank guarantees on loans by the government to enable the private sector to rebuild immediately.

B. Strategies

The following strategies can be adopted for the post-disaster recovery and reconstruction activities:

a. **Building Back Better (BBB)**. Recovery activities based on BBB principles will promote longer-term disaster risk reduction and management. BBB principle should look at the how to make infrastructure and facilities safer from future disasters like stronger engineering design, the advantages of resettlement of facilities in disaster-safe areas instead of rebuilding in the same disaster-prone areas, etc.

b. **Focus on the most vulnerable and socially disadvantaged groups such as children, women, and the disabled**. Recovery programming needs to give priority to the most vulnerable groups, including female-headed households, children and orphans, and the poor, and take into account those with special needs.

c. **Community Participation and Use of Local Knowledge and Skills**. The participation of the community in all process (identification, planning, design and implementation) of recovery activities will help ensure the acceptability of projects and optimize the use of local initiatives, resources and capacities.

d. **Secure development gains**. Recovery strategies, although may be a separate set of activities, must be supportive of existing development plans and must attempt to re-establish and secure previous development gains.

e. **Coordinated and coherent approaches to recovery**. Projects for disaster recovery must have the full and effective coordination among all involved agencies based on comprehensive information exchange, flexibility in administrative procedures, and uniformity of policies. In some instances, a special new agency may be needed to oversee, coordinate and monitor complex disaster recovery programs. Under this strategy, capacity building activities for the local public administration may be part of the recovery activities including a well-defined monitoring and evaluation system for the overall implementation of the recovery plan.

f. **Efficient use of financial resources**. The overall strategy should also include the identification of fund sources that are suited for the recovery activities. It should be clear how assistance to the recovery of the private sector would be delivered. Also, some cheaper source of funds from international donor partners should be initially identified for longer-term expensive projects.

g. **Transparency and accountability**. The overall plan and implementation of projects for recovery must be transparent, especially to those affected, through open and wide dissemination of information on all aspects of the recovery process. An effective monitoring system must be established.

Step 4.2 Estimate recovery needs

Recovery needs are intended to bring back normalcy to all affected areas and sectors as soon as possible. Some of the possible recovery related activities are:

1. Food-for-work or a combination of cash-for-work to rehabilitate/reconstruct damaged houses.
2. Direct subsidy on housing materials especially to those who are the poorest.
3. Setting up of temporary housing in either alternative suitable building facilities or in tents, until the destroyed houses are rebuilt.
4. Additional operation budget over and above the regular government appropriations for the sector required to finance additional personnel or to pay overtime to existing personnel.
5. Provision of basic household utensils that may have been destroyed during the disaster.
6. Additional budget to preventing and control the possible occurrence of violence in evacuation centers.
7. Credit programs for housing repairs.

Step 4.3 Estimate reconstruction needs

Reconstruction needs are generally long-term in nature (3 years or more) and are intended to 'build back better' from the ruins of a disaster. The possible reconstruction related activities in the housing sector could include the following:

- Relocation of housing areas to safe areas, as necessary. In this case, the additional costs land acquisition, and basic services provision (water, sanitation, electricity, etc.) should be included.
- Assistance in the reconstruction and repair of housing structures under a building-back-better strategy to ensure future disaster resilience through the adoption and enforcement of improved construction standards.

- Structural retrofitting of undamaged or partially damaged houses so that they are not affected by disaster event in the future.
- Soft-term credit for reconstruction and repair of housing units. Such schemes can be accompanied by technical assistance for improved disaster resilient standards of construction.
- Other mitigation measures such as construction of support infrastructure to prevent serious landslides and floods to housing units.

Step 4.4 Prioritize identified projects for recovery

Among the projects identified, relative priorities can be set in order to determine which among them are the more important.

Based on the broad strategies for recovery, the assessment team should select the priority projects/ activities among the identified needs.

The prioritization can be made by using a set of impact indicators and the level by which the projects can achieve said impacts. Examples of the criteria that can be used are the following, among others:

a. Economic impact, which can be evaluated in terms of the relative cost to the government for not undertaking reconstruction or rehabilitation.

b. Equity and social impact, which can be in terms of the number of beneficiaries who are poor and destitute and who could not afford to rebuild on their own without outside support.

c. Sustainability, which can be in terms of the reduction of risks and vulnerability of the people and other economic assets to future disasters.

The criteria above can be placed in a matrix like the one below where the impacts are ranked according to low, medium or high.

This matrix can show the relative benefits of proposed projects to the people in the affected areas, which, in turn, will inform and assist the government in determining the priority projects within the sector.

Matrix 2. Impacts of identified post-disaster projects

Name of Proposed Project	Expected Impacts on Recovery								
	Economic Impact			Equity and Social Impact			Sustainability		
	High	Medium	Low	High	Medium	Low	High	Medium	Low

Step 4.5 Summarize the estimated recovery and reconstruction needs and draft the implementation schedule

Based on the prioritized recovery and reconstruction needs, a summary should be created by the assessment team enumerating the post-disaster projects for the recovery and reconstruction.

The identified needs should have a rough schedule of implementation, outlining at the very least-the activities, timing and budget required for all the programs and projects. The following techniques can be considered:

1. Identify the specific projects according to their relative urgency or priority in relation to recovery.
2. Plot the timeline of activities of all the projects, with the urgent ones on top, in a Gantt chart with the corresponding funding requirement on an annual basis. This will assist the national government in programming the necessary funds over a certain time period, like on a quarterly or annual basis.
3. Identify and include in the list of projects that need further feasibility studies, which may be funded by foreign grants.
4. To the maximum extent possible, a logical framework (log-frame) should be created for each of the project proposed for inclusion in the recovery plan. Log-frames are normally required by foreign donors to consider project proposals.

The recovery and reconstruction needs of the sector can be summarized in the table below showing the financing requirements over the years.

Note: Reconstruction needs mostly require long-term implementation periods. They normally require three or more years to complete.

Table 6. Summary of recovery and reconstruction projects in the housing sector.

Name of Specific Projects	Annual Needed Amount of Assistance (Rs)						Total Needs (Rs.)
	Disaster Year	Year 1	Year 2	Year 3	Year 4	Year 5	
Projects for Recovery							
a.							
b.							
c.							
Total							
Projects for Reconstruction							
a.							
b.							
c.							
d.							
Total							
GRAND TOTAL							

Notes for filling Table 6

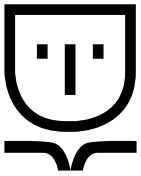
- *Project titles can be inserted under the column on recovery and reconstruction needs.*
- *Columns can be added to accommodate any additional reconstruction needs beyond Year 5.*

Step 5. Draft the post-disaster damages, losses and needs (PDNA) report of the sector

With all the information gathered using the previous steps, a report can be drafted by the assessment team, which will be the inputs of the sector in the overall recovery and reconstruction plan. The following format may be considered:

1. Brief description of the sector in the disaster-affected areas.
2. Damages in the sector by areas and by types of assets affected.
3. Losses in the sector emphasizing the losses in income, increase in expenditures, estimated period before normalcy will be attained, etc.
4. Impact on the livelihood, individual households, vulnerable groups and the consequences to the greater community if no assistance for recovery will be provided.
5. Proposed strategies for recovery and reconstruction of the sector.
6. Needs of the sector, by priority, and the draft schedule of implementation with the estimated funds required for each project over time.

The draft sector report should be submitted to the State Disaster Management Office for consolidation.



Education Sector

This section contains the following contents – specific to this sector – in order to guide the user to successfully conduct post-disaster needs assessment in India:

1. **The Introduction to the Sector**
    a. Baseline information
    b. Post-disaster Situation and Performance
    c. Estimation of Disaster Effects
    d. Estimation of Disaster Impact
    e. Estimation of Post-Disaster Recovery and Reconstruction Requirements

2. **The Standard Procedure for the Sector Assessment**
    a. Recommended Assessment Team
    b. Steps in conducting a PDNA in the education sector
        - Collect baseline information on sector assets and production flows
        - Estimate value of damage and production flow changes
        - Analyze the impacts of the damages and losses to affected population
        - Identify the recovery strategies and estimate recovery and reconstruction needs
        - Draft the post-disaster damages, losses and needs (PDNA) report of the sector

The user is advised to refer to:

a. *The "Introduction of the PDNA Manual" for a complete information of the concepts and definitions on the post-disaster needs assessment (PDNA);*
b. *The section on "Disaster Effects, Impact Assessment, Needs Estimation" for a more detailed discussion in identifying the possible impacts within and across sectors; and*
c. *The section on "Estimation of Post-Disaster Recovery and Reconstruction Needs" for a more detailed discussion on identifying and prioritizing post-disaster needs*

Introduction

The education sector[77], though typically not as severely affected as the housing sector, often has the complexity of acting as a shelter for those persons displaced as a result of a disaster.

Delays in the creation of temporary shelters or alternative accommodation for displaced persons may have significant effects on the disruption of children's education, their safety and well-being, the ability of their families, particularly mothers, to resume livelihoods and therefore the return to normalcy of affected communities and societies.

Disasters in India, such as the flash floods and landslides in Uttarakhand State, in 2013, suggest that not only is the infrastructure of the education sector affected as a result of an event but the school calendar may also be disrupted.[78]

The education sector assessment team may include, in addition to the officials from the government ministry or department with responsibility for education, civil engineers or architects to assess the damage to the structures, and educational professionals, psychologists, economists and other social scientists to ascertain the change in economic flows and the impact of the event to the sector.

a) Baseline Information

In order to conduct an assessment of an event in the education sector, it is essential to know the number and typologies of the education facilities that exist at the national and State levels. It is important to understand the structure of the education system and the ownership arrangement, being able to categorize schools according to ownership: private, public, and combined ownership of public and private, or religious based. The normal number of classroom hours per day or annual days per student is also essential.

The UNDP Report on the Kosi Floods of 2008 indicated that the vulnerability of the affected Districts reflected not only the demographic, occupational and other characteristics of the population, but also in terms of acute shortages of basic facilities and social infrastructure. Table 1 presents the baseline data for basic educational facilities in selected villages in the State of Bihar, by District, as presented in the UNDP report. Such information is essential to define the context of the education sector.

Table 1. The proportion and number of basic educational facilities in selected villages in the State of Bihar by District

District	% Villages with Primary Schools	% Villages with Middle Schools	% Villages with Secondary Schools	Number of Industrial Schools	Training Schools
Supaul	79.9	33.9	8.5	3	1

[77]According to the India System of National Accounts, this sector falls under "Community, social and personal services".

[78]Uttarakhand Report 2013. Government of Uttarakhand, Asian Development Bank (ADB), World Bank, and Government of Uttarakhand. Pg 38.

Araria	74.4	21.8	0.5	2	0
Purnia	52.8	15.4	2.3	0	5
Madhepura	70.7	44.3	8.6	0	0
Saharsa	79.9	38.0	6.0	0	0
Total in Five Districts	67.9	28.4	4.7	5	6
Bihar	62.2	19.0	4.8	51	65

Source: Table 2.4 Basic Facilities in the Villages in Survey Districts as per Census India, 2001. Kosi Floods Report 2008. UNDP

It is also important for the education sector assessment team to be able to describe the management structure of education at the national and state levels, detailing the work force employed in the sector: the numbers of educators and principals or head teachers and the number of assistant teachers. It would be important to explain whether the sector is able to meet the needs of the population in terms of teacher/ student ratios and where gaps exist.

In addition to the infrastructure and assets of the sector, it would be important to present the socio-demographic characteristics of the population serviced by the sector, such as literacy levels and school enrolment rates and the proportion that is serviced by social programmes such as school feeding programmes. If the school is used by different age groups, during the day of learning, this should be specified.

Table 2 presents baseline data on literacy levels from selected districts in the state of Bihar as part of the assessment on the Kosi floods, 2008.

Table 2. Literacy levels of Men and Women (%) by Selected Districts in the State of Bihar (2001)

District	Male	Female
Araria	46.4	22.4
Madhepura	48.8	22.1
Purnia	45.6	23.4
Supaul	52.4	20.8
Saharsa	51.7	25.3
Bihar	59.7	33.1

Source: Table 2.2 Kosi Flood Report 2009 based on Census of India, 2001

It would be important for the sector team to be able to have an inventory of what educational equipment and furniture exists in the various facilities, including sporting equipment and education materials.

The sources of data for the pre disaster situation in the education sector and its characteristics is most usually found in the Ministry of Education annual reports and other administrative reports from the national and state levels. The most recent Population and Housing Census is a rich source of information on the socio-demographic characteristics of the population relevant to education and should be consulted in addition to academic studies and studies undertaken by international partners such as UNICEF or UN Women.

b) Post-Disaster Situation and Performance

Estimating the effects of the event on the education sector requires the collection of data on the number, size and type of educational facilities, and their contents, that have been partially or totally destroyed as a result of the event.

The facilities include peripheral buildings such as toilet facilities, fences, teacher's houses or any other building that forms part of the education compound. The playing fields attached to the schools should be included. The contents of the facilities have to be taken into consideration including, education materials, laboratory equipment, computer equipment or books held by the school. Both the affected buildings and their contents are to be reported as the effect of damage to the physical infrastructure and assets of the sector. This should always be presented according to the geographic location of the affected schools, indicating rural or urban and the ownership structure.

Many methods have been used to collect this data following an event, from self-reporting by the affected head teachers or principals, to collection of data by Government-appointed teams from the national or State levels and/ or reliance on the data collected by first responders. The verification of the data initially collected is always essential and is the work of the education sector assessment team. Where data gaps exist, this team may make recommendations as to how such data may be collected, through quick surveys or field visits. Just as with other social sector teams, the education sector assessment team may be supported by use of geo-spatial imagery of the before and after images of the particular community in which the event has occurred.

Table 3 presents a summary table, which was used detailing damage to physical infrastructure and assets of the sector as a result of floods in the state of Uttarakhand in 2013.

Table 3. Effects of the event to the infrastructure and assets of the educational sector

Educational Buildings Partially and Totally Destroyed			
Districts	**Primary and Secondary**	**Higher education / Vocational Institutes**	**Totally Affected Facilities**
	Number of Units	**Number of Units**	**Number of Units**
Bageshwar	82	0	82
Chamoli	153	1	154
Pithoragarh	32	0	32
Rudraprayag	54	0	54
Uttarkashi	166	1	167
Other Districts	379	5	384
Total	866	7	873

Source: Table 11: Needs Assessment for Educational Buildings. India Uttrakhand Disaster June 2013.

Once the effects of the event are satisfactorily captured, to the best of the ability of the assessment team and within the existing time constraints, then the estimation of the economic value of the effects can be carried out. Economic value should be estimated at current market prices at the level of the unit, that is, the construction cost of a school of a particular size, utilising particular materials. Or in the case of partial destruction, the replacement cost of a roof, repairs to floors, windows or doors. These values can be supplied based on estimates by the Government's own Ministry or Department of Works or Education or from private developers and contractors. The value of the contents of the schools is also to be valued at market prices.

c) Estimation of Disaster Effects

These values would provide an estimation of the economic value of the damage to the sector.

Following the Tropical Cyclone Phailin and the subsequent floods in October of 2013, the Government of Odisha reported that some 5,825 primary schools were damaged and the cost of repair amounted to Rs 23,858.61 lakhs. 226 College and University buildings were also extensively damaged and economic value of that damage was estimated to be Rs4,792.00 lakhs.

There are other costs also that are incurred as a result of an event. Before repairs or construction can begin, the demolition of badly damaged structures and the removal of debris and mud, which have been left behind by the event are some of these costs that should be estimated. It is an unplanned and an additional expenditure; either absorbed by the Government or the private educational institution. Such expenditure is represented as a change in economic flow in the sector. So too are additional expenditures utilised in the rental of alternative premises or in the construction of temporary schools to continue the education of the students, as a result of the event. If schools have to be relocated for safety and to reduce risk, then this cost of relocation, such as the acquiring of land, its preparation for building, will have to be identified and included as a change in economic flows either to the public or private sector. If income from student fees is not received, this too should be included.

Any repair of damage to facilities that were used as temporary shelter or the sanitary facilities before the students can once again use them, should be included as an additional cost. There may be increased costs for students assigned to alternative locations until repairs to their usual school buildings have taken place.

If Government's ability to properly coordinate or manage the sector has been disrupted as a result of the event, the additional costs, which have to be incurred, should be identified. These may manifest themselves as costs to hire additional administrative personnel. Costs incurred to reduce risk or vulnerabilities such as rental of temporary facilities for teachers, or security personnel to safeguard educational equipment or temporary facilities, should be identified.

All these economic values combine to provide the total effects of the event on the education sector.

d) Estimation of Disaster Impact

How has the event impacted the sector, is one of the critical questions which the Government wants

answered as an outcome of the assessment. The results of the impact assessment should be presented concisely and clearly.

The estimation should also provide an understanding of the scale or magnitude of the event to the sector. One way to do so is to examine the proportion of educational facilities damaged and destroyed, as a proportion of the national or state stock. Another possible way is to estimate the number of students that will either be affected by the event and for how long and the number of school days lost in the calendar year. The value of GDP for the education sector is defined by the number of hours of education time provided to students. Thus, we need to know if the disaster causes school interruptions, which are not compensated in the same calendar year of the event. The change in economic flows collected, as part of the assessment, should be presented to the macro-economic assessment team so that this can be taken into account in the examination of the overall economic impact. It may be found that Government's unexpected expenditure to keep children in schools, through renting of facilities or the creation of temporary facilities may affect the Government's fiscal position.

The imported component of the sector (i.e. the value of items not produced in country, and which must be imported from abroad) and the likely impact of the construction requirements for new building materials on the country's net import earnings should also be examined.

The impact analysis should also address the social dimension of the event. How has the quality of life been affected due to the lower number of school days or time spent in school? Will the event affect the completion of examinations unfavourably for a particular group of students? Will it result in certain students being kept away from school for a period of time, which may result in discouraging students or their early transition into the work force? Will teachers suffer hardship through relocation from unaffected areas to affected areas? And what of the psycho-social trauma suffered by both students and teachers, what may be the effects and for how long may they be so affected?

There may also be impacts at the household or personal level caused by having to acquire books and training materials, school uniforms, etc. that were destroyed by the disaster or maybe caused due to the increase in school fees or transport, etc. There may be additional costs to the household food bill, as children no longer receive supplemental meals at school. These additional household costs are not to be added to the changes in sector flows to avoid double accounting; instead, these additional costs of living should be delivered to the assessment team in charge of estimating disaster impact at household or personal level.

In the final analysis it would be important for the sector team to ascertain the extent to which the event may delay the government meeting its stated development goals in the education sector.

e) Estimation of Post-Disaster Recovery and Reconstruction Requirements

Arising from the impact analysis and consultation with the affected population and key stakeholders, the sector experts should develop recommendations for a recovery strategy. The Government may have its own goals for the sector so it is important to review recent sector, national and sub national development plans or budget statements.

Among the key questions, which the Government wants answered is, what is an indicative cost of recovery in the sector and how long is recovery estimated to take.

To arrive at the cost of recovery it is important to take into consideration the cost of reconstruction and to consider what will reduce future risk. In other words, how can the education sector build back better?

It should be noted that recovery in the sector not only addresses the reconstruction of the physical assets damaged as a result of the event but the identification of the measures which hasten the recovery process or support the sector in meeting the financial and technical requirements for recovery. 'Building back better' may speak not only to structural efforts but also to non-structural measures needed, to build better the processes, for the delivery of education services and therefore the introduction of these processes may require additional costs.

The cost of recovery therefore is equal to the cost of reconstruction plus the cost of building back with resilience to future events. In the case of repairs to existing structures, recovery costs should include the costs of retrofitting those structures to withstand future events of a similar nature, when required. The cost of renting alternative premises when classrooms have been destroyed and over the time of reconstruction; possible additional costs of teachers (overtime, or training and on psycho social counselling, etc.)

How long recovery may take, is a factor of not only the measures for financing for recovery but the capacity in related sectors such as the construction sector and infrastructure as road or bridges may affect access.

When all of these and other measures are taken into account then a realistic time frame can be provided to answer how soon recovery may take place in the sector.

Education Sector

STANDARD PROCEDURES FOR SECTOR ASSESSMENT

Recommended Assessment Team

The composition of the sector assessment team may vary by the type of disaster and the extent of the likely damage and production flow changes.

Organization and Personnel	Role in the Sector Assessment

Personnel from:
• **State Department of Education**
• **State Department of Human Resource Development**
• **Local offices in the disaster-affected area who are:**
  • Civil Engineer (Education Facilities)
  • Architect (Education Facilities)
  • Education Administrator
  • Child Psychologist
  • Education Economist
  • Social Scientist
Goods/Equipment Buyer
	Lead and coordinate

Personnel from:
• **Ministry of Education**
• **Ministry of Human Resource Development who are:**
  • Civil Engineer (Education Facilities)
  • Architect (Education Facilities)
  • Education Administrator
  • Child Psychologist
  • Education Economist
  • Social Scientist
  • Goods/Equipment Buyer
	Provide baseline information and facilitate the field assessment of damages and losses

Development partners (if active in the sector)	Participate and provide technical advice

Steps in conducting a PDNA in the education sector

Step 1. Collect baseline information on sector assets and production flows

Baseline information must be compiled before the field assessment or, if possible, prior to the occurrence of disaster. The baseline data should be validated before the field visit to serve as the basis for the estimation of damages and losses for the disaster-affected area/s. This data can be compiled at the State/Region office or at the District levels. The tables below can be used for the baseline information.

Table 1. Baseline information of educational facilities in a District

Name of District:										
Total Number of Enrolled Students	**Male**		**Female**							
Type of Facilities	**Number**			**Total**	**Average Number of Students**				**Average Number of Teachers**	
Educational Facilities	**Public**	**Private**	**Religious**		**Public**		**Private**		**Public**	**Private**
					Male	**Female**	**Male**	**Female**		
Pre-Primary School										
Primary School										
Secondary School										
University										
Training Institutes										
Vocational/ Training School										
Others										
TOTAL										

The average replacement and repair costs of the assets in education can be enumerated in the following table.

Table 2. Baseline information of unit cost of educational facilities in a District

Name of District:							
Particulars	Values (in Rs)						
	Pre-Primary School	Primary School	Secondary School	University	Training Institute	Voc./ Training School	Others
Average Replacement Cost of:							
Structures							
Roof per Square Meter							
Wall per Square Meter							
Floor per Square Meter							
Desks							
Computers							
Books							
Chalk Boards							
Other Educational Materials, Equipment and Furnishings							
Average Repair Cost of:							
Structures							
Roof per Square Meter							
Wall per Square Meter							
Floor per Square Meter							
Desks							
Computers							
Books							
Chalk Boards							
Other Educational Materials, Equipment and Furnishings							

Average Fees/Revenue:							
Average Revenue per Month							
Construction/ Repair Period	**In days**						
Average Construction Period							
Average Repair Period							

Notes for filling Tables 1 and 2

- *Other types of educational facilities like public libraries should be included.*
- *The replacement and repair costs of structure/s, values of books, equipment and furnishing/s should be per unit or per type in each educational facility.*
- *Replacement costs can be estimated by the considering the acquisition or construction costs less the depreciation of the asset/s.*
- *The average construction period refers to the number of days for a new building to be erected.*
- *The average repair period refers to the number of days required for the repair of the structures/ buildings. This can be based on past experiences.*

Sources of Information

The sources of baseline information may vary by state. However, the critical list of the likely sources of information is provided below.

Ministry of Statistics and Programme Implementation	http://www.mospi.gov.in
The Registrar General & Census Commissioner, India	http://censusindia.gov.in
National Institution for Transforming India	http://niti.gov.in
Department of Higher EducationDepartment of School Education & Literacy	http://mhrd.gov.in
National Council of Educational Research and Training	http://www.ncert.nic.in
National Institute of Education	http://www.ncert.nic.in/departments/nie.html
Ministry of Human Resource Development	http://mhrd.gov.in/statist
Open Government Data (OGD) Platform India	https://data.gov.in

Note 1: Please use similar institutions at State level for baseline Information

Note 2: For Non-Government information sources, please search suitably

Step 2. Estimate value of damage and production flow changes

With the baseline information, field assessment should be undertaken in the affected Districts after a disaster. The assessment team from the State must work with their local counterparts in the Districts to ensure that the estimates for the damages and losses in the sector are accurate to the extent possible. Direct interviews with private contractors or government officials involved in the construction and repair of facilities can also be conducted during the field trip in order to validate unit costs of repair and reconstruction (which is already contained in the baseline data).

Step 2.1. Estimate the damages and losses to government education facilities

The post disaster assessments of government-owned education facilities are the primary concerns of the Ministry of Human Resources Development. Assessment should be done on a per District basis which can be totaled to create a State assessment. Each of the affected schools or educational facilities can be assessed individually. The individual assessments can be summarized later to cover the whole District. The following table can be used in assessing the damages and losses of an individual school or any educational facility.

Table 3. Damage and loss assessment of a government education facility

Name of District:						
Type of Educational Facility	Pre-Primary School ( ) Primary School ( ) Secondary School ( ) University ( ) Training Institute ( ) Voc./ Training School ( ) Others (specify): _____					
Number of Affected Students	**Male**		**Female**		**Total**	
ESTIMATED DAMAGES (Rs.)						
Damaged Assets	**Totally Destroyed**		**Partially Damaged**		**Total**	**Average Time to Repair**
	Quantity	**Total**	**Quantity**	**Total**		**Days**
	A	**B**	**C**	**D**	**E**	**F**
Structures						
Buildings/Structures						
Equipment						
Desks						
Books						
Boards						
Computers						

Furniture						
Appliances						
Other Assets						
TOTAL						

ESTIMATED LOSSES (Rs)				
Type of Losses	**Disaster Year**	**Year 1**	**Year 2**	**Total (Rs)**
Foregone Income				
Cleaning up of Debris				
Higher Operating Costs				
Other Unexpected Expenses				
TOTAL				

Notes for filling Table 3

- *The values in the baseline information should be used in estimating damages. For example, if 20 square meters of the roof are damaged, the repair cost will be the cost of roofing per square meter multiplied by 20 square meters. On the other hand, if the whole classroom is totally destroyed, the value of damage will be its replacement cost at post-disaster prices.*
- *The total for the totally destroyed (or partially damaged) assets will be the total number multiplied by the replacement cost (or average repair cost). The average replacement and repair costs are in the baseline information.*
  - *Column B = (Column A) x replacement cost*
  - *Column D = (Column C) x repair cost*
- *In formula, 'Total damages' Column E will be: = (Column B) + (Column D)*
- *The average time to repair refers to the time to restore the affected structures to their pre-disaster levels. This will give an indication on the number of days before normal services will be restored.*

A note on estimated losses:

Losses in the education sector will include the following:

- **Cost of temporary school buildings.** *The cost of temporary school buildings is a loss that must be estimated. When temporary schools are built, it will be necessary to estimate the cost of construction and related services, such as the provision of water, latrines and electric powerand the duration for which these temporary schools would function. When using rented buildings as temporary schools, the total value of rent will be part of the loss.*
- **Cost of urgent repairs of schools to be used as emergency shelter.** *Some schools may need urgent repair, water installations, latrines, etc. if they were used as temporary shelters. This should be included in the loss since this will require unexpected expenses on the part of the government.*

- **Higher costs of education.** *Government facilities may incur additional expenses (over and above the regular budget of the sector) to assist the population for any of the following reasons:*
  - *Extension of classes over a period of time to compensate for the delays due to the disaster which will require additional expenses like cost of training if new teachers will be hired, overtime payment, etc.*
  - *Supplemental feeding and subsidy on transportation costs of students and teachers, if applicable.*
  - *Higher electricity costs from the use of generator sets; higher cost of water supply; etc.*
- **Losses due to lower revenues.** *Revenue losses may arise from interruption of classes while school buildings are being repaired or reconstructed. The values of losses in revenues will be the pre-disaster revenues minus the estimated post-disaster revenues.*
- **Other losses such as demolition and cleanup costs.** *Aside from repair or reconstruction, a school building may require partial or total demolition and the resulting debris removed.*

Step 2.2 Estimate the damages and losses to private facilities

Since it may be difficult for the government to assess the damages to all private education facilities, a survey questionnaire can be used to interview the private owners. (Private schools may not allow outside people to enter their premises after a disaster). The following questionnaire can be used.

Table 4. Damage and loss assessment of a private education facility (Questionnaire)

Name of District:						
Type of Educational Facility	Pre-Primary School ( ) Primary School ( ) Secondary School ( ) University ( ) Training Institute ( ) Voc./ Training School ( ) Others (specify): _____					
Number of Affected Students	**Male**		**Female**		**Total**	
ESTIMATED DAMAGES (Rs.)						
Damaged Assets			**Partially Damaged**		**Total**	**Average Time to Repair**
		Total	**Quantity**	**Total**		**Days**
		B	**C**	**D**	**E**	**F**
Structures						
Buildings/Structures						
Equipment						

Desks						
Books						
Boards						
Computers						
Furniture						
Appliances						
Other assets						
TOTAL						

ESTIMATED LOSSES (Rs.)				
Type of Losses	**Disaster Year**	**Year 1**	**Year 2**	**Total (Rs.)**
Foregone Income				
Cleaning up of Debris				
Higher Operating Costs				
Other Unexpected Expenses				
TOTAL				

Each of the questionnaires used to assess private damages can be aggregated to create a summary of the damages and losses of the private sector.

Step 2.3 Summarize the damages and losses in the sector in a District

Based on assessment of government assets and the survey of private education facilities, the damages and losses in monetary terms can be summarized in the following table.

Table 5. Summary of damages and losses in the education sector in a District

Name of District:							
Number of Affected Students	**Male**		**Female**			**Total**	
ESTIMATED DAMAGES							
Types of Assets	**Types of Damages**						**Total Damages (Rs)**
	Totally Destroyed			**Partially Damaged**			
	Number of Schools		**Total**	**Number of Schools**		**Total**	
	Public	**Private**	**(Rs)**	**Public**	**Private**	**(Rs)**	
	A	**B**	**C**	**D**	**E**	**F**	**G**

Structures							
Pre-Primary School							
Primary School							
Secondary School							
University							
Training Institutes							
Voc./Training School							
Others (Specify)							
TOTAL							
Equipment							
Desks							
Books							
Computers							
Furniture							
Supplies							
Others (Specify)							
TOTAL DAMAGES							

ESTIMATED LOSSES

Type of Losses	**Losses (in Rs.)**						
	Within Disaster Year		**Year 1**		**Year 2**		**Total**
	Public	**Private**	**Public**	**Private**	**Public**	**Private**	
Foregone Income							
Cleaning up of Debris							
Higher Operating Costs							
Other Unexpected Expenses							
TOTAL LOSSES							

The damages and losses in the above table are the summary of those that were assessed and interviewed.

Step 2.4 Summarize damages and losses in the education sector in the State

Once the summary table for each affected District has been filled out, the information should be used to summarize the damages and losses at the State level. The summary table below can be used.

Table 6. Summary of damage and losses in the education sector in a State

Name of State:							
Number of Students Affected	Male		Female		Total		
ESTIMATED DAMAGES							
Types of Assets	Types of Damages						Total Value of Damages (Rs.)
	Totally Destroyed			Partially Damaged			
	Number of Schools		Total Value (Rs.)	Number of Schools		Total Value (Rs.)	
	Public	Private		Public	Private		
	A	B	C	D	E	F	G
District A							
Pre-Primary School							
Primary School							
Secondary School							
University							
Training Institutes							
Voc./Training School							
Others (specify)							
District B							
Pre-Primary School							
Primary School							
Secondary School							

University							
Training Institutes							
Voc./Training School							
Others (Specify)							
District N (same category as District A)							
TOTAL DAMAGES							
ESTIMATED LOSSES							
Type of Losses	**Losses (in Rs.)**						
	Within Disaster Year		**Year 1**		**Year 2**		**Total**
	Public	**Private**	**Public**	**Private**	**Public**	**Private**	
Foregone Income							
Cleaning up of Debris							
Higher Operating Costs							
Other Unexpected Expenses							
TOTAL LOSSES							

Note for filling Table 6

- *"District N" represents the last District affected. All the educational facilities affected must be included.*

Step 3. Analyze the impacts of the damages and losses to affected population

The assessment team of the sector must be able to analyze potential impacts of the damages and losses on the people. The assessment should be able to, at least, answer the following questions:

- What are the possible impacts on the future education of the youth especially the girls if the damaged facilities are not rehabilitated?

- What are the potential vulnerabilities of the students if the facilities are not repaired? (For example, increase in school drop-out rates, child labour or girls may end up uneducated and/or be forced to seek lower levels of employment outside their own villages, etc.)
- What are the added costs or consequences to families if the facilities are not repaired immediately? (For example, students may be forced to enrol in schools outside the community or there may be additional costs to families if classes will be extended beyond the normal school year).
- Are there potential losses of teaching jobs (in the private sector) if school buildings are totally destroyed?

The national targets on the millennium development goals (MDGs) can be used as indicators for analysis of impacts in the education sector.

The following matrix can be used to express the social impacts of the damages and losses to the education sector.

Matrix 1. Social impacts of the damages and losses to the education sector

Area of Impacts	Expected Impacts						Brief Description of Impacts
	General Population		Women and Children				
	S	M	L	S	M	L	
Delayed Schooling							
Vulnerability of Students							
Added Cost to Households							
Employment							
Others (Specify)							

Notes for filling Matrix 1

- *The expected impacts are segregated into a) the impacts on the general population; and b) the impacts on women and children measured as severe (S), moderate (M) or low (L). The assessment team should mark under the column whether the impacts are S, M or L.*
- *The impacts can be briefly described under the column "Brief Description of Impacts". For example, a brief description of a severe "vulnerability of students" can be due to the dangers of conducting classes in rooms that are weakened by the floods or open alternative classrooms and the "added cost to households" can be described as the higher cost of transportation if alternative schools are far away.*

Step 4. Identify the recovery strategies and estimate recovery and reconstruction needs

The post-disaster needs must be based on a framework where policies and strategies are likewise integrated. After analyzing the potential effects and impacts if no assistance will be provided to the education sector, the aggregate needs of the sector must be estimated.

Step 4.1 Identify recovery and reconstruction strategies

After the consolidation of the field assessment, the assessment team must identify or recommend the policies and strategies for the recovery and reconstruction for the sector.

The following are some of the general policies and strategies that could be considered for the sector.

A. Policy Measures

There are certain policies that can be adopted which can provide incentives to the private sector to reconstruct damaged educational facilities with higher standards of resilience. Among them are:

1. Tax breaks for private schools like real property and other taxes;
2. Exemption from payment of building permits and other related fees;
3. Duty-free importation of construction materials and equipment during the recovery and reconstruction phase; and
4. Extending bank guarantees on loans by the government to enable the private sector to rebuild immediately.

B. Strategies

The following general strategies should be considered for the education:

a. **Building Back Better (BBB).** Recovery activities based on BBB principles will promote longer-term disaster risk reduction and management. BBB principle should look at the how to make infrastructure and facilities safer from future disasters like stronger engineering design, the advantages of resettlement of facilities in disaster-safe areas instead of rebuilding in the same disaster-prone areas, etc.

b. **Focus on the most vulnerable and socially disadvantaged groups such as children, women, and the disabled.** Recovery programming needs to give priority to the most vulnerable groups, including women-children, the poor and those with special needs.

c. **Community Participation and Use of Local Knowledge and Skills.** The participation of the community in all process (identification, planning, design and implementation) of recovery activities will help ensure the acceptability of projects and optimize the use of local initiatives, resources and capacities.

d. **Secure development gains.** Recovery strategies, although may be a separate set of activities, must be supportive of existing development plans and must attempt to re-establish and secure previous development gains.

e. **Coordinated and coherent approaches to recovery.** Projects for disaster recovery must have the full and effective coordination among all involved agencies based on comprehensive information exchange, flexibility in administrative procedures, and uniformity of policies. In some instances, a special new agency may be needed to oversee, coordinate and monitor complex disaster recovery programs. Under this strategy, capacity building activities for the local public administration may be part of the recovery activities including a well-defined monitoring and evaluation system for the overall implementation of the recovery plan.

f. **Efficient use of financial resources.** The overall strategy should also include the identification of fund sources that are suited for the recovery activities. It should be clear how assistance to the recovery of the private sector will be delivered. Also, some cheaper source of funds from international donor partners should be initially identified for longer-term expensive projects.

g. **Transparency and accountability.** The overall plan and implementation of projects for recovery must be transparent, especially to those affected, through open and wide dissemination of information on all aspects of the recovery process. An effective monitoring system must be established.

Step 4.2 Estimate recovery needs

Recovery needs are intended to bring back normalcy in the sector as quick as possible.

In the education sector, quick recovery efforts must be undertaken to prevent the delay of classes of the affected students.

The government must ensure that its education services will be normalized as soon as possible. Some of the possible recovery related activities are:

- Reactivation of education activities under special conditions such as:
  - More intensive utilization of undamaged education facilities by establishing several daily “shifts” instead of normal ones;
  - Rental of alternative premises which can be used as school buildings; and
  - Setting up temporary classrooms, by using tents, containers or other similar facilities.
- Repair of schools used as temporary shelter which may have sustained damage due to overuse.
- Replacement of education materials and minimum vital equipment which cannot wait until reconstruction begins.
- Accelerated training of teachers if a large number of teachers died in the disaster.

Step 4.3 Estimate reconstruction needs

Reconstruction needs are generally long-term in nature (3 years or more) and are intended to ‘build back better’ from the ruins of a disaster.

The possible reconstruction related activities in the education sector could include the following:

- Reconstruction of public schools under a building-back-better strategy to ensure future disaster resilience through the adoption and enforcement of improved construction standards;
- Relocation of schools to safe areas, as necessary. In this case, the additional costs land acquisition, and basic services provision (water, sanitation, electricity, etc.) should be included.
- Soft-term credit for reconstruction of private schools. Such schemes can be accompanied by technical assistance for improved disaster resilient standards of construction;
- Cost of replacing furniture and equipment that were destroyed may be included within the needs for reconstruction, unless they have been covered under the recovery needs to provide temporary education services for the affected area;
- Structural retro-fitting of undamaged or partially damaged schools so that they are not affected by disaster event in the future; and
- Other mitigation measures such as construction of support infrastructure to prevent serious landslides and floods to education facilities.

Step 4.4 Prioritize identified projects for recovery

Among the projects identified, relative priorities can be set in order to determine which among them are the more important.

Based on the broad strategies for recovery, the assessment team should select the priority projects/ activities among the identified needs.

The prioritization can be made by using a set of impact indicators and the level by which the projects can achieve said impacts.

Examples of the criteria that can be used are the following, among others:

a. Economic impact, which can be evaluated in terms of the relative cost to the government of not undertaking reconstruction or rehabilitation.

b. Equity and social impact, which can be in terms of the number of beneficiaries who are poor and destitute and who could not afford to rebuild on their own without outside support.

c. Sustainability, which can be in terms of the reduction of risks and vulnerability of the people and other economic assets to future disasters.

The criteria above can be placed in a matrix like the one below where the impacts are ranked according to low, medium or high.

This matrix can show the relative benefits of proposed projects to the people in the affected areas, which, in turn, will inform and assist the government in determining the priority projects within the sector.

Matrix 2. Impacts of identified post-disaster projects

Name of Proposed Project	Expected Impacts and Their Levels of Impact on Recovery								
	Economic Impact			Equity and Social Impact			Sustainability		
	High	Medium	Low	High	Medium	Low	High	Medium	Low

Step 4.5 Summarize the estimated recovery and reconstruction needs and draft the implementation schedule

Based on the prioritized recovery and reconstruction needs, a summary should be created by the assessment team enumerating the post-disaster projects for the recovery and reconstruction.

The identified needs should have a rough schedule of implementation outlining at the very least the activities, timing and budget required for all the programs and projects.

The following techniques can be considered:

1. Identify the specific projects according to their relative urgency or priority in relation to recovery.
2. Plot the timeline of activities of all the projects, with the urgent ones on top, in a Gantt chart with the corresponding funding requirement on an annual basis. This will assist the national government in programming the necessary funds over a certain time period, like on a quarterly or annual basis.
3. Identify and include in the list of projects that need further feasibility studies, which may be funded by foreign grants.
4. To the maximum extent possible, a logical framework (log-frame) should be created for each of the project proposed for inclusion in the recovery plan. Log-frames are normally required by foreign donors to consider project proposals.

The recovery and reconstruction needs of the sector can be summarized in the table below showing the financing requirements over the years.

It needs to be noted that reconstruction needs mostly require long-term implementation periods like three or more years to complete. As such the table can be adjusted to accommodate added number of years, if needed.

Table 7. Summary of recovery and reconstruction projects in the education sector.

Name of Specific Projects	Annual Needed Amount of Assistance (Rs.)			Total Needs (Rs.)
	Disaster Year	Year 1	Year 2	
Projects for Recovery				
a.				
b.				
c.				
Total				
Projects for Reconstruction				
a.				
b.				
c.				
Total				
GRAND TOTAL				

Notes for filling Table 7

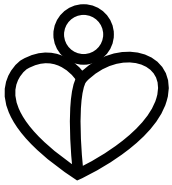
- *Project titles can be inserted under the column on recovery and reconstruction needs.*
- *Columns can be added to accommodate any additional reconstruction needs beyond Year 2.*

Step 5. Draft the post-disaster damages, losses and needs (PDNA) report of the sector

With all the information gathered using the previous steps, a report can be drafted by the assessment team, which will be developed by including the inputs of the sector in the overall recovery and reconstruction plan. The following format may be considered:

1. Brief description of the sector in the disaster-affected areas.
2. Damages in the sector by areas and by types of assets affected.
3. Losses in the sector emphasizing the losses in income, increase in expenditures, estimated period before normalcy will be attained, etc.
4. Impact on the livelihood, individual households, vulnerable groups and the consequences to the greater community if no assistance for recovery will be provided.
5. Proposed strategies for recovery and reconstruction of the sector.
6. Needs of the sector, by priority, and the draft schedule of implementation with the estimated funds required for each project over time.

The draft sector report should be submitted to the State Disaster Management Office for consolidation.



Health Sector

This section contains the following contents – specific to this sector – in order to guide the user to successfully conduct post-disaster needs assessment in India:

1. **The Introduction to the Sector**
   a. Baseline information
   b. Post-disaster Situation and Performance
   c. Estimation of Disaster Effects
   d. Estimation of Disaster Impact
   e. Estimation of Post-Disaster Recovery and Reconstruction Requirements
2. **The Standard Procedure for the Sector Assessment**
   a. Recommended Assessment Team
   b. Steps in conducting a PDNA in the health sector
      - Collect baseline information on sector assets and production flows
      - Estimate value of damage and production flow changes
      - Analyze the impacts of the damages and losses to affected population
      - Identify the recovery strategies and estimate recovery and reconstruction needs
      - Draft the post-disaster damages, losses and needs (PDNA) report of the sector

The user is advised to refer to:

a. *The "Introduction of the PDNA Manual" for a complete information of the concepts and definitions on the post-disaster needs assessment (PDNA);*
b. *The section on "Disaster Effects, Impact Assessment, Needs Estimation" for a more detailed discussion in identifying the possible impacts within and across sectors; and*
c. *The section on "Estimation of Post-Disaster Recovery and Reconstruction Needs" for a more detailed discussion on identifying and prioritizing post-disaster needs.*

Introduction

The health sector often bears a double burden at the time of a disaster . One derived from the effects of the event on the health of the affected population and the other may be derived from the effects of the event on the infrastructure and assets and the resultant disruption of the services provided by the sector.

Even where the effects to the infrastructure and assets of the sector may have not been severe as a result of an event, the health sector may still be severely affected due to the increased demand for their services in the response to the event and the difficulty caused by the event, which may create challenges for delivery of health services and access to services. The sector may also have to address the subsequent health threats which the population may face as a result of the disaster in view of changed environmental conditions. Table 1 presents a distribution of different diseases found in some 40 surveyed villages following the 2008 Kosi floods.

Table 1. Villages suffering from different diseases, In the aftermath of Kosi Flood, 2008

Disease Type	Males		Females		All	
	Number	% of Total Population	Number	% of Total Population	Number	% of Total Population
Cold and Cough	2,815	1.4	3,240	1.8	6,055	1.6
Water-borne Diseases	2,310	1.2	2,899	1.6	5,209	1.4
Digestive Problems	550	0.3	600	0.3	1,150	0.3
Fever	5,950	3	5,514	3.1	11,464	3
Skin Disease	11,139	5.6	7,681	4.3	18,820	5
Stomach Problems	5,490	2.7	3,690	2.1	9,180	2.4
Others	713	0.4	445	0.3	1,158	0.3
Total Population	**28,967**		**24,069**		**53,036**	

Source: Table 3.7 Kosi Floods 2008. UNDP Report

Assessing these effects and their impacts is the task of the health sector team when undertaking a post disaster assessment. Identifying realistic recommendations for recovery and reconstruction is the ultimate task.

The health sector assessment team should include civil engineers or architects who may be required to estimate damage, while medical doctors, epidemiologists and economists would be required to estimate changes in flows.

a) Baseline Information

In order to conduct an assessment of an event on the health sector, it is important to be able to paint a clear and concise picture of health care at the national and State levels, as it existed prior to the disaster. Such a description should entail the socio-demographic characteristics of the population with the main epidemiological indicators including incidence of different diseases relevant to the disaster situation.

The number of health facilities that exist at the national and state levels before the disaster occurred and the types of health facilities categorised by the nature of services which they provide and their location, should be presented. The ownership structure, defining privately or publicly owned facilities, and the catchment area covered is important to include. The distribution of the services provided between the two sectors would be important information. Table 2 presents the number of health facilities that existed in selected villages before the disaster occurred, by type of facilities, as reported by the UNDP study on the Kosi floods in the state of Bihar, 2008.

Table 2. Basic Health Facilities in Selected Villages, State of Bihar per Lakh Population by selected

District	Allopathic Hospitals	Maternity Hospitals	Primary health Centres
Supaul	1.3	0.3	1
Araria	0.5	0.1	1
Purnia	0.9	0.2	1
Madhepura	0.6	0.2	2
Saharsa	0.4	0	1
Total in Five Districts	0.7	0.2	1
Bihar	1.3	0.3	2

Source: Table 2.4 Basic Facilities in the Villages in Survey Districts as per Census India, 2001. Kosi Floods Report 2008. UNDP

It is also important for the health sector team to describe the structure of health care in the country, detailing the management and numbers of health care providers and if the sector is able to meet the needs of the population and what are the gaps. If there are some particular or unique health challenges faced by the population in the affected area, this too should be highlighted.

As an example, the Government of Bihar State Report on the Kosi Floods of 2010, noted that total health facilities coverage per 1,00,000 persons in the affected district was between 9 and 11 while the state average was 11 persons per 1,00,000. The report concluded that the basic health indicators such as crude birth rate, crude death rate, infant mortality rate and total fertility rates were considerably above the state and national average.

The fee structure for the delivery of health services should be explained, if it exists. If information is available on the health costs for particular services this should be provided.It would be important for the sector team

to be able to have an inventory of what medical equipment, supplies and furniture exists in the various facilities, including vehicles such as ambulances.

The sources of data for the pre-disaster situation in the health sector and its characteristics is most usually found in the Ministry of Health annual reports and other administrative reports from the national and state levels. Recent health surveys on the population, academic studies and studies undertaken by international partners such as WHO, FAO, UNICEF or UN Women may be helpful.

b) Post-Disaster Situation and Performance

Estimating the effects of the event on the health sector requires the collection of data on the number, size and type of health facilities and their contents that have been partially or totally destroyed as a result of the event. The facilities include peripheral structures such as medical laboratories, morgues, fences, garage, or any other structure and assets like ambulances that form part of the health facility. The contents of the health facilities should be taken into consideration including, medical equipment, furniture, appliances, computers, medical research journals, etc. Both the affected structures and their contents are to be reported as the effect of damage to the physical infrastructure and assets of the sector.

Losses in the sector will be due to foregone income from fees, clearing of debris and other unexpected expenses including the cost of temporary health facilities to accommodate additional medical needs of the people. These effects should always be presented according to the types of health facilities, geographic location, indicating whether private or public.

c) Estimation of Disaster Effects

Estimating the effects of the event in the health sector requires the collection of data on the number, size and type of health facilities which were partially or totally destroyed, the contents therein and any other peripheral buildings that form part of the facility such as adjoining pharmacies, fencing, outside toilet facilities or storage facilities. Medications and supplies stored in the facilities should be included. This is reported as the effects of the disaster on the physical infrastructure and assets of the sector or damage. This should always be presented according to the geographic location of the affected heath facilities and the ownership structure.

This data following an event, is usually collected by government health officials at the national and State levels and/or collected by first responders. The verification of the data initially collected is always essential and is the work of the health sector assessment team. Where data gaps exist, the health sector assessment team may make recommendations as to how such data may be collected, through quick surveys or field visits. They may be supported by use of geo-spatial imagery of the before and after images of the particular community in which the event has occurred and key informant interviews.

Once the effects of the event are satisfactorily captured, to the best of the ability of the health sector assessment team and within prevailing time constraints, an estimation of the economic value of the effects can be carried out. Economic value should be estimated at current market prices at the level of the unit. That is, the construction cost for a health facility designed for a particular purpose, taking into consideration size

and construction materials used, or in the case of partial destruction, the replacement cost of a roof, repairs to floors, windows or doors or replacement of medical equipment damaged. These values can be supplied based on estimates by the State government's own Department of Works or from the procurement or maintenance departments of the Health Department. The value of the specialized equipment and furniture are also to be valued at market prices. This information can often be sourced from the procurement offices of the Health Ministry or from Ministry of Finance.

The health sector usually experiences significant additional expenditure and lower revenues as a result of a disaster. This expenditure results in a change in economic flows to the sector. Such expenditure may occur as a result of attempting to ensure that affected populations have access to health services, through the establishment of mobile clinics or temporary health facilities. Costs may be incurred through higher expenditure for treatment of injured, such as incurred in the transporting of patients to non-damaged hospitals or other facilities, when required; higher expenditure on patients referred to other facilities; where applicable, lower revenues due to giving attendance to lower number of patients; additional costs incurred through the special monitoring and surveillance of epidemics; costs in vector control; and costs of prevention such as the distribution of vaccines and the promotion of health awareness activities such as advice on the boiling of water, etcetera. There may be increased costs for overtime for health care providers, transport costs, increased amounts of medicines and supplies, etc.;and for the conduct of special programmes to address psychosocial trauma following an event.

The case of the Government of Odisha, in their memorandum on Cyclone Phailin and the subsequent flood in October 2013, demonstrates the extent to which Health Sector officials must go to safeguard the health of the population. The report indicated that in order to restore health services in the affected areas, 185 medical teams and 338 medical relief centres were opened. Forty-seven (47) medical officers, 132 paramedics were mobilized from medical colleges and unaffected areas to the districts such as Puri, Balasore, Bhadrak, Jajpur, Kendrapada, Mayurbhanj and Ganjam. Packets of ORS amounting to 12,49,670 and 96,55,000 Halogen tablets and 16,700 ASVs were supplied. These items would require costing by the health sector assessment team so that an economic value could be applied to the additional expenditures of the health sector.

The costs for the removal of debris and sanitization of partially damaged facilities before use may also have to be taken into account. So too the costs of removal and safe disposal of bio-hazardous materials from damaged hospitals.

When all estimates have been completed, only then can a true picture of the total effects of the event on the sector be discerned.

d) Estimation of Disaster Impact

How has the event impacted the sector, is one of the critical questions which the Government wants answered as an outcome of the assessment. The results of the impact assessment should be presented concisely and clearly.

It should provide an understanding of the scale or magnitude of the event to the sector. One way to do so is to examine the proportion of health facilities to the national or sub national stock of health facilities that

have either been destroyed and/or partially damaged. Another is to present the time required to continue the temporary health facilities until the rebuilt permanent facilities come on stream.

The economic impact should be reflected in the change in economic flows collected as part of the assessment presented, so that this information can be taken into account in the examination of the overall economic impact to be done by the macro-economic team. It may be found that Government's unexpected expenditure to safeguard the health of the population,which has been affected as a result of the effects of the event, may affect the Government's fiscal position.

The imported component of the sector which includes the likely impact of the construction requirements for new building materials and the importation of damaged or destroyed health equipment and medical supplies may impact negatively on the country's net import earnings and this should also be taken into account. This will become apparent on the impact of the country's balance of payments (BOP).

The health sector assessment team is expected to address the consequences of the event on the health status of the population or address the social impacts. Will there be any long- term effects of the event, or threats of new epidemics? Will the effects of the event impact negatively on the government being able to meet its stated health goals? These are some of the issues that will be explored in the impact analysis.

The health sector assessment team will also need to address the impact of the event on the workers in the health sector and to ensure that the differential impact on male and female workers is taken into consideration, in light of the usual preponderance of females in the health sector workforce. Issues such as overtime, deployment in faraway locations and that of safety, will have to be explored.

e) Estimation of Post-Disaster Recovery and Reconstruction Requirements

Arising from the impact analysis and consultation with the affected population and key stakeholders, the sector experts should develop recommendations for a recovery strategy. The Government's own goals for the sector as stated in recent development plans, budget statements or sector plans should inform the health sector team's development of recommendations for recovery and reconstruction.

Among the key questions, which the Government wants answered is, what is an indicative cost of recovery in the sector and how long is recovery estimated to take?

To arrive at the cost of recovery it is important to take into consideration the cost of reconstruction and to consider what will reduce future risk. In other words: how can the health sector build back better?

It should be noted that recovery in the sector not only addresses the reconstruction of the physical assets damaged as a result of the event but the identification of the measures which hasten the recovery process or support the sector in meeting the financial and technical requirements for recovery. 'Building back better' may speak not only to structural efforts but also to non-structural measures needed to build better the processes for the delivery of health services and therefore the introduction of these processes may require additional costs.

It is important to note that the costs of recovery (recovery needs) are those amounts of losses for which there is no provision in the regular budget for sector.

Recovery costs should therefore be determined by the fact that any expenditures over and above the normal or non-disaster level with regards to provision of immediate to medium term health care should be included. As an example, recovery needs may include the cost of setting up and operation of alternative temporary health facilities until the destroyed ones have been rebuilt, any increased personnel costs (overtime or special assignations outside the normal residence, etc.), the cost of prevention (vaccination, increased monitoring of disease, information campaigns, etc.), plus any costs of controlling both the occurrence of outbreaks and of vectors (spraying, etc.). We also may find that there is need for special nutrition programs in cases where agriculture sector production losses are high.

The cost of recovery then is equal to the cost of reconstruction plus the cost of building back with resilience to future events. In the case of repairs to existing structures, recovery costs should include the costs of retrofitting those structures to withstand further events of a similar nature, if required.

How long recovery may take, is a factor of not only the measures for financing for recovery but also the capacity in related sectors such as the construction sector.

When all of these and other measures are taken into account then a realistic time frame can be provided to answer how soon recovery may take place.

Health Sector

STANDARD PROCEDURES FOR SECTOR ASSESSMENT

Recommended Assessment Team

The composition of the sector assessment team may vary by the type of disaster and the extent of the likely damage and production flow changes.

Organization and Personnel	Role in the Sector Assessment

Personnel from:
• **State Department of Health and Family Welfare**
• **Local in the disaster-affected area who are:**
  • Civil Engineer (Health facilities)
  • Architect (Health facilities)
  • Medical Doctor
  • Epidemiologist
  • Health Economist
  • Goods/Equipment Buyer
	Lead and coordinate

Personnel from:
• **Ministry of Health and Family Welfare who are:**
  • Civil Engineer (Health facilities)
  • Architect (Health facilities)
  • Medical Doctor
  • Epidemiologist
  • Health Economist
  • Goods/Equipment Buyer
	Provide baseline information and facilitate the field assessment of damages and losses

Development partners (if active in the sector)	Participate and provide technical advice

Steps in conducting a PDNA in the health sector

Step 1. Collect baseline information on sector assets and production flows

Baseline information must be compiled before the field assessment or, if possible, prior to the occurrence of disaster. The baseline data should be validated before the field visit to serve as the basis for the estimation of damages and losses for the disaster-affected area/s. This data can be compiled at the State/Region office or at the District levels. The tables below can be used for the baseline information.

Table 1. Baseline information of medical facilities in a District

Name of District:									
Type of Medical Facilities	Number		Total	Average Number of Clients Per Day				Average number of Medical Staff	
	Public	Private		Public		Private		Public	Private
				Male	Female	Male	Female		
Health Center									
Primary Health Center									
Community Health Center									
Others									
Hospitals									
District/ General/ Taluk Hospital									
Ayurvedic Hospital									
Others									
Other Facilities									
Anganwadi Centers									
Medical Laboratories									
Others									
Total									

The average replacement and repair costs of the assets in health can be enumerated in the following table.

Table 2. Baseline information of unit cost of medical facilities in a District

Name of District:						
Particulars	**Average Values (in Rs.)**					
	Health Centers		**Hospitals**		**Other Facilities**	
	Single Floor	**Multi-Floor**	**Single Floor**	**Multi-Floor**	**Single Floor**	**Multi-Floor**
Average Replacement Cost of:						
Structure						
Roofing Per Square Meter						
Wall Per Square Meter						
Flooring Per Square Meter						
Electrical Installation						
Plumbing						
Average Repair Cost of:						
Structure						
Roofing Per Square Meter						
Wall Per Square Meter						
Flooring Per Square Meter						
Electrical Installation						
Plumbing						
Average Fees / Revenue:						
Average Fee/s Per Client Per Visit						
Average Revenue Per Day or Month						
Construction / Repair Period	**In Days**					
Average Construction Period						
Average Repair Period						

The following table may be used to estimate the baseline unit costs of medical equipment and supplies.

Table 3. Baseline information of unit cost of medical equipment and supplies in a district

Name of District:			
Medical Equipment and Supplies	**Unit Costs (Rs.)**		
	Average Acquisition Value Per Unit	**Average Replacement Cost Per Unit**	**Average Repair Cost Per Unit**
Equipment			
CT Scanner			
X-ray Machine			

MRI Machine			
Other Equipment (Specify)			
Supplies			
Medicines			
Other Medical Supplies			
Other Assets			
Furniture			
Ambulance			
Other Vehicles			
Others (Specify)			

Notes for filling Tables 1, 2 and 3

- *Other types of medical facilities like mobile clinics should be included.*
- *The construction cost of structure/s, values of equipment, supplies and furnishing/s should be per unit or per type in each facility.*
- *The average construction period refers to the number of days for a new building to be erected.*
- *The average repair period refers to the number of days required for the repair of the structures/ buildings. This can be based on past experiences.*
- *Types of equipment and supplies, especially those are important and expensive, should be enumerated.*

Sources of Information

The sources of baseline information may vary by state. However, the critical list of the likely sources of information is provided below.

Ministry of Statistics and Programme Implementation	http://www.mospi.gov.in
The Registrar General & Census Commissioner, India	http://censusindia.gov.in
National Institution for Transforming India	http://niti.gov.in
Ministry of Health & Family Welfare	http://www.mohfw.nic.in
Department of Health Research | MoHFW | Government of India	http://www.dhr.gov.in
Open Government Data (OGD) Platform India	https://data.gov.in
Central Bureau of Health Intelligence	http://www.cbhidghs.nic.in
NHM Health Statistics Information Portal	https://nrhm-mis.nic.in

Note 1: Please use similar institutions at State level for baseline Information

Note 2: For Non-Government information sources, please search suitably

Step 2. Estimate value of damage and production flow changes

With the baseline information, field assessment should be undertaken in the affected districts after a disaster. The assessment team from the State must work with their local counterparts in the District to ensure that the estimates for the damages and losses in the sector are accurate to the extent possible. Direct interviews with private contractors or government officials involved in the construction and repair of facilities can also be conducted during the field trip in order to validate unit costs of repair and reconstruction (which is already contained in the baseline data).

Step 2.1. Estimate the damages and losses to government health facilities

The post disaster assessments of government-owned health facilities are the primary concerns of the Ministry of Health and Family Welfare. Assessment should be done on a per District basis, which can be totalled to create a State assessment. The following table can be used in assessing the damages and losses.

Table 4. Damage and loss assessment of government health facilities

<table>
<tr><td>Name of District</td><td colspan="6"></td></tr>
<tr><td>Name of Health Facility</td><td colspan="6"></td></tr>
<tr><td>Type of Health Facility</td><td colspan="6">Primary Health Center ( ) Community Health Center ( )
District / General / Taluk Hospital ( ) Ayurvedic Hospital ( ) Anganwadi Centers ( ) Medical Laboratories ( ) Other Facility (Specify): _____</td></tr>
<tr><td rowspan="2">Number of Clients or Patients Affected</td><td colspan="2">Male</td><td colspan="2">Female</td><td colspan="2">Total</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="7">ESTIMATED DAMAGES (Rs.)</td></tr>
<tr><td rowspan="3">Damaged Assets</td><td colspan="2">Totally Destroyed</td><td colspan="2">Partially Damaged</td><td>Total</td><td>Average Time to Repair</td></tr>
<tr><td>Quantity</td><td>Total (Rs)</td><td>Quantity</td><td>Total (Rs)</td><td>(Rs)</td><td>Days</td></tr>
<tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td></tr>
<tr><td colspan="7">Structures</td></tr>
</table>

Structures / Buildings						
Equipment						
CT Scan						
X-ray Machine						
MRI Machine						
Other Equipment (Specify)						
Supplies						
Medicines						
Other Medical Supplies						
Other Assets						
Furniture						
Ambulance						
Other Vehicles						
Others (Specify)						
TOTAL						

ESTIMATED LOSSES (Rs.)

Type of Losses	Disaster Year	Year 1	Year 2	Total (Rs.)
Foregone Income				
Cleaning up of Debris				
Higher Operating Costs				
Other Unexpected Expenses				
TOTAL				

Notes for filling Table 4

- *There is a possibility that totally destroyed and partially damaged structures may occur for a certain health facility. For instance, one hospital building may be totally destroyed while some of its building are only partially damaged.*
- *The values in the baseline information should be used in estimating damages. For example, if 20 square meters of the roof are damaged, the repair cost will be the cost of roofing per square meter multiplied by 20 square meters. On the other hand, if the whole structure is totally destroyed, the value of damage will be its replacement cost at post-disaster prices.*
- *The total for the totally destroyed (or partially damaged) assets will be the total number multiplied by the replacement cost (or average repair cost). The average replacement and repair costs are in the baseline information.*
  - *Column B = (Column A) x replacement cost*
  - *Column D = (Column C) x repair cost*
- *In formula, 'Total damages' Column E will be: = (Column B) + (Column D)*
- *The average time to repair refers to the time to restore the affected structures to their pre-disaster levels. This will give an indication on the number of days before normal services will be restored.*

A note on estimated losses:

Losses in the health sector will include the following:

- *Higher costs of health care. Government health facilities may incur additional expenses to assist the disaster-affected population (over and above the regular budget of the sector). This higher cost can be for any of the following reasons:*
- *Treatment of physically and psychologically injured persons over a period of time which will require additional expenses for medicine and supplies*
- *Transportation costs of injured persons to alternative, unaffected health facilities*
- *Additional home visits to women and children needing more attention since they are more vulnerable and at risk*
- *Rent of additional equipment, transportation to make more out of facility service provision*
- *Overtime payment of health sector personnel, or cost of employing temporary additional staff if needed.*
- *Losses due to lower revenues. Closure of private and public health care facilities due to physical damages would result in the loss of revenues. On the other hand, even if the facilities are not affected, there may be a reduction in demand/patients if the facility has become inaccessible or if the people lost their source of income to pay for health services. Revenue losses will be: Pre-disaster revenues minus the estimated post-disaster revenues.*

- *Other unexpected expenditures like:*
  - *Direct costs of monitoring and control of outbreak of diseases. After a disaster, there is a possibility of breakout of epidemics which may require direct interventions like health surveillance and other disease control like fumigation, control of water-borne diseases, vaccination, public information and education, etc.*
  - *Demolition and clean-up costs. The costs of demolition, removal of debris in the affected health facilities, disposal of bio-hazardous materials, among others are considered losses in health sector. Demolition costs vary widely in relation to the type of building materials involved. The health sector specialist should consult with an engineer or architect at this point. Typically the cost of removal of debris up to the roadside is incurred by the health facilities while the disposal of debris from the road to the disposal site may be incurred by other mandated agencies.*

Losses can extend beyond the year that the disaster occurred and these should be reflected in the loss assessment for the coming year/s. The duration will also include the time required for controlling and monitoring the possible outbreak of disease that may change the morbidity levels arising from the disaster. Losses are expressed in monetary value at current prices.

Step 2.2 Estimate the damages and losses to private facilities

Since it may be difficult for the government to assess the damages to all private medical facilities, a survey questionnaire can be used to interview the private owners. (Private clinics and hospitals may not allow outside people to enter their premises after a disaster).

Table 5. Damage and loss assessment of a private health facility (Questionnaire)

Name of District						
Name of Health Facility						
Type of Health Facility	Primary Health Center ( ) Community Health Center ( ) District / General / Taluk Hospital ( ) Ayurvedic Hospital ( ) Anganwadi Centers ( ) Medical Laboratories ( ) Other Facility (Specify): _____					
Number of Clients or Patients Affected	**Male**		**Female**			
ESTIMATED DAMAGES (Rs.)						
Damaged Assets	**Totally Destroyed**		**Partially Damaged**		**Total**	**Average Time to Repair**
	Quantity	**Total (Rs.)**	**Quantity**	**Total (Rs.)**	**(Rs.)**	**Days**
	A	**B**	**C**	**D**	**E**	**F**

Structures						
Structures / Buildings						
Equipment						
CT Scan						
X-ray Machine						
MRI Machine						
Other Equipment (Specify)						
Supplies						
Medicines						
Other Medical Supplies						
Other Assets						
Furniture						
Ambulance						
Other Vehicles						
Others (Specify)						
TOTAL						

ESTIMATED LOSSES (Rs.)				
Type of Losses	**Disaster Year**	**Year 1**	**Year 2**	**Total (Rs.)**
Foregone Income				
Cleaning up of Debris				
Higher Operating Costs				
Other Unexpected Expenses				
TOTAL				

Each of the questionnaires used to assess private damages can be aggregated to create a summary of the damages and losses of the private sector.

Step 2.3 Summarize the damages and losses in the sector in a District

Based on assessment of government assets and survey of private health facilities, the damages and losses can be summarized in the following table.

Table 6. Summary of damages and losses in the health sector in a District

Name of District:							
Total Number of Clients or Patients Affected	**Male**			**Female**			**Total**
ESTIMATED DAMAGES							
Types of Assets	**Types of Damages**						**Total Damages (Rs.)**
	Totally Destroyed			**Partially Damaged**			
	Public	**Private**	**Total (Rs.)**	**Public**	**Private**	**Total (Rs.)**	
	A	**B**	**C**	**D**	**E**	**F**	**G**
Primary Health Center							
Community Health Center							
District / General / Taluk Hospital							
Ayurvedic Hospital							
Anganwadi Centers							
Medical Laboratories							
Others (Specify)							
TOTAL DAMAGES							
ESTIMATED LOSSES							
Type of Losses	**Losses (in Rs.)**						
	Within disaster year		**Year 1**		**Year 2**		**Total (Rs.)**
	Public	**Private**	**Public**	**Private**	**Public**	**Private**	
Foregone Income							
Cleaning up of Debris							
Higher Operating Costs							
Other Unexpected Expenses							
TOTAL LOSSES							

The damages and losses in the above table are the summary of those that were assessed and interviewed at each education facility.

Step 2.4 Summarize damages and losses in the health sector in the State

Once the summary table for each affected District has been filled out, the information should be used to summarize the damages and losses at the State level. The summary table below can be used.

Table 7. Summary of damage and losses in the health sector in a State

Name of State:							
Total Number of Clients or Patients Affected	**Male**			**Female**			**Total**
ESTIMATED DAMAGES							
Types of Assets	**Types of Damages**						**Total Damages (Rs.)**
	Totally Destroyed			**Partially Damaged**			
	Public	**Private**	**Total (Rs.)**	**Public**	**Private**	**Total (Rs.)**	
	A	**B**	**C**	**D**	**E**	**F**	**G**
District A:							
Primary Health Center							
Community Health Center							
District / General / Taluk Hospital							
Ayurvedic Hospital							
Anganwadi Centers							
Medical Laboratories							
Others (Specify)							
District B:							
Primary Health Center							
Community Health Center							
District / General / Taluk Hospital							
Ayurvedic Hospital							
Anganwadi Centers							
Medical Laboratories							
Others (Specify)							
District N:							
TOTAL DAMAGES							

ESTIMATED LOSSES							
Type of Losses	**Losses (in Rs.)**						
	Within Disaster Year		**Year 1**		**Year 2**		**Total (Rs.)**
	Public	**Private**	**Public**	**Private**	**Public**	**Private**	
Foregone Income							
Cleaning up of Debris							
Higher Operating Costs							
Other Unexpected Expenses							
TOTAL LOSSES							

Note for filling Table 7

- *District N represents the last District affected. All the health facilities affected must be included.*

Step 3. Analyze the impacts of the damages and losses to affected population

The assessment team must be able to analyze potential impacts of the damages and losses in the health sector. A simple assessment must be able to at least answer the following questions:

- What are the possible impacts on the future health conditions of the population, especially the vulnerable groups like pregnant women, lactating mothers, children, the elderly etc., if the damaged health facilities are not rehabilitated?
- What are the added health-related vulnerabilities of the people if the health facilities are not repaired? (For example, break out of epidemics; cancellation of vaccination and regular check up of pregnant women and infants; spread of diseases, etc.)
- What are the added costs or consequences to families if the health facilities are not repaired immediately?
- Are there possible losses of jobs and/or productivity if the medical infrastructure is immediately repaired? Losses in productivity may occur if injured workers are not medically treated immediately.
- Are there significant number of people that have been affected with post-traumatic stress disorder (PTSD), 'disaster syndrome' and other psycho-social illnesses which may need long-term medical rehabilitation and assistance?
- Are there possible illnesses that may be detectable only after a longer period of time such as those caused by toxic wastes from industries, mines, fuel containers, etc. that were leaked into the natural environment?

The indicators in the millennium development goals (MDGs) can also be used in the impact analysis of the health sector. The above assessment will serve as additional inputs in the overall social impact assessment of the human recovery needs assessement (SIA/HRNA).

The following matrix can be used to express the social impacts of the damages and losses to the health sector

Matrix 1. Social impacts of the damages and losses to the health sector

Area of Impacts	Expected Impacts						Brief Description of Impacts
	General Population			Women and Children			
	S	M	L	S	M	L	
Maternal Mortality							
Infant Mortality							
Increase of Disabilities							
Added Cost to Households							
Employment							
Economic Productivity							
Others (Specify)							

Notes for filling Matrix 1

- *The expected impacts are segregated into (a) the impacts on the general population; and (b) the impacts on women and children measured as severe (S), moderate (M) or low (L). The assessment team should mark under the column whether the impacts are S, M or L. The maternal mortality and infant mortality will apply mostly apply to women and children.*

  The impacts can be briefly described under the column "Brief Description of Impacts". For example, a brief description of a severe "increase in disabilities" can be due to the inability of the health services to address the needs of those physically and mentally affected by the disaster; the "added cost to households" can be described as the higher cost of going to alternative clinics that are far from the disaster area/s; while the impact to "employment" can be the loss of jobs from destroyed hospitals.

Step 4. Identify the recovery strategies and estimate recovery and reconstruction needs

The post-disaster needs must be based on a framework where policies and strategies are likewise integrated.

After analyzing the potential effects and impacts if no assistance will be provided to the health sector, the aggregate needs of the sector must be estimated.

Step 4.1 Identify recovery and reconstruction strategies

After the consolidation of the field assessment, the assessment team must identify or recommend the policies and strategies for the recovery and reconstruction for the sector. The following are some of the general policies and strategies that could be considered for the sector.

A. Policy measures

There are certain policies that can be adopted which can provide incentives to the private sector to reconstruct damaged health facilities with higher standards of resilience. Among them are:

1. Tax breaks for the private sector like real estate and other taxes;
2. Exemption from payment of building permits and other related fees;
3. Duty-free importation of medical equipment during the recovery and reconstruction phase; and
4. Extension of bank guarantees on loans by the government to enable the private sector to rebuild immediately.

B. Strategies

The following general strategies should be considered for the sector:

a. **Building Back Better (BBB).** Recovery activities based on BBB principles will promote longer-term disaster risk reduction and management. BBB principle should look at the how to make health facilities safer from future disasters like stronger engineering design, the advantages of resettlement of facilities in disaster-safe areas instead of rebuilding in the same disaster-prone areas, etc.

b. **Focus on the most vulnerable and socially disadvantaged groups such as children, women, and the disabled.** Recovery programming needs to give priority to the most vulnerable groups, including women, female-headed households, children, the poor, and take into account those with special needs, to avoid their being overlooked.

c. **Community Participation and Use of Local Knowledge and Skills.** The participation of the community in all process (identification, planning, design and implementation) of recovery activities will help ensure the acceptability of projects and optimize the use of local initiatives, resources and capacities.

d. **Secure development gains**. Recovery strategies, although may be a separate set of activities, must be supportive of existing development plans and must attempt to re-establish and secure previous development gains.

e. **Coordinated and coherent approaches to recovery.** Projects for disaster recovery must have the full and effective coordination among all involved agencies based on comprehensive information exchange, flexibility in administrative procedures, and uniformity of policies. In some instances, a special new agency may be needed to oversee, coordinate and monitor complex disaster recovery programs. Under this strategy, capacity building activities for the local public administration may be part of the recovery activities including a well-defined monitoring and evaluation system for the overall implementation of the recovery plan.

f. **Efficient use of financial resources.** The overall strategy should also include the identification of fund sources that are suited for the recovery activities. It should be clear how assistance to the recovery of the private sector will be delivered. Also, some cheaper source of funds from international donor partners should be initially identified for longer-term expensive projects.

g. **Transparency and accountability.** The overall plan and implementation of projects for recovery must be transparent, especially to those affected, through open and wide dissemination of information on all aspects of the recovery process. An effective monitoring system must be established.

Step 4.2 Estimate recovery needs

Recovery needs are intended to bring back normalcy in the sector as quickly as possible. In the health sector, quick recovery efforts must be undertaken to prevent the deterioration of the health of the affected population.

The government must ensure that its health services will be normalized as soon as possible.

Some of the possible recovery related activities are:

- Setting up of temporary hospitals in either alternative suitable building facilities or in tents, until the destroyed facilities are rebuilt.
- Additional budget over and above the regular government appropriations to finance additional personnel or to pay the overtime work of existing personnel.
- Replenishment of medical supplies and medicines that may have been destroyed during the disaster.
- Preventing and controlling the possible occurrence of disease outbreaks or epidemics. Under this heading, the cost of public information campaigns, vaccinations, vector control schemes and monitoring of morbidity levels are to be included.
- Psycho-social interventions can be provided especially to those who were traumatized and experienced longer term depression.
- If food insecurity is imminent due to the disaster, a temporary nutrition scheme for mothers and children may be designed and implemented.

Step 4.3 Estimate reconstruction needs

Reconstruction needs are generally long-term in nature (3 years or more) and are intended to 'build back better' from the ruins of a disaster.

The possible reconstruction related activities in the health sector could include the following:

- Relocation of health areas to safe areas, as necessary. In this case, the additional costs land acquisition, and basic services provision (water, sanitation, electricity, etc.) should be included.
- Assistance in the reconstruction and repair of health structures under a building-back-better strategy to ensure future disaster resilience through the adoption and enforcement of improved construction standards.
- Structural retro-fitting of undamaged or partially damaged structures so that they are not affected by disaster event in the future.
- Soft-term credit for reconstruction and repair of private health facilities. Such schemes can be accompanied by technical assistance for improved disaster resilient standards of construction.
- Medium- to long-term medical treatment to injured persons as well as psychological attention to the affected population
- Other mitigation measures such as construction of support infrastructure to prevent serious landslides and floods to health facilities.

Step 4.4 Prioritize identified projects for recovery

Among the projects identified, relative priorities can be set in order to determine which among them are the more important. Based on the broad strategies for recovery, the assessment team should select the priority projects/activities among the identified needs.

The prioritization can be made by using a set of impact indicators and the level by which the projects can achieve said impacts. Examples of the criteria that can be used are the following, among others:

a. Economic impact, which can be evaluated in terms of the relative cost to the government of not undertaking reconstruction or rehabilitation.

b. Equity and social impact, which can be evaluated in terms of the number of beneficiaries who are poor and destitute and who could not afford to rebuild on their own without outside support.

c. Sustainability, which can be evaluated in terms of the reduction of risks and vulnerability of the people and other economic assets to future disasters.

The criteria above can be placed in a matrix like the one below where the impacts are ranked according to low, medium or high. This matrix can show the relative benefits of proposed projects to the people in the affected areas, which, in turn, will inform and assist the government in determining the priority projects within the sector.

Matrix 2. Impacts of identified post-disaster projects

Name of Proposed Project	Expected Impacts								
	Economic Impact			Equity and Social Impact			Sustainability		
	High	Medium	Low	High	Medium	Low	High	Medium	Low

Note

The assessment of the sector must rank the expected impacts of the identified projects.

Step 4.5 Summarize the estimated recovery and reconstruction needs and draft the implementation schedule

Based on the prioritized recovery and reconstruction needs, a summary should be created by the assessment team enumerating the post-disaster projects for the recovery and reconstruction.

The identified needs should have a rough schedule of implementation outlining at the very least the activities, timing and budget required for all the programs and projects.

The following techniques can be considered:

1. Identify the specific projects according to their relative urgency or priority in relation to recovery.
2. Plot the timeline of activities of all the projects, with the urgent ones on top, in a Gantt chart with the corresponding funding requirement on an annual basis. This will assist the national government in programming the necessary funds over a certain time period, like on a quarterly or annual basis.
3. Identify and include in the list of projects that need further feasibility studies, which may be funded by foreign grants.
4. To the maximum extent possible, a logical framework (log-frame) should be created for each of the project proposed for inclusion in the recovery plan. Log-frames are normally required by foreign donors to consider project proposals.

The following table can be used in plotting the implementation period of recovery and reconstruction needs.

Table 8. Summary of recovery and reconstruction projects in the health sector.

Name of Specific Projects	Annual Needed Amount of Assistance (Rs.)			Total Needs (Rs.)
	Disaster Year	Year 1	Year 2	
Recovery Projects				
a.				
b.				

c.				
d.				
Total				
Reconstruction Projects				
a.				
b.				
c.				
d.				
Total				
GRAND TOTAL				

Notes for filling Table 8

- *Project titles can be inserted under the column on recovery and reconstruction needs.*
- *Columns can be added to accommodate any additional reconstruction needs beyond Year 2.*
- *If the government decides to provide assistance to private sector through credit, it should be properly noted in the list.*

Step 5. Draft the post-disaster damages, losses and needs (PDNA) report of the sector

With all the information gathered using the previous steps, a report can be drafted by the assessment team, which will include the inputs of the sector needed to develop the overall recovery and reconstruction plan. The following format may be considered:

1. Brief description of the sector in the disaster-affected areas.
2. Damages in the sector by areas and by types of assets affected.
3. Losses in the sector emphasizing the losses in income, increase in expenditures, estimated period before normalcy will be attained, etc.
4. Impact on the livelihood, individual households, vulnerable groups and the consequences to the greater community if no assistance for recovery will be provided.
5. Proposed strategies for recovery and reconstruction of the sector.
6. Needs of the sector, by priority, and the draft schedule of implementation with the estimated funds required for each project over time.

The draft sector report should be submitted to the State Disaster Management Office for consolidation.

Culture and Heritage Sector

This section contains the following contents - specific to this sector – in order to guide the user to successfully conduct post-disaster needs assessment in India:

1. **The Introduction to the Sector**
    a. Baseline information
    b. Post-disaster Situation and Performance
    c. Estimation of Disaster Effects
    d. Estimation of Disaster Impact
    e. Estimation of Post-Disaster Recovery and Reconstruction Requirements
2. **The Standard Procedure for the Sector Assessment**
    a. Recommended Assessment Team
    b. Steps in conducting a PDNA in the culture and heritage sector
        - Collect baseline information on sector assets and production flows
        - Estimate value of damage and production flow changes
        - Analyze the impacts of the damages and losses to affected population
        - Identify the recovery strategies and estimate recovery and reconstruction needs
        - Draft the post-disaster damages, losses and needs (PDNA) report of the sector

The user is advised to refer to:

a. *The "Introduction of the PDNA Manual" for a complete information of the concepts and definitions on the post-disaster needs assessment (PDNA);*
b. *The section on "Disaster Effects, Impact Assessment, Needs Estimation" for a more detailed discussion in identifying the possible impacts within and across sectors; and*
c. *The section on "Estimation of Post-Disaster Recovery and Reconstruction Needs" for a more detailed discussion on identifying and prioritizing post-disaster needs.*

Introduction

In the national accounts of India, culture is included within Arts, Entertainment and Recreation. Under this umbrella are such categories as creative arts and entertainment; libraries, archives and other cultural activities; and entertainment and recreation.

UNESCO suggests further categories for examination when undertaking an assessment of the Culture Sector. These are: built heritage and cultural/natural sites; moveable properties and collections; intangible cultural heritage; repositories of heritage (including museums, libraries, and archives); and cultural and creative industry. Through each of these it is possible to assess the effects and impacts of an event on the culture sector and to make recommendations for recovery and reconstruction.

It is important to remember that there will be heritage facilities, artifacts and intangible cultural products and processes that are of particular spiritual or cultural significance and may yet never be able to be fully recovered or restored through reconstruction and so defy economic valuation. The value of such tangible and intangible heritage, may be measured more in terms of its intrinsic value and its impact on the members of the community who hold it dear or in high esteem. Cultural sites under this sector will include:

- World heritage sites
- National heritage buildings
- Archeological sites including underwater archeological sites
- Historical sites including thematic heritage trails and cultural routes
- Places of worship
- Museums, archives, collections of arts and other antiquities
- Cultural centers, theatres, etc.
- Artisan and craft communities
- Other assets

a) Baseline Information

In order to conduct an assessment of an event on the culture and heritage sector, it is important to know the nature and number of cultural facilities or activities that exist at the national and State levels before the disaster occurred.

An examination of the culture and heritage sector should include a general overview of the cultural activities within the affected areas, framed within a historic and geographic perspective. In addition to this overview, the assessment team for the culture and heritage sector should provide baseline information on infrastructure and assets held within the sector.

Information on the types of cultural activities categorized by the number and characteristics of public heritage assets such as world heritage buildings, other heritage buildings, museums, archaeological sites,

moveable goods, archives or documentary collections. Number and characteristics of private historical heritage assets whether individually or institutionally owned, categorized into religious buildings, houses located in historic centers, libraries or collections located in foundations. The culture sector assessment team may also wish to identify cultural programmes that occur among indigenous communities or cultural spaces or recreational parks. Once a full description of the pre disaster situation is undertaken detailing the number and location of the cultural assets, then the infrastructure should be categorized by the nature of facilities (i.e. materials used in construction, whether board, brick, mud), the size of the facilities and the furnishings and equipment, where specialized equipment is contained, this should be highlighted.

The production of cultural goods and services and the numbers of persons who are engaged in such activities and the number of persons who normally have access to cultural activities in particular regions or spaces may be information of value. In addition, data is required on the number of persons employed in the culture and heritage sector by categorization of employment.

The sources of information for the pre-disaster situation in the culture and heritage sector and its characteristics is most usually found in reports of the Ministry of Culture as well as in cultural and academic studies and in labour force surveys. It is worthy to note that information can also be located through cooperative associations of cultural practitioners, craftsmen and women and through religious bodies.

b) Post-Disaster Situation and Performance

Estimating the effects of the event on the culture requires the collection of data on the number, size and type of cultural assets that have been partially or totally destroyed as a result of the event. For heritage buildings and museums, peripheral structures or any other structure that forms part of the buildings should be included. The contents of museums are the more important part of the building aside from furniture, appliances, antiques, paintings, computer equipment, books, etc. Both the affected structure and their contents are to be reported as the effect of damage to the physical infrastructure and assets of the sector.

Losses in the sector will be due to foregone income from fees, restoration works, clearing of debris and other unexpected expenses including the cost of temporary shelters for cultural artifacts. These effects should always be presented according to the types, geographic location, indicating whether private or public.

c) Estimation of Disaster Effects

Estimating the effects of the event on the culture sector requires the collection of data on the number, size and type of cultural facilities that have been partially or totally destroyed as a result of the event. These would include the partial or complete collapse of buildings, sites and related infrastructure. Collections and moveable properties that have been partially or totally destroyed should be identified.

Both the buildings and their contents are to be reported as the effect of damage to the physical infrastructure and assets of the sector. This should always be presented according to the geographic location of the affected cultural facilities, indicating rural or urban and the ownership structure.

Many methods have been used to collect this data following an event, from self-reporting by the managers

of the facilities; by communities who use or hold responsibility for the facilities; by Government-appointed teams from the national or State levels; and/ or reliance on the data collected by first responders. The verification of the data initially collected is always essential and is the work of the culture sector assessment team. Where data gaps exist, the culture sector assessment team may make recommendations as to how such data may be collected, through quick surveys or field visits. Just as with other social sector teams, the culture sector assessment team may be supported by use of geo-spatial imagery of the before and after images of the particular community in which the event has occurred, when available.

The Gujarat Earthquake

The Gujarat earthquake of 2001 damaged princely palaces and religious buildings in Bhuj, Jam Nagar, Wankaner, Morbi, Maliya, Halvad, Dranghedra and Ahmadabad. The Indian National Trust for Arts and Cultural Heritage (INTACH) has estimated that of 250 heritage buildings inspected in Kachchh and Rajkot, about 40% either collapsed or were seriously damaged, while only 10% remained undamaged. Restoring the buildings to their original condition is in many cases as important a task as repairing damage directly caused by the earthquake. Seismic rehabilitation of heritage structures is a highly specialized operation and requires close cooperation of experts of archaeology, architecture, surveying, structural engineering, geo-technical engineering and chemical engineering and should be supported by computation methods and well-equipped laboratories.

Setting up maintenance programs for the future is also a vital task. Modern methods have a potentially important role to play. There were examples of the use of reinforced concrete elements added to historic buildings at Jamnagar, Dhranghedra and Halvad, which undoubtedly reduced the local damage suffered in the earthquake, although the longer-term consequences of this type of intervention may be more questionable. However, it is essential that use of modern materials and technology be integrated with traditional techniques in a harmonious and compatible manner to inject new life into the buildings. The role of indigenous materials and crafts in restoration is of primary important. There is a great need to develop a body of trained, accredited craftsmen to carry out the large amounts of restoration work required in Gujarat.

The state government also announced a package for rehabilitating damaged heritage buildings. The scale of assistance was with a limit of Rs 2 lakhs for each building. If the entire building was being used for a recognized school, college or library, or was on a long-term lease to the government/local bodies, assistance was given up to Rs 5 lakhs. Assistance was to be given only to those individuals who intended to restore their properties as heritage buildings.

The Sikkim Earthquake

An Mw 6.9 earthquake struck near the Nepal-Sikkim border on 18 September 2011, at 18:10 local time. The earthquake triggered a large number of landslides and caused significant damage to buildings and infrastructure. Sikkim was the most affected state of India, followed by West Bengal and Bihar. Neighbouring countries of Nepal, Bhutan, Tibet (China) and Bangladesh sustained damage and losses to varying extents. Landslides, rock falls, and mudslides were responsible for most loss of life and damage to infrastructure, as well as the associated economic losses. There was also extensive loss of Buddhist monasteries and temples. Old monastery temple structures, of distinctive construction in stone masonry and timber, suffered varying degree of damage to masonry walls, ranging from minor damages to partial

collapse. These heritage structures are built in random rubble masonry with mud mortar. The assessment of damages and losses to cultural heritage institutions revealed that 259 religious institutions, monuments and various heritage monasteries, temples and churches were damaged along with valuable artifacts and historic manuscripts. The total estimated damages of various monasteries, including the Dubdi Gompa, Sikkim's oldest monastery in West Sikkim (1641), was estimated at around US $500 million. Among the findings after earthquake are the following:

- While framing a post-earthquake Reconstruction Policy, special attention needs to be placed to ensure that vernacular/traditional construction used in rural housing and especially in cultural heritage monuments is not replaced by "modern" RCC buildings.
- Retrofitting of the existing vulnerable buildings, including cultural sites, should be promoted in order to reduce their long-term vulnerability, since it is the most cost effective option available for disaster risk reduction.

Reconstruction or retrofitting technology is needed for making these national treasures and monuments earthquake proof.

The Indian Ocean Tsunami

The Indian Ocean tsunami of 2004 also damaged several sites inscribed on the World Heritage List, including the Sun Temple of Koranak, in India. The Shore Temple at Mahablipuram in the Tamil Nadu State was declared a World Heritage Monument in 1984. It has a Somaskanda panel in one temple and a sculpture of the reclining Vishnu in the other. The twin-temple had around it a series of sculptures of bulls and Yalis and Varahas. To safeguard it from the threat of sea erosion, a groyne wall was erected to stop the sea.

Though the tsunami of 26 December 2004 that occurred in the Indian Ocean struck the temple and the surrounding garden, the Shore Temple was not badly damaged, as the water level returned to its normal

level within a few minutes. The damage was to the foundation of the bali peetam (sacrificial altar) in front of the temple, the steps leading to the boat jetty, and the small shrine with the Varaha Boar) sculpture at the basement of the Shore temple. As the temple foundation is on hard granite rock, it could sustain the waves created by the Tsunami; the groynes erected around the temple area on the coastline also aided its protection.

Once the effects of an event are satisfactorily captured, to the best of the ability of the assessors and within the time constraints of the assessment, then the estimation of the economic value of the effects can be carried out. Economic value should be estimated at current market prices at the level of the unit. That is, the construction cost of a building of a particular size, utilizing particular materials. Or in the case of partial destruction, the replacement cost of a roof, repairs to floors, windows or doors. Unfortunately, it does not seem that an assessment of the value of the damage to the Shore Temple and its accompanying structures was undertaken.

Sector assessment teams may have to classify damage to some facilities as severe, moderate or slight and suggest where more in-depth structural analysis of their condition may have to be done. These values can be supplied based on estimates by the Government's own Ministry of Culture or from specialized contractors or civil engineers. The value of the contents of the cultural sites should be detailed; such contents may be historic documents, archival records or electronic databases. Specialists in the field should be contacted to provide valuations, where necessary. These values would provide an estimation of the economic value of the damage to the sector.

Box 1. Report from The Hindu, the online edition of India's National Newspaper, December 29, 2004

The Shore Temple stands its ground

By T.S. Subramanian

— Photo Courtesy: ASI, Chennai Circle.

The Shore Temple, behind a haze, photographed a few minutes after the tsunami struck. (Left) The dislocated foundation stones of the `balipeetam.' — Photo Courtesy: ASI, Chennai Circle.

CHENNAI, DEC. 29. Some structures and rocks, perhaps the components a of a complex of which the Shore Temple at Mamallapuram was originally a part, came into view when the sea initially receded from the shoreline before the waves hit back with brute force on December 26, according to accounts provided by eyewitnesses today. But these objects were promptly submerged when the waves came back. These could not be promptly photographed, although in the minutes that followed, staff members of the Archaeological Survey of India, under whose charge the monument remains, managed to capture a few misty and hazy images of the temple. This was caused by the onslaught of water.

The giant waves smashed the groyne wall built in the 1970s and made of big blue metal boulders on the shore, tore down the fence, flooded the lawns and entered the Shore Temple. "The Shore Temple rises from a bedrock and that saved it. The groyne wall saved several visitors too," said T. Satyamurthy, Superintending Archaeologist, Archaeological Survey of India (ASI), Chennai Circle.

The waves dislocated the foundation of the balipeetam(sacrificial altar) in front of the Shore Temple. The boat jetty/flight of steps and the miniature shrine and the Varaha sculpture at the basement of the Shore Temple, which were discovered by the ASI between 1990 and 1993, were flooded.

Other costs are incurred as well, as a result of an event. Before repairs or construction can begin, the demolition of badly damaged structures and the removal of debris, which have been left behind by the event may have to take place. These costs should be estimated. It is an unplanned and an additional expenditure, to be absorbed either by the Government or the Cultural institution and is represented as a change in economic flow.

Disruption of the production of cultural goods may also occur as a result of a disaster and lost revenue should be estimated. Any higher operational costs, to produce the cultural goods as a result of the disaster, should also be valued.

If it becomes necessary to construct temporary facilities to accommodate historic documents or artifacts as a result of the event, this cost should be identified. If additional costs have to be incurred to safeguard artifacts or sites, these will have to be identified and included as a change in economic flows either to the public or private sector. If income from fees is not tenable, due to disruption of access to museums or historic sites as a result of a disaster, this too should be estimated. As in the case of the Temple by the Shore the income, which may have been disrupted a result of the lack of visitors to the site, during the time of its damage, should have been estimated.

If Government's ability to properly coordinate or manage the sector has been disrupted as a result of the event, the additional costs, which have to be incurred should be identified. These may manifest themselves as costs to hire additional administrative personnel. Costs incurred to reduce risk or vulnerabilities such as bolstering falling structures or safeguarding artifacts from exposure to natural elements or from vandalism, looting, conflict, or the introduction of inappropriate cultural practices should be included.

All these economic values combine to provide total effect of the event on the Culture sector.

d) Estimation of Disaster Impact

How has the event impacted on the sector is one of the critical questions which the Government wants

answered as an outcome of the assessment. The results of the impact assessment should be presented concisely and clearly.

It should provide an understanding of the scale or magnitude of the event to the sector. One way to do so is to examine the proportion or significance of cultural facilities damaged and or destroyed as a proportion of the national or global stock. Another is to estimate the number of persons who would not have access to the historical site or would be affected as a result of the disruption caused by the event and for how long this disruption may last. The change in economic flows collected as part of the assessment should be presented so that this can be taken into account in the examination of the overall economic impact of the event to the national, state or regional economy. Does the culture sector, or some particular part of it, provide a stream of foreign exchange earnings or revenue, and if so, how has this been affected by the disaster? It may be found that Government's unexpected expenditure to provide access to religious or other heritage facilities, may affect the Government's fiscal position.

The impact analysis should also address the social impact of the event. The impact of the event at the personal and or household level should be examined, in terms of lost household income and livelihoods.

We may look at the impact of the event on persons who have been involved in the production and sale of cultural products. This information should be disaggregated according to the number of women and men who work in the creation of cultural products and how their income earning potential has been affected. This information may be captured by the trade and commerce sector but it is important for the culture sector team to bring this to the attention of the commerce team if they have not picked it up.

The cultural sector assessment team would be expected to speak to the possible threats or opportunities for conflict resolution or exacerbation, which may arise as a result of the impact of the cultural sector in a disaster.

e) Estimation of Post-Disaster Recovery and Reconstruction Requirements

Arising from the impact analysis and consultation with the affected population and key stakeholders, the sector experts should develop recommendations for a recovery strategy. The Government may have its own goals for the sector so it is important to review recent sector, national, state and sub national development plans or budget statements. There is growing recognition that culture, when engaged with positively, can strengthen social inclusion or reduce conflict, therefore, more emphasis is being placed on the positive outcomes which can be gained from taking cognisance of the cultural dimensions of development throughout recovery and reconstruction.

Among the key questions, which the Government wants answered is, what is an indicative cost of recovery in the sector and how long is such estimated to take.

To arrive at the cost of recovery it is important to take into consideration both the cost of reconstruction and to consider what will reduce future risk. In other words how can the sector Build Back Better.

It should be noted that recovery in the sector may not only address the reconstruction of the physical assets damaged as a result of the event but also the identification of the measures, which hasten the recovery process or supports the sector, in meeting the financial and technical requirements for recovery. 'Building

back better' may speak not only to structural efforts but also to non-structural measures to build better the processes for the delivery of cultural services and therefore the introduction of these processes may require additional costs. It may necessitate acquiring land space for the convening of religious or cultural practices or removal of artifacts to alternative sites until the original sites can be restored.

The cost of recovery therefore is equal to the cost of reconstruction plus the cost of building back with resilience to future events. In the case of repairs to existing structures, recovery costs should include the costs of retrofitting those structures to withstand future events of a similar nature.

How long recovery may take, is a factor of not only the measures for financing for recovery but the capacity in related sectors such as the construction sector and infrastructure such as road or bridges which may affect access.

When all of these and other measures are taken into account then a realistic time frame can be provided to answer how soon recovery may take place in the sector.

Culture and Heritage Sector

STANDARD PROCEDURES FOR SECTOR ASSESSMENT

Recommended Assessment Team

The composition of the sector assessment team may vary by the type of disaster and the extent of the likely damage and production flow changes.

Organization and Personnel	Role in the Sector Assessment

Personnel from:
• **State Department of Culture**
• **Local offices in the disaster-affected area who are:**
  • Architect / Conservator
  • Structural Engineer
  • Archaeologist
  • Collection / Libraries / Archives Expert
  • Cultural Anthropologist
  • Economist
	Lead and coordinate

Personnel from:
• **Ministry of Culture**
  • Architect / Conservator
  • Structural Engineer
  • Archaeologist
  • Collection / Libraries / Archives Expert
  • Cultural Anthropologist
  • Economist
	Provide baseline information and facilitate the field assessment of damages and losses

Development partners (if active in the sector)	Participate and provide technical advice

Steps in conducting a PDNA in the culture and heritage sector

Introduction

The culture and heritage sector will refer to the assets which are historical, religious, and cultural, which by their nature carry India's heritage. This will also include structures like museums that house valuable documents, artifacts and other historical materials. In dealing with this sector, the following must be noted:

1. Some assets may not have direct market value but may have enormous historical, religious or cultural value to the people of India. When these structures are destroyed they can cause great emotional or spiritual effects to the people. Since such effects are unquantifiable, they should be included in the impact assessment.
2. The cost of restoration of damaged temples and other heritage structures may cost more than the usual engineering costs of ordinary infrastructure. For example, the cost of restoring damaged ancient temples will cost more, if such temples will be restored using the original way in which they were constructed.

Step 1. Collect baseline information on sector assets and production flows

Baseline information must be compiled before the field assessment or, if possible, prior to the occurrence of disaster. The baseline data should be validated before the field visit to serve as the basis for the estimation of damages and losses for the disaster-affected area/s. This data can be compiled at the State/Region office or at the District levels. The tables below can be used for the baseline information.

Table 1. Baseline information of cultural assets in a District

Name of District					
Cultural Assets	Ownership		Description	Average Visitors Per Month	Average fee per Visitor (Rs.)
	Private	Public			
Museums					
2.					
n.					
Religious Sites					
1.					
2.					
n.					
Historical Sites					
1.					
2.					
n.					

Other Cultural Sites					
1.					
2.					
n.					

Notes for filling Table 1

- *The above table will provide the assessment team with an overall picture of the cultural sector in the area – the types of cultural and heritage sites, their location where visitors go, the visitor attractions, etc. - which they can use in post-disaster damage and loss assessment.*
- *Cultural and heritage sites can be either man-made, natural formations or assets.*
- *If a certain site is both religious and historical, they should only be counted as one.*

Sources of Information

The sources of baseline information may vary by state. However, the critical list of the likely sources of information is provided below.

Ministry of Statistics and Programme Implementation	http://www.mospi.gov.in
The Registrar General & Census Commissioner, India	http://censusindia.gov.in
National Institution for Transforming India	http://niti.gov.in
Ministry of Culture	http://www.indiaculture.nic.in
Make in India Initiatives	http://www.makeinindia.com
Museums of India	http://museumsofindia.gov.in
National Culture Fund	http://ncf.nic.in
Open Government Data (OGD) Platform India	https://data.gov.in

Note 1: Please use similar institutions at State level for baseline Information

Note 2: For Non-Government information sources, please search suitably

Step 2. Estimate value of damage and production flow changes

With the baseline information, field assessment should be undertaken in the affected Districts after a disaster. The assessment team from the State must work with their local counterparts in the Districts to ensure that the estimates for the damages and losses in the sector are accurate to the extent possible. Direct interviews with private contractors or government officials involved in the construction and repair of facilities can also be conducted during the field trip in order to validate unit costs of repair and reconstruction (which is already contained in the baseline data).

Step 2.1. Estimate the damages and losses of cultural sites

Repair and replacement costs should be estimated for the damaged components of the company/s including the estimated time needed to reconstruct the damages. The cultural assessment team must have the expertise in reconstruction and restoration of affected structures and artifacts. They should also interview the officers operating the cultural sites to ascertain the extent and value of the damages and the estimated period before operations can be fully restored to the pre-disaster level.

The value of damaged assets and lost income, from each site,can be summarized in the following table which should be used in interviewing the officials as a questionnaire.

Table 2. Value of damages and losses of a cultural and heritage site

Name of District:						
Name of Site						
Category	Museum ( ) Religious Site ( ) Historical Site ( ) Other Cultural Site ( )					
Ownership	Public ( ) Private ( )					
Number of Employees	**Male**		**Female**			
ESTIMATED DAMAGES						
Damage to Structures and Assets	**Totally Destroyed**		**Partially Damaged**		**Total Damages (Rs.)**	**Average Time to Replace or Repair (Days)**
	Number of Totally Destroyed	**Average Replacement Cost (Rs.)**	**Number of Partially Damaged**	**Average Repair Cost (Rs.)**		
	A	**B**	**C**	**D**	**E**	**F**
Structures						
Inventories						
a. Artifacts						
b. Manuscripts						
c. Others						
Office Equipment						
Others (Specify)						
TOTAL						

ESTIMATED LOSSES (Rs.)				
Types of Losses	**Disaster Year**	**Year 1**	**Year 2**	**Total**
Foregone Income				
Cleaning up of Debris				
Higher Operating Costs				
Other Unexpected Expenses				
TOTAL				

Notes for filling Table 2

- *There are various types of structures in heritage sites, which may need special expensive restoration after a disaster. The actual estimated cost of restoration should be used.*
- *Inventories or stocks in various types of cultural and historical sites will vary. If, for example, a museum lost an artifact, which has no market value and cannot be replaced, the actual cost of damage can be expressed qualitatively in the impact assessment part.*
- *'Average Replacement Cost' will be the average pre-disaster value of the structures and assets that were totally destroyed while 'average repair cost' will be the estimated cost of repair of the partially damaged assets.*
- *In formula, the total damages of the companies surveyed will be (Column E) = (Column A) x (Column B) + (Column C) x (Column D).*
- *Years 1 to 2 are the years after the disaster.*

A note on estimated losses:

Losses in the culture sector will include the following:

- *Foregone income from visitors and other related sources of income, which will last until the facilities are repaired.*
- *Possible higher cost of operation that may arise after the disaster, such as payment of higher rates of electricity from alternative sources, or acquiring raw materials from alternative sources or renting temporary premises while repairing or rebuilding the original premises.*
- *Costs involved for the demolition or removal of debris, etc.*
- *Additional cost of visitor promotion after the disaster.*

Losses can continue during the entire period of recovery and reconstruction. It is expressed in monetary values at current prices.

Step 2.2. Summarize the damages and losses in the sector in a district

Based on the survey of affected cultural and heritage sites, the following table can be used to consolidate the damages and losses of the sector within the district.

Table 3. Value of damages and losses of cultural and heritage sites

Name of District:					
Number of People Earning Livelihood from the Cultural Sites		Male		Female	
Name of Cultural Site	Damages (Rs.)	Estimated Losses (Rs.)			
	Estimated Cost of Repair	Disaster Year	Year 1	Year 2	Total Losses
Museums					

Museum 1					
Museum 2					
Museum N					
Religious Sites					
Religious Site 1					
Religious Site 2					
Religious Site N					
Historical Sites					
Historical Site 1					
Historical Site 2					
Historical Site N					
Other Cultural Sites					
Cultural Site 1					
Cultural Site 2					
Cultural Site N					
TOTAL					

Step 2.3 Summarize the damages and losses in the sector in the State

Once the summary table for each affected District has been filled out, the information should be used to summarize the damages and losses at the State level. The summary table below can be used.

Table 4. Summary of damages and losses in a State

Name of State:								
Total number of people employed in cultural sites			**Male**		**Female**			
Type of Cultural or Heritage Sites	**Within the Disaster Year**				**Losses Beyond Disaster Year**			
	Damages		**Losses**		**Year 1**		**Year 2**	
	Public	**Private**	**Public**	**Private**	**Public**	**Private**	**Public**	**Private**
Museums								
Religious Sites								
Historical Sites								
Other Cultural Sites								
TOTAL								

Step 3. Analyze the impacts of the damages and losses to affected population

The assessment team of the sector should analyze all potential impacts of the damages and losses of the sector and must answer the following questions:

- Were workers laid off, leading to massive unemployment?
- Were livelihoods lost, especially those who depend on the arrival of tourists like tourist guides and micro-entrepreneurs engaged in handicrafts for souvenirs?
- What are the spiritual and cultural impacts of the loss of heritage, religious and historical sites?

The following matrix can be used to express the social impacts of the damages and losses to the tourism sector.

Matrix 1. Social impacts of the damages and losses to the tourism sector

Area of Impacts	Expected Impacts						Brief Description of Impacts
	General Population			Women and Children			
	S	M	L	S	M	L	
Employment							
Livelihoods							
Culture							
Others (Specify)							

Notes for filling Matrix 1

- *The expected impacts are segregated into a) the impacts on the general population; and b) the impacts on women and children measured as severe (S), moderate (M) or low (L). The assessment team should mark under the column whether the impacts are S, M or L.*
- *Severe impacts are very distinct and extensive change in the situation for more than 50% of the people in the sector, which will require outside assistance for more than 6 months to enable them to cope and recover.*
- *Moderate impacts are distinct changes in the situation affecting 20% to 50% of the people in the sector, which may require 3 to 6 months outside assistance to enable the people to cope and recover.*
- *Low impacts are distinct changes but affect less than 20% of the people and may not be widespread or only in limited areas, which may require less than 3 months of outside assistance before the people recover.*
- *The impacts can be briefly described under the column "Brief Description of Impacts". For example, a brief description of a severe "employment" can be the massive laying off of workers from the hotels and resorts; the "livelihoods" can be described as the loss of businesses that are dependent on tourist arrivals; while the impact to "culture" can happen if religious sites of worship are destroyed.*
- *The impacts on women and children may be different from the general population. The assessment team must be able to observe any special issues or concerns that may affect women.*

Step 4. Identify the recovery strategies and estimate recovery and reconstruction needs

The post-disaster needs must be based on a framework where policies and strategies are likewise integrated. After analyzing the potential effects and impacts if no assistance will be provided to the sector, the aggregate needs of the sector must be estimated.

Step 4.1 Identify recovery and reconstruction strategies

After the consolidation of the field assessment, the assessment team must identify or recommend the policies and strategies for the recovery and reconstruction for the sector. The following are some of the general policies and strategies that could be considered.

A. Policy measures

There are certain policies that can be adopted over a limited period, which can provide incentives to the private sector to reconstruct damaged assets with higher standards of resilience. Among them are:

1. Income tax breaks for private companies such as:
    a. Temporary reduction or freeze or deferment in the collection of tax;
    b. Temporary freeze on basic service charges in the utilization of certain services over the time of the recovery phase;
    c. Non-collection of property taxes for the duration of the recovery period;
    d. Exemption from registration fees for replacements of the destroyed equipment and machinery over a certain period of time.
2. Subsidizing construction materials and equipment to be imported by private companies during the recovery and reconstruction phase through an exemption from paying customs duties and other levies.
3. Extending bank guarantees on loans by the government to enable the private sector to rebuild immediately.

B. Strategies

The following strategies can be adopted for the post-disaster recovery and reconstruction activities:

a. **Building Back Better (BBB)**. Recovery activities based on BBB principles will promote longer-term disaster risk reduction and management. BBB principle should look at the how to make infrastructure and facilities safer from future disasters like stronger engineering design, the advantages of resettlement of facilities in disaster-safe areas instead of rebuilding in the same disaster-prone areas, etc.
b. **Focus on the most vulnerable and socially disadvantaged groups such as children, women, and the disabled**. Recovery programming needs to give priority to the most vulnerable groups, including female-headed households, children and orphans, and the poor, and take into account those with special needs.
c. **Community Participation and Use of Local Knowledge and Skills**. The participation of the community

in all process (identification, planning, design and implementation) of recovery activities will help ensure the acceptability of projects and optimize the use of local initiatives, resources and capacities.

d. **Secure development gains**. Recovery strategies, although may be a separate set of activities, must be supportive of existing development plans and must attempt to re-establish and secure previous development gains.

e. **Coordinated and coherent approaches to recovery**. Projects for disaster recovery must have the full and effective coordination among all involved agencies based on comprehensive information exchange, flexibility in administrative procedures, and uniformity of policies. In some instances, a special new agency may be needed to oversee, coordinate and monitor complex disaster recovery programs. Under this strategy, capacity building activities for the local public administration may be part of the recovery activities including a well-defined monitoring and evaluation system for the overall implementation of the recovery plan.

f. **Efficient use of financial resources**. The overall strategy should also include the identification of fund sources that are suited for the recovery activities. It should be clear how assistance to the recovery of the private sector would be delivered. Also, some cheaper source of funds from international donor partners should be initially identified for longer-term expensive projects.

g. **Transparency and accountability**. The overall plan and implementation of projects for recovery must be transparent, especially to those affected, through open and wide dissemination of information on all aspects of the recovery process. An effective monitoring system must be established.

Step 4.2 Estimate recovery needs

Recovery needs are intended to bring back normalcy in the sector as quickly as possible. Recovery activities should include those that will enable companies to resume their normal operations. Some of the possible recovery-related activities in the sector can include:

- Repairs of the damages to structures, which are normally affected by strong winds and floods and provide access to tourists.
- Emergency procurement of vital equipment necessary to normalize operations.
- Clearing of debris that may have affected the sector.

Step 4.3 Estimate reconstruction needs

Reconstruction needs are generally long-term in nature (3 years and more) and are intended to 'build back better' from the ruins of a disaster. It is to be noted that reconstruction activities should include both public as well as private facilities and may require different types of financing strategies. It is to be noted that since the companies in this sector are revenue-generating enterprises, financing their needs can come through soft-term credit schemes for the reconstruction and repair of their damaged assets. Such schemes can be accompanied by technical assistance for improved disaster resilient standards of construction. Some possible reconstruction related activities in the sector could include the following:

- Soft-term credit for the replacement or reconstruction of affected structures under a building-back-better strategy to ensure future disaster resilience through the adoption and enforcement of improved construction standards;
- Procurement of equipment and machinery;
- Structural retro-fitting of undamaged or partially damaged structures so that they are not affected by disaster event in the future;
- Relocation of facilities to safer areas; and
- Other mitigation measures such as construction of support infrastructure to prevent serious landslides and floods.

Step 4.4 Prioritize identified projects for recovery

Among the projects identified, relative priorities can be set in order to determine which among them are the more important. Based on the broad strategies for recovery, the assessment team should select the priority projects/activities among the identified needs. The prioritization can be made by using a set of impact indicators and the level by which the projects can achieve said impacts. Examples of the criteria that can be used are the following, among others:

a. Economic impact, which can be evaluated in terms of the relative cost to the government of not undertaking reconstruction or rehabilitation.

b. Equity and social impact, which can be in terms of the number of beneficiaries who are poor and destitute and who could not afford to rebuild on their own without outside support.

c. Sustainability, which can be in terms of the reduction of risks and vulnerability of the people and other economic assets to future disasters.

The criteria above can be placed in a matrix like the one below where the impacts are ranked according to low, medium or high.

This matrix can show the relative benefits of proposed projects to the people in the affected areas, which, in turn, will inform and assist the government in determining the priority projects within the sector.

Matrix 2. Impacts of identified post-disaster projects

Name of Proposed Project	Expected Impacts on Recovery								
	Economic Impact			Equity and Social Impact			Sustainability		
	High	Medium	Low	High	Medium	Low	High	Medium	Low

The projects identified by the assessment team must be included in the above matrix.

Step 4.5 Summarize the estimated recovery and reconstruction needs and draft the implementation schedule

Based on the prioritized recovery and reconstruction needs, a summary should be created by the assessment team enumerating the post-disaster projects for the recovery and reconstruction. The identified needs should have a rough schedule of implementation outlining at the very least the activities, timing and budget required for all the programs and projects. The following techniques can be considered:

1. Identify the specific projects according to their relative urgency or priority in relation to recovery.
2. Plot the timeline of activities of all the projects, with the urgent ones on top, in a Gantt chart with the corresponding funding requirement on an annual basis. This will assist the national government in programming the necessary funds over a certain time period, like on a quarterly or annual basis.
3. Identify and include in the list of projects that need further feasibility studies, which may be funded by foreign grants.
4. To the maximum extent possible, a logical framework (log-frame) should be created for each of the project proposed for inclusion in the recovery plan. Log-frames are normally required by foreign donors to consider project proposals.

The recovery and reconstruction needs of the sector can be summarized in the table below showing the financing requirements over the years. Reconstruction needs mostly require long-term implementation periods. They normally require three or more years to complete.

The following table can be used in plotting the implementation period of recovery and reconstruction needs.

Table 5. Summary of recovery and reconstruction needs of the sector

Name of Projects	Annual Needed Amount of Assistance (Rs.)			Total Needs (Rs.)
	Disaster Year	Year 1	Year 2	
Recovery Projects				
Total				
Reconstruction Projects				
Total				
GRAND TOTAL				

Notes for filling Table 5

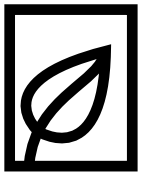
- *Project titles can be inserted under the column on recovery and reconstruction needs.*
- *Columns can be added to accommodate any additional reconstruction needs beyond Year 2.*

Step 5. Draft the post-disaster damages, losses and needs (PDNA) report of the sector

With all the information gathered using the previous steps, a report can be drafted by the assessment team, which will include the inputs of the sector in developing the overall recovery and reconstruction plan. The following format may be considered:

1. Brief description of the sector in the disaster-affected areas.
2. Damages in the sector by areas and by types of assets affected.
3. Losses in the sector emphasizing the losses in income, increase in expenditures, estimated period before normalcy will be attained, etc.
4. Impact on the livelihood, individual households, vulnerable groups and the consequences to the greater community if no assistance for recovery will be provided.
5. Proposed strategies for recovery and reconstruction of the sector.
6. Needs of the sector, by priority, and the draft schedule of implementation with the estimated funds required for each project over time.

The draft sector report should be submitted to the State Disaster Management Office for consolidation.



The Environment

This section contains the following contents – specific to this sector – in order to guide the user to successfully conduct post-disaster needs assessment in India:

1. **The Introduction to the Sector**
    a. Baseline information
    b. Post-disaster Situation and Performance
    c. Estimation of Disaster Effects
    d. Estimation of Disaster Impact
    e. Estimation of Post-Disaster Recovery and Reconstruction Requirements
2. **The Standard Procedure for the Sector Assessment**
    a. Recommended Assessment Team
    b. Steps in conducting a PDNA in the environment sector
        - Collect baseline information on sector assets and production flows
        - Estimate value of damage and production flow changes
        - Analyze the impacts of the damages and losses to affected population
        - Identify the recovery strategies and estimate recovery and reconstruction needs
        - Draft the post-disaster damages, losses and needs (PDNA) report of the sector

The user is advised to refer to:

a. *The "Introduction of the PDNA Manual" for a complete information of the concepts and definitions on the post-disaster needs assessment (PDNA);*
b. *The section on "Disaster Effects, Impact Assessment, Needs Estimation" for a more detailed discussion in identifying the possible impacts within and across sectors; and*
c. *The section on "Estimation of Post-Disaster Recovery and Reconstruction Needs" for a more detailed discussion on identifying and prioritizing post-disaster needs.*

Introduction

The environment is not an institutional sector of economic and social activity; rather, the environment is an issue that cuts across all sectors of economic and social activity. The environment is not included in the world-wide system of national accounts which is what countries use to keep track of the production of goods and services in all sectors of activity. One of the reasons for such exclusion is the fact that not all environmental assets and services have market values. Some industrialized countries are making use of a satellite account for the environment, which are often called "green accounts". India has an evolving green accounting system and the country is looking at viable international practices to adopt.

Nevertheless, it is possible to apply the existing methodology of assessing disaster impact and effects and of estimation of post-disaster needs for recovery and reconstruction to the case of the environment.[81] To be sure, disasters may generate changes that may destroy environmental assets or capital and/or to works, which have been built to take advantage of the assets, and may produce losses when the associated environmental services are reduced, diminished in quantity or rendered more costly.

For the analysis, it is essential to differentiate between built environment and natural environment, and to realize that essentially the formal sectors of agriculture, fishery, forest and tourism utilize the natural environment, while all other formal sectors of economic and social activity make use of the built environment.

For purposes of the assessment, environmental assets – which are subject to disaster-induced destruction – may be divided as follows:

– Physical (climate, air, soil and water);

– Biotic (human beings, flora and fauna);

– Perceptual (landscape, scientific and cultural resources); and

– Interactions between them.

Damage to the environment may be estimated as the value of fully or partially destroyed assets.

- If the destruction is permanent, the value of damage is equivalent to the commercial value of assets if there is a market for them.
- If there is no such market and a reversal of the environmental change is deemed feasible, the value of damage may be indirectly estimated as the cost of rehabilitating the affected assets.

As an example of this, if agricultural lands are completely destroyed and there is no possibility of rehabilitation (because of technical or economic reasons), the value of damage will be the value of the land. If there is hillside soil erosion, the value of damage may be estimated as the cost of stabilizing the slopes through soil conservation works. **It should be noted, however, that since lands are assessed in the agriculture sector, damages and losses to lands should be excluded in the environment sector assessment.**

[81]The reader is referred to the thorough discussion on this available in Handbook for Estimating the Socio-Economic and Environmental Effects of Disasters; Section Five, Environment, United Nations Economic Commission for Latin America and the Caribbean (UN-ECLAC), Santiago, Chile, 2003.

The disruption of production flows would refer to the temporary changes in the flows of environmental services. The services that those environmental assets provide to the society and economy include:

- Regulation of the water cycle;
- Carbon sequestering;
- Maintenance of the biodiversity;
- Recreation; and
- Degradation and transformation of waste.

It is recognized that the lack of markets for some environmental goods and services pose obstacles for evaluating the value of damage, and a solution is to make indirect estimations of such values. However, although the value of such services obtained from natural or unbuilt resources have been determined or measured in few countries, India has no established values yet. It is possible to transpose the values obtained in other countries to the conditions of India using as a basis the characteristics of the services and of the natural assets that render them possible.

Note that the disruption or losses of environmental service flows would occur from the time of the natural event that caused the disaster, to the time when the environmental assets have been rebuilt, either naturally or through man-made interventions to restore or rebuild them.

It is important to mention that the value of environmental losses accruing to built resources are routinely estimated under the formal sectors of economic and social activity that utilize them. Therefore, special care must be exercised by the environment assessment team not to duplicate the estimations of damage and losses of the environment that have been made, or which are to be made, by the separate assessment teams that cover the formal or institutional sectors of social and economic activity that utilize the environment. **Stating it differently, the environment assessment team should concentrate its efforts in estimating damage to natural or unbuilt resources and estimating losses in natural environment services only, to avoid double accounting of disaster effects**.

Disaster impact would refer to the consequences of the disaster effects in the environment. Post-disaster needs for recovery would be the value of activities designed to enable the return to normalcy of the services of the environment, while reconstruction requirements refer to the cost of man-made interventions to assist nature in rebuilding the assets of the environment to normal or pre-disaster conditions, when they are economically feasible.

a) Baseline Information

While the system of national accounts offers an accounting framework for analyzing and evaluating the performance of an economy, it does not cover the environment, as has been pointed out earlier. The concept of environmental accounting has arisen recently as a solution to such limitation, and involves the segregation and elaboration of accounts that include the assessment of environmental costs and benefits, as well as the accounting for the maintenance of tangible wealth.[82]

[82]See System of Environmental-Economic Accounting 2012, Central Framework, United Nations, New York, 2014.

India has been closely following such recent developments and, as a result, the Central Statistical Office in the Ministry of Statistics and Programme Implementation, through its Social Statistics Division, publishes an annual Compendium of Environment Statistics for India; its most recent version provides information updated through 2013.[83] The data included therein provides some of the baseline information required for disaster impact and post-disaster needs assessment, as it includes data on biodiversity, the atmosphere, land and soil, water and human settlements.

For the estimation of disaster effects and impact on the environment, baseline information must be collected in regard to the following assets and services of the environment within the disaster-affected areas, as the first stage of the assessment such as:

- Characteristics, extent and location of forests:
  - o reserved forests, protected forests, and unclassified forests;
  - o very dense forest, moderately dense forests, open forests;
  - o biosphere reserves, protected areas (incl. national parks, wild life sanctuaries, etcetera);
- Characteristics, extent and location of mangroves;
- Characteristics of protected areas, wildlife sanctuaries, and national parks; and
- Characteristics of physical infrastructure – such as bridges, roads, research facilities, observation towers, etcetera) available within protected areas or national parks.

The environment assessment team should also collect any existing reports that may provide information on the economic valuation of environmental services, which may be used in the estimation of the value of disruption on environmental service flows.

b) Post-Disaster Situation and Performance

After collecting and analyzing baseline information and any existing preliminary reports on possible damage to environment assets and disruption of environmental services caused by the disaster, the environment assessment team should undertake field visits to the disaster-affected areas to obtain first-hand information on disaster effects and impacts on the environment.

During these field visits, the team should obtain or verify data on the geographical extent and intensity of destruction that the environmental assets may have sustained, as well as of quantities and type of debris and mud that may have resulted after the disaster and which may need to be removed to appropriate and environmentally safe sites. In that respect, the environment assessment team should coordinate with the separate sectorial assessment teams to ensure that no duplication of efforts is made, bearing in mind that the sectorial assessment teams will be responsible for estimating damage and losses sustained by the environment in their respective areas of jurisdiction (e.g. in the built environment that each sector makes use of).

[83]See Compendium of Environment Statistics, India, 2014, Social Statistics Division, Central Statistical Office, Ministry of Statistics and Programme Implementation, New Delhi, 2014. Available in http://www.mospi.gov.in/.

In respect of environmental services that may have been affected, the environment assessment team should collect information concerning the geographical extent of such affected services and the degree of destruction that has been caused by the disaster (e.g. that 85 per cent of the area where carbon sequestering is normally made has reduced its capacity by, say, 50 per cent of the normal).

On the basis of the information thus collected in the field, the environment assessment team should be able to:

(i) determine which environment assets have been permanently destroyed and will not be able to recover at all;

(ii) develop a calendar for the (natural or man-assisted) recovery of environmental assets and services that can be achieved; and

(iii) estimate the financial requirements for such recovery activities.

c) Estimation of Disaster Effects

Destruction of environmental assets

As indicated before, an estimation of the value of destroyed environmental assets that are under natural or non-built conditions is to be made by the environment assessment team, while the separate sectorial assessment teams are to estimate the value of destroyed environmental assets in the built environment, since they are better positioned to make such analysis and quantification for use in the evaluation of disaster effects.

Therefore, the environment assessment team should concentrate its estimations on the value of destroyed environmental assets of natural forests, mangroves and protected areas. Such assessment involves the estimation (by actual physical measurement and/or by using aerial photography or satellite imagery) of the disaster-affected area of such resources, and of the degree of disaster-induced destruction. In connection to the latter, the following qualitative classification may be adopted for subsequent quantification of damage or destruction:

- Total destruction of environmental assets. This may occur when it is deemed impossible for the affected ecosystem to recover over, say, a period of 25 years or more, and the likelihood that the affected areas may be put to future use is nil.
- Very severe destruction of environmental assets refers to those that are serious and destructive with very extensive range or coverage, which will require high cost of rehabilitation.
- Severe destruction of environmental assets refers to extensive damage but with a possibility to partially recover over the medium to the long term at a very high cost.
- Moderate destruction will refer to the destruction of environmental areas that is feasible to recover in the short to medium term through introduction of costly to moderately costly remediation measures.
- Minimal or Slight destruction of assets are those that will require natural regeneration or low-cost assisted remedial measures that ensure short-term recovery.
- Zero destruction refers to destruction that is very negligible requiring natural generation in a short period of time.

In the case of timber products, since they have associated market values, the procedure for estimating the value of damage involves the estimation by the assessment team of the following:

(i) Define the extent of forest that is commercially harvestable in the disaster-affected area (as a percentage of the total affected area);

(ii) Define the relative extent of tree affectation using the previously-listed classification (i.e. total destruction, severe destruction, moderate destruction and slight destruction) expressing it in percentage terms of the total harvestable forest affected;

(iii) Obtain the equivalent harvestable area affected, using the aforementioned weighting factors;

(iv) Estimate timber yield per hectare of harvestable area (in cubic meters per hectare);

(v) Obtain average unit price of timber (Rupees per cubic meter); and

(vi) Estimate the value of the damage to timber in the affected area (multiplying iii, times iv, and v).

Other non-timber forests products that may have associated market values (such as honey, mushrooms, nuts, etcetera) may be subject to a similar procedure for the estimation of disaster damage.

The value of possible destruction or degradation of soil, water and air is to be estimated in the sectors where these environmental assets are directly utilized. In the case of agricultural lands and soils, they may be rendered useless for agriculture production through either erosion or sedimentation. Standards for soil erosion, in agriculture lands, have been defined by the United Nations Food and Agriculture Organization (FAO);[84] when these standards are exceeded, the land may not be usable for production and the value of damage would be equal to the pre-disaster commercial value of the land. In certain areas, sediment deposition may be so high – in some cases, more than 50 centimeters – that the soil may not be able to sustain agricultural production or may require remedial measures so costly as to render the operation un-economical, so that the value of damage may be equal to the pre-disaster commercial value of the land.

In the case of damage to water resources, the estimation of its value is quite complicated; but it may be possible to equate the value of damage to the cost of the remedial measures or investment required to restore the assets to its initial quantity and quality. In any case, such estimations are to be made by the water and sanitation assessment team, as its members are in the best position to make the required analysis, as well as to avoid double accounting.

In the case of damage or pollution to air, since there is no experience of costs to clean up and restore air quality after a disaster (such as after a volcanic eruption), the only indirect manner available is to equate the damage to the summation of the costs to treat patients for the disease caused by inhaling polluted air, the additional costs of deviating air traffic to avoid passing through the areas where ash is present in the vicinity of the volcano, and the losses in tourism revenues caused by the disaster[85]. **Again, such values of damage would be estimated by the separate assessment teams of health, transport and tourism sectors.**

The value of damage to destroyed infrastructure assets in natural parks and forest preserves (including, roads, bridges, observation towers, housing units for park rangers, research stations, etcetera) may be

[84]See A Provisional Methodology for Soil Degradation Assessment, Food and Agriculture Organization of the United Nations, Rome, Italy, 2008.

[85]The reader should be aware that in the absence of a procedure to estimate the value of degradation of the quality of air (damage, under the current methodology for disaster effects assessment), it has been necessary to equate damage to the resulting costs of solving the problems caused by the disaster, which are in fact changes in the flows of production under the same methodology.

obtained from the government institutions that operate them, and should be estimated by the environment assessment team, using the same characteristics they had before the disaster, in combination with the unit construction costs for them that prevailed at the time the disaster occurred.[86]

Disruption to environmental service flows

In order to estimate the possible, temporary disruptions to the flows of environmental services the environment assessment team may resort to the utilization of use and non-use values. Use values of environmental services may be direct and indirect. Direct use values refer to the goods and services produced by ecosystems, which may be used as inputs in productive processes; some of them have market values, such as timber, fuelwood and carbon. Indirect use values refer to environmental services provided by forest and other ecosystems including, inter alia: regulation of the water cycle, carbon sequestration, maintenance of biodiversity, recreation and degradation and transformation of waste, as was pointed out earlier.

While it has not been possible to locate quantitative information on the economic valuation of environmental services of forests in India, which could be used to estimate possible changes on environmental flows caused by disasters, indirect estimations on the economic loss of environmental service flows may be made using data from other countries. The environment assessment team should be aware that in recent years, efforts have been made to estimate the value of such services in ecosystems associated to the various life zones as defined by Holridge, as shown in the following table:[87]

Table 1. Average values of eco-systemic environmental services in the Holdridge life zones (US Dollars at 2000 prices per hectare per year)

Ecosystem	Average Value, US$/Hectare/Year
Polar Desert	94.22
Boreal Rainforest	106.25
Cool Temperate Desert	56.09
Cool Temperate Desert Scrub	117.00
Cool Temperate Steppe	90.73
Cool Temperate Rainforest	86.32
Cool Temperate Wet Forest	62.77
Warm Temperate Thorn Scrub	108.86
Warm Temperate Dry Forest	171.46
Warm Temperate Wet Forest	130.58
Subtropical Thorn Woodland	128.56
Subtropical Dry Forest	196.84
Subtropical Moist Forest	263.70
Subtropical Wet Forest	77.06
Subtropical Very Dry Forest	77.16
Tropical Dry Forest	101.32
Tropical Wet Forest	149.72

[86]Should design and construction standards for these works be required to improve disaster resilience or to reduce disaster risk, the additional costs (in comparison to the normal construction costs) are to be considered when estimating reconstruction requirements.

[87]See Mawdsley, Jonathan, O`Malley, Robin, and Ojima, Dennis S., A Review of Climate-Change Adaptation Strategies for Wildlife Management and Bio-Diversity Conservation, in Conservation Biology, Volume 23, No. 5, October 2009.

For some Central American countries, in an assessment of disaster impact caused by Hurricane Felix, data on the economic values of environmental services of forest ecosystems was utilized, as shown in Table 2:[88]

Table 2. Reference Values of Environmental Services Provided by Forest Ecosystems in selected countries of Central America (US Dollars at 2007 prices per hectare per year)

	Costa Rica		Honduras	Nicaragua
	Primary Forest	Secondary Forest		
Carbon Sequestration	38.00	29.26	35.00	35.00
Water Cycle Protection	5.00	2.50	9.00	9.00
Bio-diversity Protection	10.00	7.50	9.00	9.00
Ecosystem Protection	5.00	2.50	3.60	3.00
Total	**58.00**	**41.76**	**56.60**	**56.00**

The environment assessment team should be aware that data on the reference value of environmental services provided by other ecosystems – including coastal systems (mangroves and sea grass meadows), coral reefs, and others, are available as well in the scientific literature, which may be used in India with the necessary adaptations to supplement those shown above.[89]

For the estimation of changes and losses in environmental service flows due to damage to different ecosystems, the environment assessment team may use the above reference values, duly adapted to India conditions, and follow the steps:

(i) Ascertain the extent of destruction in the affected ecosystems;

(ii) Adopt the appropriate reference values per hectare per year for each type of environmental service normally obtained from the affected ecosystems, as described in Tables 16-1 and 16-2;

(iii) Estimate the time required for recovery of the disaster affected ecosystems; and

(iv) Estimate the present value of the losses in services over the entire recovery period required, adopting the typical discount rate for development projects used in India.

As an alternative to the above procedure, it would be possible to use the concepts and methods of contingent valuation, travel cost valuation, hedonic pricing and others, in the estimation of losses in environmental services. However, since the valuation of economic services has not yet fully developed in India, it is suggested that such impacts should be assessed qualitatively at present.

[88]See Impacto del Huracán Felix en la Región Autónoma del Atlántico Norte y de las lluvias torrenciales en el noroeste de Nicaragua, United Nations Economic Commission for Latin American and the Caribbean, Mexico, 2008, Carranza, C. et al, Valoración de los servicios ambientales de los bosques de Costa Rica, Ministry of Environment and Mining, San José, Costa Rica, 1996; and Constanza, Robert, et al, The value of the world´s ecosystem services and natural capital, University of Maryland, http://www.esd.ornl.gov/.

[89]In that regard, see The Economics of Ecosystems and Biodiversity (TEEB), Ecological and Economic Foundations, London, 2010. (http://www.teebweb.org/).

d) Estimation of Disaster Impact

The impact of the disaster on the environment may be expressed in terms of the percentage reduction in total environmental assets that existed prior to the disaster and of the fraction of carbon sequestration, regulation of the water cycle, and other environmental services that has resulted after the disaster. These are the consequences of the effects of the disaster on the environment in the affected area.

The environment assessment team should be aware that the estimated values of environmental asset destruction and of losses in environmental services are not to be used to estimate the macro-economic impact of the disaster, since these values are not used to estimate gross domestic product (GDP) at national or state levels. However, after the recovery and reconstruction requirements for the environment have been estimated, it is possible that the implementation of such programmes may involve the need to import assets or construction materials that have no domestic production in India, or the need to reduce exports of domestic products to meet the post-disaster internal demands. The environment assessment team should estimate the cost of those additional imports and the cost of the possible non-exports arising from the post-disaster recovery and reconstruction stages, and inform the macro-economic assessment team accordingly.

Furthermore, should any of those activities involve additional expenditures or any change in collection of taxes of any kind (increases in import duties or decline in export duties, as an example), such amounts are to be estimated by the environment assessment team and delivered to the macro-economic impact assessment team for inclusion in the analysis of fiscal impact.

e) Estimation of Post-Disaster Recovery and Reconstruction Requirements

For the case of the environment, recovery needs are defined as the expenditures required to assist nature in achieving the pre-disaster environmental services level provided by environmental assets that are capable of restoration (and which are not to be written off as totally destroyed). For that purpose, the environment assessment team should estimate the cost of the following activities:

- Removal of downed trees;
- Cost of control of invasive species in damaged areas to speed up recovery;
- Minus: any possible salvage revenue obtained from sale of downed trees.

Reconstruction needs include the financial amounts required to rebuild associated infrastructure and assets and to replant some tree species that may have been destroyed. These needs may include:

- Reconstruction of walking trails, internal roads, bridges, observation towers, research stations, nurseries, storage facilities, etc. located within forests and other ecosystems;
- Replanting or repopulating of trees in affected forests, with a view to restore the pre-disaster tree population and associated environmental services.

Similar estimations of recovery and reconstruction requirements are to be made for the case of other affected ecosystems.

The Environment

STANDARD PROCEDURES FOR SECTOR ASSESSMENT

Recommended Assessment Team

The composition of the sector assessment team may vary by the type of disaster and the extent of the likely damage and production flow changes.

Organization and Personnel	Role in the Sector Assessment

Personnel from:
• **State Department of Environment, Forest and Climate Change**
• **Local personnel of offices in the disaster-affected area:**
  • Environmental Specialist (Biodiversity / Ecology/ Pollution / Soil Degradation / Salinisation / Climate Change)
  • Environmental Economist
  • Environmental Impact Assessor
  • Communication Specialist
	Lead and coordinate

Personnel from:
• **Ministry of Environment, Forest and Climate Change who are:**
  • Environmental Specialist (Biodiversity / Ecology/ Pollution / Soil Degradation / Salinisation / Climate Change)
  • Environmental Economist
  • Environmental Impact Assessor
  • Communication Specialist
	Provide baseline information and facilitate the field assessment of damages and losses

Development partners (if active in the sector)	Participate and provide technical advice

Steps in conducting a PDNA in the environment sector

Introduction

The baseline information required in assessing the environment can be derived from existing background information available with respect to and in India. The baseline information in the PDNA Guidelines will only serve as a basis for the pre- and post-disaster conditions of the natural environment. The baseline information for the PDNA does not intend to replace whatever baseline other organizations, like IPCC, are using for India. On the other hand, information derived for PDNA should be seen in conjunction with data from national and international forums.

To avoid double counting, the environmental assessment should cover only the possible, temporary disruptions to the flows of environmental services utilizing the indirect use values which refer to environmental services provided by forest and other ecosystems including, inter alia: regulation of the water cycle, carbon sequestration, maintenance of biodiversity, recreation and degradation and transformation of waste. The following should be noted.

1. The value of possible destruction or degradation of soil, water and air is to be estimated in the sectors where these environmental assets are directly utilized, and not in the environment sector.
2. Direct use values (the goods and services produced by ecosystems used as inputs in productive processes) like timber, fuel wood and carbon have market values and as such they are assessed in other sectors like agriculture.
3. In the case of damage to water resources, the estimation of its value may be equated to the cost required to restore the assets to its initial quantity and quality. In any case, such estimations are to be made by the water and sanitation assessment team, as its members are in the best position to make the required analysis.
4. In the case of damage or pollution to air, since there is no experience of costs to clean up and restore air quality after a disaster (such as after a volcanic eruption), damages can be indirectly estimated by the cost of treating patients for the disease caused by inhaling polluted air; the additional costs of deviating transportation traffic; and the losses in tourism revenues among others. In the case of artificially-induced disasters connected with, for example industrial estates, the consequences of spills, explosions, fall outs, etc. are cross-cutting and across various media. A cumulative/integrated systems approach is needed for this purpose. Again, such values of damage would be estimated by the separate assessment teams of health, transport and tourism sectors.

Due to the difficulty in putting direct values in the damages and losses to the natural environment (which has no direct market values), the assessment of the environment sector needs to be more descriptive on the pre- and post-disaster natural environment condition.

Step 1. Collect background information on environmental assets and production flows, which can be used as the baseline for assessment

Baseline data or information is necessary to compare the pre- and post-disaster effects and impacts. The latest background information, studies, reports, etc. can be used as the references for which the post-disaster assessment can be based. They must be compiled before the field assessment or, if possible, prior to the occurrence of disaster and validated before the field visit. The following are some possible sources of background information from which baseline data can be based on:

- **Environmental profiles for the area/s or region.** Specific environmental details like forest cover, coral areas, biodiversity, etc. are available in some areas, districts, provinces or regions, which have environmental profiles used for their spatial development plans and other development activities. Satellite images and maps, if existing, will be extremely helpful.
- **Project reports from national and international environmental organizations.** Previous studies conducted by national or international agencies like environmental impact assessments of projects, environmental accounting and other environment-related assessments usually contain basic baseline information.
- **Wildlife and fisheries management plans.** Environmental management plans usually have baseline information in which the plan/s was/were based on.
- **National parks or marine reserves.** Specific databases must be available with the agencies in charge of national parks and marine reserves.
- **Local knowledge on natural resources management.** In some instances, local governments and institutions have environmental profiles on specific areas, which can be used as baseline.

Sources of Information

The sources of baseline information may vary by state so data can be compiled at the State/Region office or at the District levels. The list of the likely sources of information is provided below.

Ministry of Statistics and Programme Implementation	http://www.mospi.gov.in
The Registrar General & Census Commissioner, India	http://censusindia.gov.in
National Institution for Transforming India	http://niti.gov.in
Ministry of Environment and Forests	http://www.moef.nic.in
Ministry of Environment, Forest and Climate Change	http://envfor.nic.in
National Green Tribunal	http://www.greentribunal.in
Central Pollution Control Board	http://cpcb.nic.in
India Environment Portal	http://www.indiaenvironmentportal.org.in
Indian State-Level Basic Environmental Information Database (ISBEID)	http://isbeid.gov.in/home.aspx

Open Government Data (OGD) Platform India	https://data.gov.in
Forest Survey of India	http://fsi.org.in
State of Environment Atlas of India	http://www.soeatlas.org
Bhuvan, Indian Geo-Platform of ISRO	http://bhuvan.nrsc.gov.in

Note 1: Please use similar institutions at State level for baseline Information

Note 2: For Non-Government information sources, please search suitably

The result of this step will be a description of the pre-disaster environmental situation in the disaster-affected area/s. Particular attention should be given to special protected areas such as National Parks, UNESCO World Heritage Sites, Marine Parks, etc. Based on the above-mentioned sources of information, tables, maps and other quantitative information can be created.

The tables below can be used for the baseline information.

Table 1. Baseline information of environmental assets in a District

Name of District:				
Environmental Assets (Name)	**Number of Environmental Assets by Ownership**		**Area (Hectare)**	**Pre-Disaster Description and Characteristics**
	Private	**Public**		
Forests (Primary, Secondary, Mixed, Mangrove, others)				
Protected Areas (Wildlife Sanctuaries, National Parks, Wetlands, Coral Reefs, others)				
Other Environmental Assets (Areas of Importance: High Biodiversity, Breeding Grounds, Endangered Species, Landscape/Recreation)				
TOTAL				

Notes for filling Table 1

- *The above table will provide the assessment team with an overall picture of the environmental assets in the area, which will help prioritize the areas for post-disaster assessment and as a reference for the same.*
- *Note that the environmental assets are often closely linked to other sectors. For example, "natural formations" (e.g. underwater caves, rivers in caves, mountains etc. are estimated in the Culture Sector Assessment. The results of the sector assessments will be important for the Environment Assessment; special care should be taken to avoid double counting in the environmental assessment.*
- *"Ownership" refers broadly to management of the environmental asset (not specifically to ownership through legal land rights).*

Table 2. Baseline information of environmental service flows in a District

Environmental Service	Estimated Value of Service (Rs./Hectare/Yr)		
	Forests	Protected Areas	Other Environmental Assets
Carbon Sequestration			
Water Cycle Protection			
Bio-Diversity Protection			
Ecosystem Protection			
Recreation			
Others (Specify)			

Notes for filling Table 2

- *For estimates of baseline information of environmental service flows, it requires an estimated value of service per environmental service type.*
- *As this is an emerging area in India, if estimates are not already available from credible sources (e.g. scientific journals, comprehensive project environmental impact assessments), it is recommended NOT to estimate the value of services. The assessment of changes in environmental service flows after the disaster should instead be qualitatively assessed. As such Table 1 will suffice.*

Table 3. Assets of agency or company operating physical infrastructure at an environmental site

Name of District:			
Name of Agency or Company			
Category	Forests ( ) Protected Areas ( ) Other Environmental Assets ( )		
Ownership	Public ( ) Private ( )		
Number of employees	**Male**		**Female**
Assets	**Estimated Replacement Cost**		**Estimated Repair Cost**
Roads And Bridges			
Internal Roads (Km)			
Internal Bridges (M)			
Structures			
Living Quarters			
Research Facilities			
Observation Towers			
Other Buildings (Specify)			
Equipment			
Vehicles			
Machinery			
Others (Specify)			
Stocks/Inventories			
Materials/Stocks			
Others (Specify)			

Notes for filling Table 3

- *If roads and bridges are estimated in the transportation sector, they should not be included in the environment sector.*

Step 2. Estimate value of damage and production flow changes

With the baseline information, field assessment should be undertaken in the affected Districts after a disaster. The assessment team from the State must work with their local counterparts in the Districts to ensure that the estimates for the damages and losses in the sector are accurate to the extent possible.

Data gathering can be carried out at the actual affected areas through direct observations and consultations with the affected people. For areas that are inaccessible, data gathering can be done at local offices of agencies concerned with the environment combined with interviews of key government and non-governmental actors. Stakeholder consultations with representatives of the affected community that are inaccessible, including women, should be carried out if possible.

Step 2.1. Estimate the effects on environmental assets in the District

Due to the difficulties and uncertainties associated with quantitative valuation of environmental assets, the main assessment of post-disaster effects can be qualitative. The following matrix and table present a suggested format to aid the qualitative assessment; the environmental assessment team can revise the format if more detailed assessment is feasible.

Matrix 1. Qualitative criteria of environmental impact

Impact Level	Damage	Damage Description
A	**Total Destruction**	Total destruction of environmental assets. This may occur when it is deemed impossible for the affected ecosystem to recover over, say, a period of 25 years or more, and the likelihood that the affected areas may be put to future use is nil.
B	**Very Severe Destruction**	Very severe destruction of environmental assets refers to those that are serious and destructive with very extensive range or coverage, which will require high cost of rehabilitation.
C	**Severe Destruction**	Severe destruction of environmental assets refers to extensive ones but with a possibility to partially recover over the medium to the long term at a very high cost.
D	**Moderate Destruction**	Moderate destruction will refer to the destruction of environmental areas that is feasible to recover in the short to medium term through introduction of costly to moderately costly remediation measures.
E	**Minimal or Slight Destruction**	Minimal or Slight destruction of assets are those that will require natural regeneration or low-cost assisted remedial measures that ensure short-term recovery.
F	**Zero destruction**	Zero destruction refers to destruction that is very negligible requiring natural generation in a short period of time.

Using the above matrix, a qualitative assessment can be done using the table below.

Table 4: Qualitative post-disaster assessment of environmental assets

Name of District:				
Name of Area	**Special Features of Asset and Services Provided**	**Area Affected (Hectare)**	**Impact Level (A-F)**	**Immediate Physical Effects**
Area 1				
Area 2				
Area N				

Notes for filling Table 4

The areas can be the name of forests, protected areas, wetlands and other environmentally sensitive areas, which the assessment team must identify.

Step 2.2. Estimate the losses in environmental services in the District

After the qualitative assessment of environmental assets, the assessment team may decide to attempt a quantitative assessment of the losses in environmental services due to the destruction or degradation of the natural environment. This can be undertaken as a 'secondary' optional assessment, but due to difficulties for such a quantitative assessment, the results should be treated with caution. It is equally important to exercise caution by duly recognizing the limits and limitations of data sets and inferences. This is also due to paucity of adequate spread and depth of data through a systems perspective. If the quantitative value cannot be estimated at the time of assessment, Table 5 below can be disregarded.

Table 5: Initial Estimate of Losses in Environmental Services

Name of District:							
ESTIMATED LOSSES							
Losses in Environmental Service Provided	**Extent of Damage (%)**	**Recovery Time (Yrs)**	**Disaster Year**	**Year 1**	**Year 2**	**Years 3-10**	**Total (Rs.)**
Carbon Sequestration							
Water Cycle Protection							

Bio-diversity Protection							
Ecosystem Protection							
Recreation							
Others (Specify)							
TOTAL							

Notes for filling Table 5

If credible estimates for the value of environmental service flows already exist, it may be possible to estimate the losses associated with Forests, Protected Areas, and Other Environmental Assets. The baseline information on environmental service flows and estimated recovery time of the asset can be used to calculate associated losses. Otherwise, the effects and impacts due to the losses in environmental services should only be done qualitatively.

Step 2.3. Estimate the damages and losses to physical infrastructure for environmental assets in a district

Repair and replacement costs should be estimated for the damaged components of the company/ies including the estimated time needed to reconstruct the damages. The environmental assessment team should interview the officers of the company/ies operating the physical infrastructure at the environment site, to ascertain the extent and value of the damages and the estimated period before operations can be fully restored to the pre-disaster level. The officials and experts in the company/ies can estimate their respective damages more accurately.

Caution must be exercised in the valuation of environmental effects and impacts to avoid double counting. For instance, if the affected forests are commercial in nature, their effects should be included in the agriculture sector. The potential decline in fish catch due to the damages to corals and mangroves should be accounted for in the fisheries sub-sector while the cost of their rehabilitation (corals and mangroves) are in the environment sector. If, on the other hand, the effects are difficult to quantify (like the effects on biodiversity), the next best option is to qualitatively describe the physical effects on the natural environment.

The value of damaged assets can be summarized in the following table, which should be used in interviewing the officials as a questionnaire.

Table 6. Value of damages and losses of a company operating physical infrastructure at an environmental site

Name of District:						
Name of Company						
Category	Forests ( ) Protected Areas ( ) Other Environmental Assets ( )					
Ownership	**Public ( ) Private ( )**					
Number of Employees	**Male**		**Female**			
ESTIMATED DAMAGES						
Damage to Structures and Assets	**Totally Destroyed**		**Partially Damaged**		**Total Damages (Rs.)**	**Average Time to Replace or Repair (Days)**
	Number of Totally Destroyed	**Average Replacement Cost (Rs.)**	**Number of Partially Damaged**	**Average Repair Cost (Rs.)**		
	A	**B**	**C**	**D**	**E**	**F**
Internal Roads (km)						
(Surface Type)						
Internal Bridges (m)						
(Main Material)						
Structures						
Living Quarters						
Research Facilities						
Observation Towers						
Other Buildings (Specify)						

Equipment						
Vehicles						
Others (Specify)						
Stocks/Inventories						
Stocks/Materials						
Others (Specify)						
TOTAL						

ESTIMATED LOSSES (Rs.)				
Types of Losses	**Disaster Year**	**Year 1**	**Year 2**	**Total**
Foregone Income				
Cleaning up of Debris				
Higher Operating Costs				
Other Unexpected Expenses				
TOTAL				

Notes for filling Table 6

- *'Average Replacement Cost' will be the average pre-disaster value of the structures and assets that were totally destroyed while 'average repair cost' will be the estimated cost of repair of the partially damaged assets.*
- *In formula, the total damages of the companies surveyed will be (Column E) = (Column A) x (Column B) + (Column C) x (Column D).*
- *Years 1 to 2 are the years after the disaster.*
- *In case that the company is also assessed by the Tourism or Culture Assessment teams, the results must be validated to avoid double counting.*

Step 2.4. Summarize the damages and losses in the sector in a State

Once the assessment for each affected environmental asset has been completed at the District level, the

information should be used to summarize the damages and losses at the State level. The summary table below can be used.

Table 7. Summary of damages and losses in a State

Name of State:							
Environmental Asset Types	**Special Features of Asset and Services Provided**	**Area Affected (Hectare)**	**Impact Level (A-F)**	**Immediate Physical Effects**			
A. QUALITATIVE ASSESSMENT OF ENVIRONMENTAL ASSETS							
Forests							
Protected Areas							
Other Environmental Assets							
B. EFFECTS ON PHYSICAL INFRASTRUCTURE AT ENVIRONMENTAL SITES							
Total number of people employed by companies operating physical infrastructure for an environmental asset				Male	Female		Total
ESTIMATED DAMAGES							
Types of Assets	**Types of Damages**						**Total Damages (Rs.)**
	Totally Destroyed			**Partially Damaged**			
	Public	**Private**	**Total (Rs.)**	**Public**	**Private**	**Total (Rs.)**	
	A	**B**	**C**	**D**	**E**	**F**	**G**
District A:							
Company 1							
Company 2							
Company N							
District B:							
Company 1							
Company 2							
Company N							

TOTAL DAMAGES						
ESTIMATED LOSSES						
Type of Losses	**Losses (in Rs.)**					
	Within Disaster Year		**Year 1**	**Year 2**		**Total**
	Public	**Private**	**Public**	**Private**	**Public**	**Private**	
Foregone Income							
Cleaning up of Debris							
Higher Operating Costs							
Other Unexpected Expenses							
TOTAL LOSSES							

Step 3. Analyze the impacts of the disaster on the environmental resources, ecosystems as well as the potential impact on the economy and the people in the state

Environmental impacts can affect the population directly and indirectly whether in the short or long run. Direct short-term effects are visible and can be easily identified. In contrast, many indirect and usually long term environmental effects of disasters can involve changes in community structures and ecological processes that may not be well understood or visible.

The EA team should identify at least the qualitative impacts on the following:

1. Carbon sequestration
2. Water cycle protection
3. Bio-diversity protection
4. Ecosystem protection
5. Recreation
6. Strategic wildlife areas and highly diverse ecological and biological areas;
7. Areas important for the maintenance of species useful to agriculture, fish-farming, animal raising, etc.
8. Biological corridors and areas of seasonal importance to the feeding or reproduction of one or more species.
9. Woodlands, wetlands, etc. and the environmental services provided by these areas.
10. Impacts on the population such as potential reduction of air and water quality, increase or over population of one species that will be detrimental to the people (like mosquitoes, pests, etc.)
11. Potential or added risk of businesses and the people from future disasters, etc.

Step 4. Identify the recovery strategies and estimate recovery and reconstruction needs

Once the assessment has been completed, the strategies and needs to rehabilitate the environment can be estimated. The recommended strategies can include:

- Opportunities to re-orient livelihoods along sustainable pathways, using environmentally sound construction practices, introducing alternative energy options, identifying ecosystem restoration requirements; and main streaming disaster risk reduction.
- Understanding of the specific vulnerabilities of women and other groups, and identify their capacities and needs to engage in the environmental recovery process.
- "Build Back Better" by integrating environmental needs within early recovery programming and across the relevant relief and recovery clusters.

The identified needs should have a rough schedule of implementation outlining at the very least the activities, timing and budget required for all the programs and projects. The following techniques can be considered:

1. Identify the specific projects according to their relative urgency or priority in relation to recovery.
2. Plot the timeline of activities of all the projects, with the urgent ones on top, in a Gantt chart with the corresponding funding requirement on an annual basis. This will assist the national government in programming the necessary funds over a certain time period, like on a quarterly or annual basis.
3. Identify and include in the list of projects that need further feasibility studies, which may be funded by foreign grants.
4. To the maximum extent possible, a logical framework (log-frame) should be created for each of the project proposed for inclusion in the recovery plan. Log-frames are normally required by foreign donors to consider project proposals.

Reconstruction needs mostly require long-term implementation periods. They normally require three or more years to complete. The recovery and reconstruction needs of the sector can be summarized in the table below showing the financing requirements over the years.

Table 8. Summary of recovery and reconstruction needs of the environment sector

Name of Projects	Annual Needed Amount of Assistance (Rs.)			Total Needs (Rs.)
	Disaster Year	Year 1	Year 2	
Recovery Projects				
a.				
b.				
c.				
Total				

Reconstruction Projects				
a.				
b.				
c.				
d.				
Total				
GRAND TOTAL				

Notes for filling Table 8

- *Project titles can be inserted under the column on recovery and reconstruction needs.*
- *Columns can be added to accommodate any additional reconstruction needs beyond Year 2.*
- *It should be noted that some environmental areas assessed cuts across the borders of districts or even states. In such a case, the area should only be assessed as a single entity. Moreover, caution must be exercised that the identified needs of this sector are not included in the other sectors.*

Step 5. Draft the post-disaster damages, losses and needs (PDNA) report of the sector

With all the information gathered using the previous steps, a report can be drafted by the assessment team, which will be the inputs of the sector in the overall recovery and reconstruction plan. The following format may be considered:

1. Brief description of the sector in the disaster-affected areas.
2. Damages in the sector by areas and by types of assets affected.
3. Losses in the sector emphasizing the losses in the identified environmental services and the estimated period before normalcy will be attained, etc.
4. Impact on the livelihood, individual households, vulnerable groups and the consequences to the greater community if no assistance for recovery will be provided.
5. Proposed strategies for recovery and reconstruction of the sector.
6. Needs of the sector, by priority, and the draft schedule of implementation with the estimated funds required for each project over time.

The draft sector report should be submitted to the State Disaster Management Office for consolidation.

ABOUT THE INSTITUTE

National Institute of Disaster Management (NIDM) constituted on 30.10.2006 under The Disaster Management Act 2005 has been entrusted with the responsibility for planning and promoting training and research in the area of disaster management, documentation and development of national level information base relating to disaster management policies, prevention mechanism and mitigation measures. Re-designated from the National Centre for Disaster Management of the Indian Institute of Public Administration on 16th October 2003, NIDM is steadily marching towards the mission of making a disaster resilient India by developing and promoting a culture of prevention and preparedness at all levels.

FUNCTIONS

Under The Disaster Management Act 2005, the Institute, has been entrusted with the following functions:

- Develop training modules, undertake research and documentation in disaster management and organize training programmes
- Formulate and implement a comprehensive human resource development plan covering all aspects of disaster management
- Provide assistance in national level policy formulation
- Provide required assistance to the training and research institutes for development of training and research programmes for various stakeholders
- Provide assistance to the State Government and State training institutes in the formulation of State level policies, strategies, disaster management framework and any other assistance as may be required for capacity building
- Develop educational materials for disaster management including academic and professional courses
- Promote awareness among stakeholders including college or school teachers and student, technical personnel and others associated with multi-hazard mitigation, preparedness and response measures
- Undertake, organize and facilitate study courses, conferences, lecturers, seminars within and outside the country to promote the aforesaid objectives
- Undertake and provide support for publication of journals, research papers and books as well as establish and maintain libraries etc.

nidm
Resilient India - Disaster free India

National Institute of Disaster Management (NIDM)
(Ministry of Home Affairs, Government of India)

A-wing, 4th Floor, NDCC-II Building, Jai Singh Road, New Delhi - 110001
Website : www.nidm.gov.in

978-93-82571-29-2

Design & Print : kam@kamstudio.net