THE WORLD BANK

SAMIA AMIN and
MARKUS GOLDSTEIN, Editors

DATA against NATURAL DISASTERS

ESTABLISHING EFFECTIVE SYSTEMS FOR RELIEF, RECOVERY, AND RECONSTRUCTION

Data Against Natural Disasters

Data Against Natural Disasters

Establishing Effective Systems for Relief, Recovery, and Reconstruction

EDITED BY

Samia Amin

Markus Goldstein

THE WORLD BANK

Washington, DC

1818 H Street, NW
Washington, DC 20433
Telephone: 202-473-1000
Internet: www.worldbank.org
E-mail: feedback@worldbank.org

1 2 3 4 11 10 09 08

ISBN: 978-0-8213-7452-8
eISBN: 978-0-8213-7453-5
DOI: 10.1596/978-0-8213-7452-8

Library of Congress Cataloging-in-Publication Data

Data against natural disasters : establishing effective systems for relief, recovery and reconstruction / [editors Samia Amin, Markus Goldstein].
p. cm.
Includes bibliographical references and index.
ISBN 978-0-8213-7452-8 — ISBN 978-0-8213-7453-5 (electronic)
1. Disaster relief—Developing countries—Case studies. 2. Information storage and retrieval systems—Natural disasters—Case studies. 3. Emergency management—Developing countries—Case studies. I. Amin, Samia, 1980, II. Goldstein, Markus P., 1970.
HV555.D44D38 2008
363.34'80684—dc22
2007051395

Cover design by: Serif Design Group, Inc.

Information is not knowledge.

Albert Einstein

Contents

Part Two

Box

Figures

Tables

Foreword

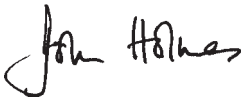
In recent years, the world has witnessed both massive destruction caused by natural disasters and immense financial and physical support materializing for the victims of these calamities. Climate change can reasonably be expected to increase countries' vulnerability to natural hazards in the future. So that these natural hazards do not become man-made disasters, we require effective systems to identify needs, manage data, and help calibrate responses. Such systems, if well designed, can help coordinate the influx of aid to ensure timely and efficient delivery of assistance to those who need help most. The emphasis on aid effectiveness is particularly important in the context of disaster response because, as is now clear, vulnerability to natural disasters and inefficiencies in aid distribution may lead to unnecessary economic losses, increased suffering, and greater poverty. For those committed to saving lives, fighting poverty, and spurring development, early preparation for effective disaster management is critical.

Data Against Natural Disasters makes a valuable contribution to our understanding of the conditions and actions necessary for establishing effective disaster management information systems. The volume's introductory chapters outline the data needs that arise at different stages in disaster response and explore the humanitarian community's efforts to discover more effective mechanisms. These overviews are preceded by an introduction that summarizes some of the key lessons one may derive from the six country case studies that constitute the rest of the volume.

These six case studies examine country-level efforts to establish information management systems to coordinate disaster response. Not all of

the attempts proved successful, but they included important technical and institutional innovations that are worthy of study. Collectively, they yield important lessons both for forward-thinking countries seeking ex ante disaster preparedness and for humanitarian responders hoping to implement good systems quickly after calamities have struck. This volume will, we hope, increase the resilience of poor countries facing the inevitable threat posed by natural hazards.

Danny Leipziger
Vice President and Head of Network
Poverty Reduction and Economic Management
World Bank



John Holmes
Under-Secretary for Humanitarian Affairs and Emergency Relief Coordinator
United Nations

Acknowledgments

This book has benefited from the guidance of Margaret Arnold, Uwe Deichmann, and Ian O'Donnell, who served as peer reviewers. We thank them for their insightful and valuable comments. We also thank Louise Cord for her guidance and Marcin Sasin for his invaluable efforts in defining the work program. We are grateful to Brendan McDonald and Patrick Gordon (United Nations Office for the Coordination of Humanitarian Affairs) for their collaboration with us on this project.

The initial design of this study and the identification of case studies benefited tremendously from the comments of a large number of people. We would like to thank, in particular, the following individuals for their input on the topic and the case studies selected for this volume: Margaret Arnold, Jehan Arulpragasam, Piet Buys, Uwe Deichmann, Wolfgang Fengler, Saroj Jha, and David McKenzie (all of the World Bank); Maxx Bonnel and Lynette Larson (United Nations Office for the Coordination of Humanitarian Affairs); Omar Dario Cardona (IDEAS); Caroline Clarke (Inter-American Development Bank); Louise Comfort (University of Pittsburgh); Marcus Cox (Agulhas); Paul Currion (Emergency Capacity Building Project); Claude de Ville de Goyet (International Disaster Preparedness, Inc.); and Max Dilley (United Nations Development Programme).

We would also like to thank Robert Zimmermann for his meticulous editing of the manuscript, and Stephen McGroarty, Andrés Meneses, Nora Ridolfi, and Dina Towbin for their excellent work in producing this volume. Valuable logistics support was provided by Cécile Wodon.

Individual chapter authors have added acknowledgments in their chapter notes.

Data Against Natural Disasters has been financed through generous grants from the Global Facility on Disaster Risk Reduction and the Trust Fund for Environmentally and Socially Sustainable Development.

Contributors

Samia Amin worked on impact evaluation and monitoring systems as a junior professional associate at the Poverty Reduction Group at the World Bank in 2006–08. She received a bachelor's degree in political science and French from Middlebury College and a master's degree in public policy from the John F. Kennedy School of Government, Harvard University. She has worked as a junior fellow at the Carnegie Endowment for International Peace, where she researched issues of nation building and nuclear nonproliferation. Her primary interest is education policies in developing countries as a means of spurring human development. Her recent work includes the book, *Are You Being Served? New Tools for Measuring Service Delivery* (World Bank 2008).

Marcus Cox is a director of Agulhas, a London-based development consultancy providing research, analysis, and policy advice for multilateral and bilateral clients. His specializations include aid effectiveness, political economy analysis, fragile states, and the rule of law. He has worked extensively in the Balkans and Southeast Asia. He holds a PhD from Cambridge University in post-conflict state building and is senior editor at the European Stability Initiative, a nonprofit research and policy institute.

Claude de Ville de Goyet retired in 2001 as director of the Emergency Preparedness and Disaster Relief Coordination Program of the Pan American Health Organization, where he was involved in the development of the logistics support system. He has over 40 years of experience in disaster risk reduction and humanitarian assistance. He is now a senior consultant with

bilateral aid organizations and the international community. A medical doctor, he also has a bachelor of science degree in operational research and computer sciences and a postgraduate degree in public health and tropical medicine. He is the author of numerous publications.

Markus Goldstein is a senior economist in the Poverty Reduction Group at the World Bank, where he works on poverty analysis, monitoring, and impact evaluation. His recent research involves work on HIV/AIDS, land tenure, poverty measurement, risk, and intrahousehold allocation. He is the author or coauthor of many scholarly articles and books, including the recent books, *Beyond the Numbers: Understanding the Institutions for Monitoring Poverty Reduction Strategies* (World Bank 2006) and *Are You Being Served? New Tools for Measuring Service Delivery* (World Bank 2008). He has taught at the London School of Economics, the University of Ghana, and Georgetown University.

Patrick Gordon is a specialist in the development of information platforms to support coordination efforts within host governments and the United Nations during the onset of natural disasters and ongoing complex emergencies. He is currently serving as technical coordinator at the United Nations Office for the Coordination of Humanitarian Affairs, where he is responsible for leading and managing all technical subprojects. Previously, he was manager at the United Nations Humanitarian Information Centre established in January 2005 in response to the tsunami in Sri Lanka. His work experience covers more than 20 years in communications and information management in development and in humanitarian and emergency response.

Brendan McDonald has been working in humanitarian affairs since 1999. He is currently manager of the Field Information Services Unit, United Nations Office for the Coordination of Humanitarian Affairs, New York. The unit seeks to facilitate and promote the use of information to support the provision of humanitarian assistance in complex emergencies and sudden-onset disasters. He has also worked with nongovernmental organizations, including CARE International in Kosovo, and Children's Aid Direct in the Democratic People's Republic of Korea. Previously, he served with the Australian Regular Army for 10 years. He holds a master's degree in social science (international development), Royal Melbourne Institute of Technology.

Jock McKeon is with the Poverty Reduction Group, Poverty Reduction and Economic Management Network, World Bank. Since late 2006, he has been based in Banda Aceh, where he leads World Bank assistance in monitoring reconstruction funds in Indonesia. Since 2005, he has been tracking reconstruction finances as a consultant with the United Nations Development Programme and the World Bank in tsunami-affected Indonesia, the Maldives, Sri Lanka, and Thailand and, more recently, in Myanmar, which has been affected by Cyclone Nargis. He has extensive experience with the development assistance databases used throughout the region. Previously, he worked as an insurance specialist for Australia's banking and insurance regulator.

M. A. L. R. Perera is senior associate at Health Policy Research Associates (Pvt) Ltd. in Colombo, Sri Lanka. He is a health systems management specialist. He holds various degrees, including a master's in medical science (community medicine) and a doctor of medicine degree. He is a board-certified consultant in community medicine at the Post Graduate Institute of Medicine, Colombo University, among numerous other teaching and consulting posts. He was the Sri Lanka national point person for disaster prevention and management from 1986 to 1994, and was responsible for initiating the national disaster prevention and management program.

Marcin Sasin is an economist with the Poverty Reduction Group of the Poverty Reduction and Economic Management Network at the World Bank. His current research lies at the intersection of poverty, migration, climate change, and disaster reduction. He spent three years as the World Bank country economist in Poland. He has written numerous papers on currency crises, labor market performance, and household welfare.

Abbreviations

BRR	Agency for the Rehabilitation and Reconstruction of Aceh and Nias (Indonesia)
CENOE	National Emergency Operations Center (Mozambique)
CONRED	Office of National Coordination for Disaster Reduction (Guatemala)
DPC	Directorate of Civil Protection (Haiti)
ECLAC	United Nations Economic Commission for Latin America and the Caribbean
ERRA	Earthquake Reconstruction and Rehabilitation Authority (Pakistan)
FOSS	free, open-source software
GIST	geographic information support team
HIC	Humanitarian Information Center
IASC	Inter-Agency Standing Committee (United Nations)
INGC	National Institute for Disaster Management (Mozambique)
IT	information technology
LSS	logistics support system
MINUSTAH	United Nations Stabilization Mission in Haiti
NGO	nongovernmental organization
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
PAHO	Pan American Health Organization
PERRA	Provincial Earthquake Reconstruction and Rehabilitation Authority (North West Frontier Province, Pakistan)

RAN	Recovery Aceh Nias Database
Risepak	Research and Information System for Earthquakes—Pakistan
SERRA	State Earthquake Reconstruction and Rehabilitation Authority (Azad Jammu and Kashmir)
SUMA	humanitarian supply management system
TEC	Tsunami Evaluation Coalition
TRIAMS	Tsunami Recovery Impact Assessment and Monitoring System
UN	United Nations
UNDAC	United Nations Disaster Assessment and Coordination
UNDP	United Nations Development Programme
UNGIWG	United Nations Geographic Information Working Group
UNICEF	United Nations Children's Fund
UNSDI	United Nations Spatial Data Infrastructure
WFP	World Food Programme

All dollar amounts (US$) are U.S. dollars unless otherwise indicated.

PART ONE
INTRODUCTION

1

Using Data Against Disasters: Overview and Synthesis of Lessons Learned

Samia Amin, Marcus Cox, and Markus Goldstein

Introduction

There is a clear consensus within the humanitarian community today: natural disasters have become a constant feature of the global landscape. Climate change is likely to increase the incidence of extreme weather events and add to the continuing threat of earthquakes. Inevitably, the impact falls hardest on poor communities in the developing world that have the fewest resources for coping with disaster. We may have once thought of disasters as occasional setbacks in the development process. It is now obvious that vulnerability to disaster is a key element of underdevelopment and a major barrier to achieving the United Nations Millennium Development Goals.

The consensus has major implications for how we should respond to disasters. Ad hoc responses hastily assembled in the aftermath of a disaster are not equal to the task. Major investment is needed to build permanent response capacity in countries and across the world.

Information management systems are a critical element of effective response capacity. Responding to a major disaster involves numerous challenges in information management: tracking displaced and vulnerable populations; logging the damage to housing, infrastructure, and services;

dealing with the sudden influx of humanitarian supplies; and coordinating the work of dozens and even hundreds of responding agencies. Essential information is controlled by many autonomous actors, and these actors may be working together for the first time. Developing systems that enable the information to be shared and analyzed to target resources is fundamental to building better response capacity.

This volume contains six case studies of initiatives to improve information management during the various phases—risk reduction, relief, early recovery, and recovery and reconstruction—in the response to disaster. The case studies are on Guatemala, Haiti, Indonesia, Mozambique, Pakistan, and Sri Lanka (table 1.1). In each country, new systems have been developed by the government, international humanitarian agencies, or civil society actors to answer the information challenge by facilitating the management of humanitarian supplies, collecting information on needs, assisting displaced populations, and undertaking reconstruction. Not all the initiatives have been rewarded with success, but each offers important technical and institutional innovations. Together, they provide a valuable body of evidence on ways to begin to address the problems in information management during disasters and on the pitfalls that new projects are likely to encounter. (Key lessons shared among the case studies are synthesized in the penultimate section of this chapter.)

The volume also contains two other introductory chapters. In chapter 2, Claude de Ville de Goyet dissects the difficulties in information management during the response to disasters. Disaster response involves a spectrum of activities, including efforts to enhance preparedness and reduce risk, needs assessment, damage and loss assessment, emergency relief, and long-term recovery. Organizations have specialized in particular aspects of disaster response. For example, nongovernmental organizations (NGOs) and the United Nations Office for the Coordination of Humanitarian Affairs focus on humanitarian response, while bilateral donors, the United Nations Development Programme, and the World Bank are primarily concerned with recovery and reconstruction. However, there is also considerable overlap in institutional mandates and the timing of the interventions of various organizations.

Each phase of disaster response presents particular information management difficulties. Thus, risk reduction and disaster preparedness require the collection of baseline information on communities, services, and infrastructure, but this information is usually scattered across many public bodies. The case studies show that even an apparently straightforward task, such

TABLE 1.1 The Phases of Disaster

Country	Disaster	System	Function
Guatemala	Hurricane Stan 2005	logistics support	inventory management: humanitarian supplies
Haiti	Hurricane Jeanne 2004 Gonaïves floods 2004 humanitarian crises	humanitarian supply management	inventory management: humanitarian supplies
Indonesia	tsunami 2004	reconstruction coordination and reporting	reconstruction assistance tracking: commitments and disbursements, gap analysis, high-level coordination and reporting
Mozambique	floods and cyclone 2007	emergency operations centers	information exchange: coordination, search and rescue, provision of relief supplies to temporary settlements
Pakistan	earthquake 2005	earthquake research, information, and relief monitoring	compilation of basic and baseline data in villages, monitoring relief activities and unmet needs
Sri Lanka	tsunami 2004	disaster information management	disaster response: Web-based applications

Source: Author compilation.

as the collection of precise information on the names and locations of rural communities, is problematic in areas where accurate maps, technical capacity, and shared languages are in short supply. Needs assessments and damage assessments should reflect commonly accepted standards and definitions and should be made available on various media and digital platforms so that they may be shared across agencies. Search and rescue operations, evacuations, and care for victims of trauma all must be planned and coordinated. Large-scale emergencies tend to trigger a mass influx of humanitarian supplies, often of questionable relevance and quality. These relief goods must be sorted through, logged, and distributed. There may be dozens or even hundreds of organizations engaged in relief and reconstruction, and the activities of these organizations must be tracked to identify gaps and redundancies. In emergencies, improvements in efficiency translate quickly into more saved lives.

De Ville de Goyet, in chapter 2, explains why information management in emergency situations has traditionally been so difficult. Under emergency conditions, humanitarian actors necessarily assign a higher priority to the speed of response; no one has the time to collect and transmit detailed statistics on the needs of scattered populations or on the accuracy of aid deliveries according to any sort of program for targeting assistance. The time constraints favor a culture of improvisation rather than evidence-based decision making. De Ville de Goyet points out that the distribution of humanitarian supplies is generally more responsive to media pressure than to evidence on the precise distribution of needs. Humanitarian agencies have tended to operate largely in isolation from each other. They carry out separate fact-finding missions and invest in custom-tailored proprietary information systems. The lack of coordination is exacerbated by gaps and redundancies in mandates and the often sharp differences in organizational culture among the actors engaged in the various overlapping phases of disaster response. The information gathered (frequently too late) for emergency relief is rarely of a nature or in a form that might support reconstruction or long-term recovery.

In recent years, there have been many attempts to address these problems. Brendan McDonald and Patrick Gordon, in chapter 3, describe ongoing efforts by the United Nations and the Inter-Agency Standing Committee, a forum for coordination between the United Nations and humanitarian agencies. In 2005, the committee endorsed the cluster approach, which aims to strengthen coordination globally and in the field by nominating lead agencies for particular clusters, sectors, or themes of action. The cluster

approach has provided an opportunity to address long-standing issues in information management during disaster response. The committee has invited cluster leads to gauge the feasibility of developing common standards, methodologies, and indicators to facilitate coordination within and among responders. It has also established the geographic information support team and the United Nations Geographic Information Working Group to promote the adoption of standards for spatial data. A key part of this effort is the United Nations Spatial Data Infrastructure, which promotes the development of a framework for sharing, processing, applying, and maintaining spatial data sets within an environment of agreed technologies, policies, and standards. These initiatives are in their infancy.

Hereafter, we compare and contrast the six case studies to identify common problems and highlight different approaches to solutions. We hope this may be a useful reference for anyone wishing to design a fresh approach or improve an existing one. We draw out larger themes that recur across the case studies. One theme is the importance of regular investment in national disaster information management systems as part of an effort to build a permanent disaster response capacity. Information management systems housed in national institutions and linked to national mechanisms for disaster response may be preferable in terms of competence and sustainability, but, during complex emergencies, the option may not be available. Another theme is the importance of linking disaster information platforms to established procedures and institutional structures for disaster response to guarantee operational relevance and ensure that stakeholders and responders are already familiar with the needs and requirements of the platforms. A third theme is the difficulty of coordination in information management and the shifts in information needs across the phases of a disaster response.

The experiences on which the case studies are based were not especially positive on any of these points. The tendency has been to develop and implement information management solutions only during the response to a disaster. However, in the scramble during a major disaster, it is difficult to persuade numerous actors to invest time and effort in applying new ways of dealing with information. Many of the initiatives described here failed to take root despite promising technical advances in system design. Moreover, as the case studies make clear, the incentives and institutional cultures of the humanitarian actors tend to operate against effective information sharing. The focus of these actors is on carrying out their mandates and following their institutional imperatives rather than on contributing to system development during a disaster. Attracting buy-in among many

actors with urgent and competing agendas emerges as perhaps the biggest challenge of all.

The next section supplies an overview of the six case studies and explores the design and institutional context of the disaster information management systems. In particular, it focuses on the need to create more incentives so stakeholders will use and contribute to such systems. The subsequent section compares and contrasts technical design features across the six systems. The penultimate section summarizes the lessons for the future, and the final section concludes.

Thinking Systematically about Data and Disasters

What is the Purpose of a Disaster Information Management System?

Across the six case studies, the answers to the question in the title above are diverse. Among the broad range of information needs involved in disaster response, these systems have mainly focused on serving one or two narrow ones. The most effective of these systems have been closely linked to a particular decision point or operating procedure and thus have satisfied the demand for a specific type of data.

The Guatemala case study (chapter 4) describes an inventory management system for humanitarian supplies implemented during and immediately following Hurricane Stan in 2005. This logistics support system (LSS) had evolved from a regional initiative of the Pan American Health Organization. It is a joint undertaking of six United Nations agencies—the Office of the United Nations High Commissioner for Refugees, the Pan American Health Organization, the United Nations Children's Fund, the United Nations Office for the Coordination of Humanitarian Affairs, the World Food Programme, and the World Health Organization—and incorporates features of systems used by the United Nations Joint Logistics Center and others to track commodities. It has been implemented during nine disasters since 2005.

The LSS represents an attempt to deal technologically with the large volumes of unsolicited goods of varying quality and usefulness that tend to arrive at a country's borders, ports, and airports in the aftermath of a major disaster. There are significant costs associated with the storage and transport of humanitarian supplies, and urgently needed items are easily lost among the mounds of low-priority goods. The LSS is a system for logging and classifying relief aid at the points of entry and then tracking the storage,

transport, and distribution of the relief goods and donated items. The database includes information on the agencies responsible, the location of the relevant storage facilities and delivery destinations, and the final beneficiaries, which, in the case of Guatemala, were the people in areas affected by the hurricane. The system is designed to be used as a tool in coordinating relief rather than as a means of exercising direct operational control over the response to a disaster. The agencies responsible for the goods may have their own computer-based inventory management systems, from which data should be exported to the LSS for central consolidation. However, in Guatemala, many line agencies did not have inventory management systems; they therefore used the LSS for internal management as well. In principle, the LSS is capable of matching supplies to needs and ensuring more efficiency in covering gaps, but, in Guatemala, there was no systematic logging of information on needs, so the matching did not occur.

The case study concludes that the main value of the system was the transparency and accountability imposed at higher levels because of the data reporting process. In the past, the distribution of humanitarian supplies in Guatemala had been carried out in an ad hoc manner, and there was a widespread perception of corruption and mismanagement. The LSS enabled line agencies to demonstrate their probity, increasing public trust in the system. Administrators also claimed that the existence of the robust reporting mechanism helped shield them from demands by politicians to divert supplies to particular constituencies.

The case study on the floods and the cyclone in Mozambique in 2007 (chapter 6) describes an information system that was used mainly to manage the delivery of relief supplies to temporary camps for persons affected by the weather disasters. However, in the face of severe capacity constraints and the near absence of a communications infrastructure, the feat was accomplished without any great technical sophistication. The National Emergency Operations Center maintained a registry of temporary camps, and the delivery of daily supplies was coordinated from there. Each day, assessment teams would provide information on the needs of each camp and on access conditions. These data were compiled into spreadsheets and shared among agencies through portable flash drives. This was a simple, but effective, way of operating in a restricted communications environment.

The Research and Information System for Earthquakes—Pakistan was developed through a civil society initiative in the aftermath of an earthquake in 2005 (chapter 7). The primary role of the system was to provide detailed information on basic needs in villages and towns to improve the

coverage of the humanitarian response. The motto of the developers of the system was No Village Left Behind. Responding to a lack of disaggregated baseline information, the system relied on census data to identify communities and the level of community access to services and infrastructure before the earthquake. The system involved links between this information and surveys and other reports on damage and basic needs. In principle, humanitarian agencies were also supposed to enter data on their activities in each village to create a self-coordinating environment. However, for reasons discussed below, this proved difficult.

The Indonesia case study highlights a system developed by the World Bank and the government to support reconstruction planning in Aceh Province and on the island of Nias following the tsunami in 2004 (chapter 5). The system was expected to serve as a tool in reconstruction planning. Project data produced by the government, international donors, and the largest NGOs were compiled to provide information on funding allocations and disbursements according to donor and sector. Because the system facilitated a comparison of this information and the results of a joint needs assessment, users were able to understand at a glance selected indicators of progress, by location and sector, in meeting core minimum needs (measured according to infrastructure and services available before the tsunami) and commitments to better rebuilding. Donors used these data to identify funding gaps and prepare progress reports. Perhaps the primary value of the system was in supporting macrolevel reporting, thereby assisting the largest actors in reconstruction in performing a time-consuming task.

Uniquely among the six case studies, the Sahana system in Sri Lanka purported to be a software platform capable of encompassing all phases of a disaster response (chapter 8). The system offered Web-based applications that relied on open-source software. The applications included the following:

- A bulletin board for tracking missing persons
- A registry of vulnerable children
- A registry of humanitarian NGOs and their activities
- A registry of temporary camps, including tracking records on camp populations, facilities, and needs
- A clearinghouse linking supplies with requests for assistance
- An inventory management system for humanitarian supplies
- A roster of volunteers
- A messaging and communications system
- Situation reporting and incident mapping

Sahana is unusual among the cases we study in that it was applied little in the country in which it was developed. The system was created by volunteers in the aftermath of the tsunami, and adoption among relief agencies was limited. Nonetheless, the system is interesting as an ambitious attempt to establish a comprehensive platform for disaster information management and to improve coordination across numerous tasks and actors, which is precisely the sort of system practitioners have been calling for.

The Hidden Wiring

An important message emerges from the case studies: an effective disaster information management system requires a good technological platform, but also much more. Software programs for storing, sharing, and manipulating data for disasters are being developed or patched together at a steady pace, often in the aftermath of disasters. The real difficulty lies in anchoring these technological approaches in an appropriate institutional context where they are supported by relevant and effective operating procedures, agreed terminology and data labeling, and a shared awareness of the benefits of proper handling of disaster information. Clearly, a disaster information management system must be supported by accepted rules, procedures, and relationships that encourage, facilitate, and guide the production, sharing, and analysis and use of data in response to disaster. In these case studies, the institutional dimension—the hidden wiring—determined the effectiveness of the systems.

Most of the systems were developed in response to a disaster and implemented during the emergency relief phase. The design of the links among institutions and the relevant institutional structures tended to be neglected in favor of solutions to data gathering, processing, and access issues. Not surprisingly, in the midst of the major emergencies, more immediate problems on the ground took priority over institutional questions and long-term sustainability. This is a key reason why a disaster information management system should be erected during the calmer periods outside the context of disaster. A system is much more likely to be effective during disasters and sustainable after a disaster if it has been developed and provided with a permanent institutional home and support structures in such a context.

Among the case studies, only in Guatemala and Mozambique were the systems located within a permanent national organization dedicated to disaster response. (Such a permanent organization also exists in Indonesia, but the information management system analyzed in the Indonesian case study was not developed within that organizational structure.) In Guatemala,

the Office of National Coordination for Disaster Reduction has been in place for three decades. The organization has a direct line to the office of the president, and its authority to coordinate across government is unchallenged. During a national emergency, the Coordination Center for Humanitarian Assistance monitors and guides international assistance. Its focus is on the management of temporary settlements and distribution centers. The Ministry of Defense provides logistics support and transport. This significant central coordinating structure was essential in securing the active participation of the government and international organizations in the LSS. However, the structure was much less effective at lower levels, where there tended to be less sense of ownership of the system.

In Mozambique, disaster preparedness is considered an essential part of the government's development program and is included as a cross-cutting theme in the country's poverty reduction strategy. In the March 2006 Master Plan for the Prevention and Mitigation of Natural Disasters, the government established an ambitious and comprehensive multisectoral program to reduce the vulnerability of the population to natural disasters. Among the initiatives described in the plan—from a flood early warning system to the introduction of drought-resistant crops—is a communications, information management, and coordination system for national emergencies. The plan outlined emergency procedures for government agencies and the nature of the national emergency operations center and regional branches that it proposed. Much of the plan has yet to be realized, and the emergency system is still not entirely in operation. It is significant, however, that the government has begun the task of defining institutional mandates for a permanent disaster response capacity and established a structure for disaster coordination and information sharing that links the capital with communities in disaster-afflicted areas.

An information management system that is developed as part of a permanent, national disaster response capacity is far more likely to succeed. To nourish the system at all times, governments might consider making information sharing a legal responsibility, even outside the context of a disaster, and donors might make information sharing during disaster response a requirement among external responders seeking financial support. These steps would provide clarity in roles and responsibilities and allow disaster information sharing to become directly regulated by operational procedures that would give the information practical value. They would also help ensure sustainability. Systems that are set up during an initial disaster response tend to disappear as soon as the emergency relief phase has ended.

The next emergency will require the creation of new ad hoc structures. Effectiveness, expertise, and resources are wasted in this way.

A Question of Incentives

In Pakistan and Sri Lanka, the systems were developed through private initiatives and were offered to humanitarian agencies on a voluntary basis (chapters 7 and 8). The systems had technical strengths that were recognized through awards received by the system developers for innovation, but they were not taken up or used effectively.

The case studies on Pakistan and Sri Lanka demonstrate the obstacles encountered by individuals seeking to introduce a disaster information management system in the midst of a major emergency. The systems were designed to enhance the allocation of resources by matching information on the needs of target populations with information on the goods and services being supplied by humanitarian actors. The relevant information is scattered across a large number of communities and autonomous actors. The value of such systems may be demonstrated only if the actors become persuaded that making an investment in information collection, processing, and sharing during an emergency is worthwhile. Neither system was able to reach a critical mass of information on needs and on supply.

In the case of Risepak, in Pakistan, 53 national and international organizations were initially persuaded to provide information on their emergency activities. They appear to have done so for altruistic reasons, after having been solicited by the Risepak team of volunteers, rather than through any clear understanding of how participation would serve their own purposes. This failure to provide incentives for participation or, at least, to explain the benefits of the system proved decisive. Few organizations judged the system output sufficient to sustain their engagement, and the system database quickly became outdated. Risepak was obliged to change the procedures for obtaining information and use its own teams of volunteers to conduct surveys in villages.

In an emergency situation, time is a scarce resource, but to participate in a shared information system, disaster responders must devote time and effort to the preparation and transmission of data. The data must also be updated at frequent intervals because they are time sensitive. If the data differ in format, level of aggregation, or some other dimension from the data habitually collected by a responder, the costs and difficulties faced by the responder rise accordingly. During an emergency, responders are

stretched thin implementing essential services, and they are already overburdened with the requirement to report to their own headquarters and donors. They are inevitably reluctant to make a speculative investment of time and other resources in an unproven system. The disaster environment thus contains many barriers to the smooth operation of a disaster information management system.

System design should therefore include careful consideration for the creation of incentives for stakeholder participation, especially during the first days or weeks of the emergency relief phase before the full practical value of the system has been clearly established. The incentives might include carrots, such as guaranteed access to data produced by other organizations working in the same districts or in the same sectors, and sticks, such as legal requirements to supply data for the system. In Indonesia, system data were aggregated and distributed in graphs and tables, which responders gladly added as documentation to the reports they were obliged to send to their headquarters and donors, and this acted as an incentive for participation. In Guatemala, importing organizations were required to register all external emergency humanitarian supplies with the LSS; otherwise, they were denied assistance with customs or customs clearance.

The prospects of overcoming the incentive problem are probably greater if the system has been officially adopted by a receptive government. In Guatemala and Indonesia, government regulations required international responders to share relevant information. Such regulations are usually followed by international partners, provided the government enforces the regulations.

Government regulation is not a final answer to the problem of incentives, however. In the case of Guatemala, a strong incentive was created for logging humanitarian supplies on the system at the point of entry, but not for using the data. Many of the technical capabilities of the LSS remained undiscovered by users, and ownership became progressively weaker at lower levels of government. The supply of information must be ensured, but so must the creation of effective demand. In Guatemala, poor communications, the lack of clear operational procedures, and the lack of a culture of evidence-based decision making all weakened demand.

Designing an Effective System

It is clear from the case studies that information management systems may serve as a support tool in many situations during the response to a disaster. The best system design will be the one that satisfies information needs

and that is most effective within national institutional structures and operational procedures. The designers should seek to create a system according to the problems it is intended to solve.

The case studies highlight issues that should be taken into account in the design process.

The Data to Be Captured

The types of information that might usefully be included in a disaster information management system generally depend on the operating procedures the system is designed to support. However, there are several common elements.

First, one should invest in the production of good baseline data. The precise names and locations of all communities, but especially communities scattered in remote areas, plus accurate maps, are basic information needs. In Pakistan, to address the confusion created in public records because different villages often have the same name and because the name of an individual village might vary across documents, Risepak contributed to the development of a collection of unique village identification codes that were being assembled at the Humanitarian Information Center for Pakistan. The center was located in Islamabad and was managed by the United Nations Office for the Coordination of Humanitarian Affairs. It also produced useful maps indicating instances in which single villages were actually agglomerations of smaller settlements. In Mozambique, disaster-prone districts are required to prepare contingency plans that include lists of potentially affected communities and details on the populations of these communities, the transport infrastructure, and the location of available stores and equipment (food, fuel, and vehicles).

The baseline data should be assembled in advance as part of the process of becoming prepared for disaster. Much of the information will be scattered across separate record and documentation systems at various government agencies. The technical barriers to collecting and consolidating this information are likely to be significant, but they may be more easily surmounted outside the context of an emergency. If it is possible to identify areas vulnerable to disaster, then extra attention should be assigned to gathering baseline data on these areas.

Second, achieving advance agreement on definitions, codes, and categories is essential to ensuring compatibility in the data produced by various sources. Because it reflected definitions and other elements shared with

the United Nations Joint Logistics Center, the LSS in Guatemala was able to import data digitally from United Nations agencies and the larger NGOs. Compatibility issues of this kind are best resolved in advance. In the midst of an emergency, responders are unlikely to be willing to participate in a shared system that requires them to spend precious time changing the types of data they collect and the way they present their data. The international humanitarian community, under the aegis of the Inter-Agency Standing Committee, is now involved in a considerable effort to address this issue.

Third, the results of needs assessments should be regularly logged onto the system to enable supplies to be matched with needs. In some of the systems examined in the case studies, rough proxies were used initially to measure basic needs. For example, in Pakistan, a rudimentary Risepak needs estimate involved matching village populations in an area and the distance of the area from the epicenter of the earthquake. Once relief teams had visited particular villages and areas, they were able to log more accurate data on basic needs.

During the reconstruction phase, there is scope for more precise assessments of needs and losses. In the Indonesia case study (chapter 5), a joint needs assessment was based on a methodology developed by the United Nations Economic Commission for Latin America and the Caribbean (see http://www.unisdr.org/eng/library/Literature/7578.pdf). This included data on damage and losses, cleanup costs, and future economic costs. This allowed for more accurate identification of funding surpluses and shortfalls by sector or location.

Fourth, the level of disaggregation emerges as a key strategic choice. In principle, greater disaggregation supports more accurate analysis. However, it also increases the burden of information collection. Risepak, in Pakistan, sought to track activities in villages to ensure that no villages were overlooked during the relief effort. However, few of the humanitarian agencies kept their own data at this level of disaggregation; they thus had more difficulty providing data in the required format. There is an obvious trade-off among data quality, cost in time and money, and system responsiveness. It is often possible to optimize two of these elements in negotiating this trade-off, but not all three. In Indonesia, system data were collected only from the major bilateral donors and the 20 largest NGOs; the approach was sufficient to capture 80 percent of all assistance flows, though, of course, it ignored the many smaller participants.

Collecting Data

In Guatemala, Pakistan, and Sri Lanka, the systems depended on individual humanitarian agencies to provide data. In Guatemala, system data capture was decentralized and autonomous. Data were entered separately by participating organizations and then consolidated at a base location. Data on humanitarian supplies were entered on the system at the border crossings, ports, or airfields where the supplies entered the country. The data were entered manually by the importing organization based on consignment documentation or physical inspection, or they were imported digitally from the organization's own inventory management system.

At Risepak, in Pakistan, the original plan called for humanitarian agencies to send information from the field using various communications media. The information would then be logged onto the system by volunteers. However, Risepak had little success in persuading responders to submit data. Risepak therefore changed strategies and began sending out teams of volunteers to visit sites and conduct surveys. This data acquisition method also proved onerous and unsustainable.

In Mozambique, information on conditions and needs at particular settlements was posted on a flip chart at the National Emergency Operations Center by returning assessment teams. The data were then prepared for distribution. There was little standardization of the data, which were entered into tables and spreadsheets. Most of the information was presented in a simple narrative format. This made data processing and consolidation difficult; the few data entry clerks struggled to keep up. There was a clear need for more data that were standardized and in digital form.

Indonesia adopted a different strategy for data capture. Data on disaster reconstruction initiatives were initially extracted from detailed project concept notes. Organizations undertaking reconstruction were required by law to register these notes with the coordinating entity, the Agency for the Rehabilitation and Reconstruction of Aceh and Nias. The processed data were returned to the data providers for verification. After the system became operational, project lists were sent around to donors periodically for updating. (Some donors reported that the exercise helped them manage their own portfolios more effectively given that frequent staff turnover had been leading to institutional information loss.) The data were entered manually into the system by World Bank staff; this last process was time-consuming and monotonous.

Quality Control

A key technical challenge in the development of a system based on decentralized data entry is ensuring the accuracy of data without sacrificing cost or timeliness. In Guatemala, internal controls were built into the LSS database to screen for obvious errors. In addition, the system logged the identity of data entry clerks to facilitate quality control, although only in respect of new records, not changes to existing records.

At Risepak, in Pakistan, volunteers screened and cleaned the data. However, the only readily available check was to compare the various entries on a particular village to see if they were consistent. In Indonesia, the World Bank used the more laborious technique of sending summaries of the data to the data providers so that these could be checked.

System managers need to be aware of the perverse incentives that may influence data quality. In Mozambique, people unaffected by the flooding were registering at the temporary settlements to benefit from humanitarian supplies. Similarly, there were incentives for governmental and nongovernmental agencies to ignore overcounting in the number of disaster-affected people in anticipation of higher financial inflows during the distribution of aid. Frequently, the only technical solution to these sorts of distortions is careful manual analysis of the data against baseline data and secondary assessment reports. Obviously, this is time consuming, but the process may exercise a deterrent effect on excesses and improve accountability and efficiency in aid distribution.

Access, Output, and Analysis

Disaster information management systems are designed to support management decisions and oversight during disaster planning and preparedness efforts, emergency relief operations, disaster recovery, and reconstruction. To facilitate the effective use of the systems, protocols and procedures must be established so that responders, donors, and other actors may securely access the systems and enter or otherwise manipulate data. The data may also need to be shared periodically among other key stakeholders and the public through published reports and analysis.

Access to databases may be readily provided over the Internet. Risepak, in Pakistan, and Sahana, in Sri Lanka, were both designed as open access computer-based systems. The developers expected this approach to promote transparency, accountability, and participation. Users were able to

search and organize the data according to location or relief organization, and the data were exportable in spreadsheets. The LSS had been designed with the technical capacity to permit public online access, though this feature was not implemented in Guatemala because of security concerns about the humanitarian supplies. There may be tensions between the desire to benefit from the advantages of openness and the willingness of stakeholders to contribute data; this issue should be addressed through direct consultations during system planning.

The LSS offers flexible search and reporting options, allowing governmental agencies and donors to generate various types of reports. A special query tool supports mapping and graphic presentations. In Guatemala, the system was used to generate updates on the humanitarian response for governmental agencies, Congress, donors, national auditing services, and the public. The case study identifies transparency, accountability, and enhanced public trust as the primary benefits of the system.

The managers of Risepak, in Pakistan, published limited analyses of the data on the system Web site. This represented a potentially useful role for the university-based civil society group that developed the system. Unfortunately, but predictably, as the disaster response progressed and calmed, the motivation to pursue this service waned.

The World Bank used the data generated by the system in Indonesia to produce various types of reports, including stocktaking reports, briefing notes, and progress reports. Other agencies appreciated the system's quarterly updates, which contained tables and graphs that they readily copied into their own reports. The distribution of this material was initially carried out by e-mail and confined to organizations that contributed data. Later, the material was made public on the World Bank's Web site.

Lessons for the Future

The case studies in this volume offer important lessons for national authorities, donors, and other national and international actors seeking to develop disaster information management systems.

Country Leadership Is Fundamental to Effective Disaster Response

Systems of this kind should be part of a concerted effort to build national disaster response capacity in vulnerable countries. To be effective, national disaster response needs to be led by national authorities. Country leadership

becomes correspondingly more important as the approach of the international community to disaster response becomes more ambitious, incorporating an awareness of human rights and goals such as better rebuilding and the long-term reduction of vulnerability. National governments have a comparative advantage in terms of legal authority, local knowledge, and ownership of local institutional structures.

Nonetheless, in complex emergencies involving breakdowns in institutions, losses in infrastructure, and movements in populations, humanitarian agencies are often obliged to operate independently alongside the state. However, as illustrated in the case of Haiti (chapter 4), external responders must take care not to displace, disrupt, or ignore national or local capacity. Bypassing the state and local actors should only be an unusual, temporary expedient. There should be a longer-term strategy to build up local and national capacity for response and coordination. If external responders have established a local disaster information management system outside government structures, they should consider ways to transfer the system, including equipment, databases, procedures, and expertise, to national institutions as part of their exit strategies.

Investments in Advance of Disaster Are Far More Effective

Perhaps the most important lesson that emerges from the experiences documented in this volume is that investments in disaster information management systems are far more likely to be effective if they are accomplished in advance. Most of the systems described in the case studies were developed or deployed in the aftermath of the onset of major disasters. Many of the problems they faced flowed directly from this fact. In the midst of a major disaster, the prospects of anchoring the system on a stable institutional foundation and supporting it through sound operating procedures are diminished. Similarly, persuading humanitarian responders to invest time and effort in a new, unproven system during a period when their capacity is stretched because of an emergency is a daunting undertaking. Ex ante preparation is therefore crucial. Bilateral and multilateral donors might encourage countries to strengthen their capacities to cope with disasters by providing financial and technical assistance for the timely adoption of disaster management systems before disaster.

Invest in the Collection of Baseline Data

Baseline data are essential. There are usually several sources of various data on populations, housing, transport infrastructure, health services, schools, and so on. However, the data are scattered across agencies and may be in

incompatible formats. In the midst of an emergency, it is difficult for humanitarian agencies to gather, interpret, and apply these data.

Investments in collecting the data outside the context of a disaster and standardizing the data presentation and data platforms are likely to pay dividends during an emergency. Good maps that clearly and precisely identify the names and locations of remote or scattered communities represent another basic and important investment. Developing a distinct place code as a unique identifier for each town or village and linking all such codes to global positioning system and other relevant data are also important steps in preparing for disaster. Promoting country engagement in the United Nations Spatial Data Infrastructure may help ensure the availability of standardized baseline data during the response to disasters.

Support the System through Coordination among Data Procedures, Institutions, and Needs

The case studies demonstrate that the development of an effective disaster information management system is both a technical and institutional challenge. If the system is not being custom-made, then it might be adapted from one of the available software packages that support disaster response. The system should always reflect local institutional requirements, however, and it should be supported by well-established guidelines and procedures for data collection, content, and presentation. This increases the value of the data during disaster response, but also boosts local institutional capacity to manage data.

The system should support specific information needs at each phase of the response to a disaster. A system that satisfies recognized information needs is more likely to be effective than a system that responds to generic needs. This means that an analysis should be undertaken of the way data will be used in disaster management, coordination, oversight, and evaluation. The virtue of an information management system lies in the evidence it provides for effective decision making during the response to a disaster. The case studies reveal that there is often little expressed demand for such evidence among national and international humanitarian agencies. Procedures that mandate evidence-based resource allocations would help create greater demand for the data and more participation in the system.

Identify an Appropriate Institutional Home for the System

The system should have a clear institutional owner that has the authority to issue system guidelines and impose system rules and procedures on national and international actors. The institution should be empowered to enhance

disaster preparedness. It should be able to promote awareness across other relevant institutions. It should be authorized to gather baseline data and address data compatibility issues.

Ideally, the system might be designed as a major tool of a national disaster management organization that would coordinate the national response to a disaster. Procedures should be established to govern the relationships with agencies responsible for any phase, sector, or theme during the response. Too often, the response to a disaster by governmental agencies is hindered by confusion in mandates and shifts in responsibilities across emergency relief, disaster recovery, and reconstruction.

Implement a Rolling Program of Capacity Building

It is important to ensure that there are sufficient trained personnel in appropriate institutions who are able to interact with the system, process and transfer data, undertake data analysis, and perform other key system functions during an emergency. Likewise, staff at lower levels of government, but particularly local government, should be encouraged to participate in the system; priority should be given to people who know well the locations that are most vulnerable to disaster.

It is inevitable that, through staff turnover, capacities will degrade fairly rapidly outside the context of disaster. Relevant institutions should therefore plan and implement a regular cycle of training, perhaps through the support of donors.

Create Positive Incentives for Sharing Information

In the case studies, persuading numerous autonomous actors to contribute information to the system emerged as one of the greatest difficulties. Positive incentives should be created to foster system participation by governmental and nongovernmental actors. The government might adopt regulations requiring agencies to contribute information. Though regulations are no guarantee of compliance in an emergency situation, most actors recognize a responsibility to coordinate their activities with the government. Provided they are convinced that the government is taking its role seriously, they are likely to comply with any reasonable requirements.

To nourish the data needs of the system, import certification for humanitarian supplies might be made conditional on registration of the supplies with the system. Likewise, sharing information might be included among the standard operating procedures imposed by the government on actors during disaster response.

The utility of the system in targeting and monitoring relief efforts must then be made evident. If actors do not experience the usefulness of the system, then efforts to enforce compliance will become less credible. The system should therefore provide regular feedback and periodic briefing notes to participants, including aggregated data and analytical reports that help participants fill their information needs in managing and reporting on their disaster initiatives, while demonstrating clearly how their contribution in information is being used for the benefit of the effectiveness of the response.

The costs of system participation should be kept low. If the system is interoperable with systems used by ministries, prominent NGOs, donors, and United Nations agencies for their own purposes, such as commodity tracking, then data may be readily and inexpensively exchanged and used. This requires investment in appropriate data platforms, standards, and definitions to ensure compatibility and interoperability.

The sorts of incentives likely to be most effective may vary during the response. Activities, data needs, and actors tend to change as the response evolves from relief to recovery and reconstruction. Chapter 2, table 2.3, summarizes the key activities and data needs associated with the various phases of a disaster response. Government regulations and low costs in time and money may be more important in encouraging system participation in the immediate aftermath of a disaster when time and manpower are scarce and organizations are less likely to enjoy the benefits of participation. Useful analytical outputs may be possible only if the system has obtained a critical mass of data; this may occur only after a few days or weeks.

Think Carefully about the Appropriate Basic Geographical Unit

The appropriate level of geographical disaggregation in the data on emergency needs and supplies emerges as a key strategic choice in the case studies. There are likely to be trade-offs among data quality and timeliness; compatibility with the level of geographical disaggregation in the systems of other actors; adequacy of the database; and cost.

Use Appropriate Technology

Advances in information and communications technologies represent opportunities to create new solutions, including, for example, systems that allow remote units to input data directly in the system via cellular or satellite networks. There is a potential for achieving exponential gains in the efficiency of disaster response operations.

The case studies offer many examples of systems that failed for many reasons: poor communications infrastructure, lack of technical capacity, incompatible data, incompatible equipment, and so on. Sometimes, simpler technologies seem more flexible in an emergency situation, such as using portable flash drives to share spreadsheets in Mozambique.

Outputs Should Meet the Needs of the System and the Needs of Users

A good disaster management information system should be able to support detailed queries by individual users and produce graphics, maps, and analytical data reports on particular areas. Periodic briefing notes and ad hoc reports tailored to the needs of specific stakeholders would do much to build the credibility of the system. Alliances with academia, civil society, and the private sector might expand the analytical input. Accurate data analysis favors a better understanding of the situation among actors and thereby improves coordination. Contributing agencies are more likely to sustain a commitment to the system if they see evidence of the value of the data to users. Increasing transparency and accountability through regular reporting also supports greater public confidence in a disaster response. In Guatemala, this proved to be a key return on investment in the system.

Conclusion

This synthesis and the introductory chapters that follow illustrate the urgency of the need to establish effective disaster information management systems. They also highlight increasing global recognition of the need to take the step from ad hoc disaster responses to the systematic ex ante development of disaster management infrastructure by vulnerable countries or provinces and districts at risk. Despite this recognition, few well-functioning systems for information sharing during the response to a disaster have been developed, as we may see in the country case studies in this volume. We have much yet to learn about responding to disasters, but experience is providing us with some points of departure.

2

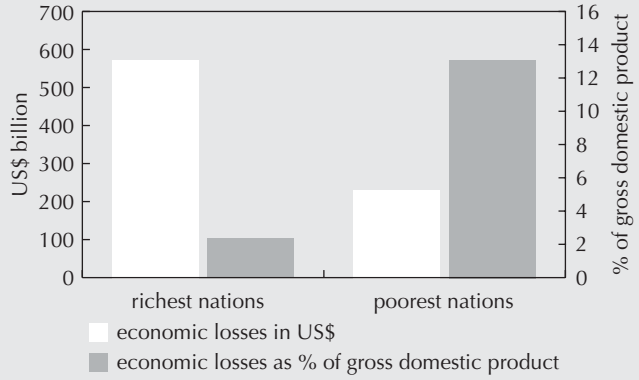
Information Gaps in Relief, Recovery, and Reconstruction in the Aftermath of Natural Disasters

Claude de Ville de Goyet

Disasters and Poverty

The myth that disasters are the greatest equalizer, striking everyone in the same manner, has long been dispelled. There is a strong relationship between vulnerability to natural disaster and poverty (GTZ, DKKV, and University of Bayreuth 2005; de Ville de Goyet and Griekspoor 2007). On the human health level, "while only 11 percent of the people exposed to natural hazards live in countries classified as low human development, they account for more than 53 percent of total recorded deaths" (UNDP 2004, 10). On the economic level, the burden of disaster is proportionally much higher in the poorest countries (World Bank 2006; UNISDR 2004). Although the absolute economic loss is greater in wealthier countries, the losses as a share of gross national income affect most profoundly the poorest countries. The loss of US$125 billion in the United States because of Hurricane Katrina represented only 0.1 percent of the gross domestic product to the country, while losses to disasters in developing countries in recent decades have been between 134 and 378 percent of gross domestic product (UNISDR 2004; see figure 2.1).

FIGURE 2.1 Disaster Losses in the Richest and Poorest Nations, 1985–99



Source: UNISDR 2004, adapted from Munich Re 1999.

What is observed at the national level holds true at the household level. The poorest individuals are more vulnerable to disasters, and the impact of disasters is making them poorer. This is well summarized by paraphrasing the International Federation of Red Cross and Red Crescent Societies: disasters seek out the poor and ensure that they stay poor (von Oelreich 2002).

Whereas the contribution of disaster risk reduction in the fight against poverty is beyond debate, the impact on long-term poverty arising from the generous international humanitarian response and early recovery effort once a disaster has occurred calls for more investigation.

Natural Disasters

Disasters may be classified as natural disasters, technological disasters, or complex emergencies. The last includes civil wars and conflicts. The classification refers to the immediate trigger: a natural phenomenon or hazard (biological, geological, or climatic), a technological accident, or a conflict. The term *natural*, if used to qualify disasters, is not meant to deny any human or societal responsibility in the consequences of the truly natural hazard (seismic or cyclonic activity, for instance). In reality, all disasters stem from the interaction of external phenomena (hazard) and a vulnerability of society that has

resulted because of risk ignorance, poverty, or misconstrued development among people.

One key difference between natural and complex disasters is often overlooked by many humanitarian actors: national authorities, part of the problem in complex emergencies, are or should be the main actors in relief and recovery. They should be the indispensable interlocutor and conduit for the international response to the extent permitted by the principles of neutrality, humanity, impartiality, and independence in the provision of humanitarian assistance. However poorly prepared the local institutions may be, marginalizing or ignoring them weakens local coping capacity and is therefore counterproductive and often self-defeating. (Moreover, lack of preparedness is not exclusive to developing countries, as Hurricane Katrina has demonstrated.)

Almost all countries are exposed to the risk of natural hazards. A natural disaster hotspots study commissioned by the World Bank and the Center for Hazards and Risk Research at Columbia University (Dilley et al. 2005) identifies 47 countries in which more than 50 percent of the population is at relatively high mortality risk from two or more natural hazards. Of these countries, only three are developed: Japan, the Republic of Korea, and Taiwan (China).

Data from the Center for Research on the Epidemiology of Disasters also suggest that there has been an overall increase in the number of natural disasters over the last 35 years.[1] As noted by the center, the data should be handled with care. In any case, there has been an undeniable increase in the *reported* number of natural disasters (table 2.1).

A report of the Independent Evaluation Group (World Bank 2006) stresses that this increase may be misleading.[2] The unreliability of basic disaster statistics (the number of people affected, the number of dead, and

TABLE 2.1 Distribution of Natural Disasters by Origin, 1970–2005

Origin	1970–79	1980–89	1990–99	2000–05
Hydrometeorological	776	1,498	2,034	2,135
Geological	124	232	325	233
Biological	64	170	361	420
Total	964	1,900	2,720	2,788

Source: UNISDR and CRED 2007.

the economic cost) is indicative of the sorry state of overall data management during emergencies.

Natural disasters are either sudden or slow in onset. Sudden-onset disasters are those presenting the most difficult challenge in data and information management. They may be geological (earthquakes, tsunamis, volcanic eruptions), climatic (flash floods, hurricanes, typhoons), or biological (major epidemics).

Most disasters are mild or moderate and do not involve significant international intervention. In a few instances, the geographical impact, the size of the affected population, or the dramatic suddenness of the event are sufficient to trigger considerable international media attention and assistance for relief and recovery. This chapter focuses particularly on large disasters in developing countries. (See table 2.2 for a list of the disasters that have attracted significant funding.)

As may be seen in table 2.2, the response to the Asian tsunami was particularly generous and, in fact, overwhelmed many humanitarian actors. The lessons learned have been amply documented in a series of external evaluations commissioned by the Tsunami Evaluation Coalition (TEC). The five comprehensive evaluations and a synthesis report carried out by the coalition, which constituted an independent learning and accountability initiative by more than 50 agencies, are a major source of information on successes and failures in data management in the aftermath of natural disasters (see Bennett et al. 2006; Christoplos 2006; de Ville de Goyet and Morinière 2006; Flint and Goyder 2006; Scheper, Parakrama, and Patel 2006; Telford, Cosgrave, and Houghton 2006).

According to the TEC report on funding:

> A total of US$14 billion has been pledged or donated by the international community for emergency relief and reconstruction in response to the tsunami. This international funding has come from two main sources: government (46 percent) and private (39 percent). With the exception of Japan, the general public provided the vast majority of the US$5.5 billion in private donations. Multilateral development banks have provided 15 percent of the international funding. (Flint and Goyder 2006, 14)

This assistance amounted to over US$8,000 per displaced person, supplying, in principle, the response and recovery actors with an incentive and ample resources for proper data management and evidence-based decision making.

TABLE 2.2 Disasters Receiving over 10 Percent of Annual International Humanitarian Funding

Year	Humanitarian funding (total, US$ million)	Disasters accounting for over 10% of the funding
2000	419.8	Mozambique floods (39.5%) Afghanistan drought (17%)
2001	464.7	Kenya drought (27.9%) India earthquake (25.6%) El Salvador earthquake (16%)
2002	294.2	India floods (31.6%) Congo, Dem. Rep. of, volcano Nyiragongo (13.4%) Kenya drought (12%)
2003	57.9	Algeria earthquake (18.5%) Horn of Africa floods (14.3%) China floods (11.2%)
2004	597.2	Iran earthquake (21.8%) Bangladesh floods (17.8%) West Africa locusts (14.7%)
2005	7,628.4	Asian tsunami (81.9%) India-Pakistan earthquake (15.4%)
2006	238.9	Indonesia earthquake (36.6%) Kenya floods (20.5%)

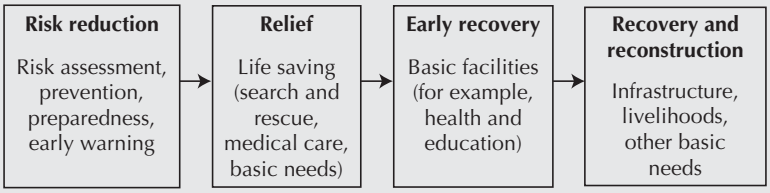
Source: FTS Database 2007.
Note: The year refers to the fiscal year of funding. Humanitarian funding refers to contributions and signed commitments.

This exceptional case of the collaborative assessment of a major disaster response offers valuable information on how data management (from needs assessment to recovery monitoring systems) actually contributed to the management of the response and the transition from relief to reconstruction.

Phases in Disaster Management

According to the traditional view, a cycle in disaster response consists of a succession of clearly distinct phases, from prevention to preparedness, early

FIGURE 2.2 The Phases of Disaster



Source: Author compilation.

warning, impact, and relief, recovery, and reconstruction. This is the classical conceptual framework illustrated in figure 2.2.

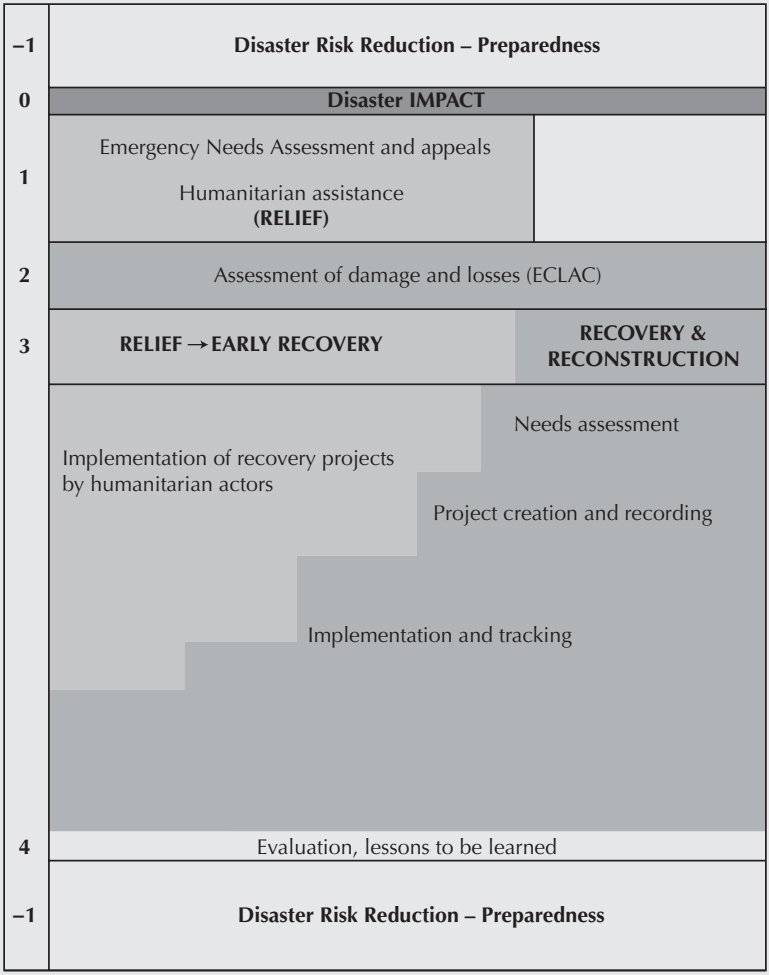
Over the years, this neat picture has been replaced by a continuum of activities and phases managed by the humanitarian community and development organizations (see figure 2.3).

Definitions

The reality in dealing with disasters does not always fit the neat definitions of the United Nations International Strategy for Disaster Reduction, an international forum on disaster reduction (see UNISDR 2004, annex 1). Confusion has arisen about the activities in each phase. The definitions nonetheless remain useful. They may be paraphrased as follows:

- *Disaster risk reduction* is the conceptual framework of elements considered with a view to minimizing the vulnerability and the risk of disaster throughout a society and avoiding (prevention) or limiting (mitigation and preparedness) the adverse impacts of hazards within a broad context of sustainable development.[3]
- *Early warning* means the provision, through well-known institutions, of timely and effective information that allows individuals exposed to a hazard to take action to avoid or reduce their risk and prepare for effective response. According to the United Nations International Strategy for Disaster Reduction, early warning systems respond to disasters by undertaking steps in several areas, namely, understanding and mapping hazards, monitoring and forecasting impending events, processing and disseminating understandable warnings to political authorities and the population, and undertaking appropriate and timely actions in response to the warnings.

FIGURE 2.3 The Overlapping Phases in Recent Major Disasters



Source: Author compilation.
Note: Light gray indicates that the activity is managed by the humanitarian sector. Dark gray indicates that the activity is managed by the development sector.

- *Preparedness* involves activities and measures taken in advance to ensure effective responses to the impact of hazards, including the issuance of timely and effective early warning and the temporary evacuation of people and property from threatened locations. Early warning is not an independent phase, but an element of preparedness.

- *Relief or response* is the provision of assistance or intervention during or immediately after a disaster to save and protect lives and meet the basic subsistence needs of people affected by the disaster. It may be of immediate, short-term, or protracted duration.
- *Recovery* is the set of decisions and actions taken after a disaster with a view to restoring or improving the predisaster living conditions of the stricken community, while encouraging and facilitating necessary adjustments to reduce disaster risk.[4] The United Nations International Strategy for Disaster Reduction includes rehabilitation and reconstruction as part of recovery.

Activities in Each Phase

Relief Phase

Activities considered as relief by the World Bank include search and rescue, evacuation, food and water distribution, temporary sanitation and health care, temporary shelter, and restoration of the access to transport (World Bank 1995). The emphasis is on the urgent but temporary nature of the assistance.

All relief and recovery phases described in figure 2.2 address basic needs. Relief activities target the most basic survival or subsistence needs of the affected population. The objective of the first responders is to save lives. This objective is often presented as the defining feature of humanitarian relief relative to development (recovery) activities. The TEC reports that its "evaluators observed a tendency in many relief agencies (and the mass media) to present all needs as critical to survival, leading the public to assume that all humanitarian activities were life-saving in nature" (de Ville de Goyet and Morinière 2006, 50). This is an oversimplification in that development programs improve primary health care, and immunization and safe water also contribute to saving lives, as does fighting extreme poverty through initiatives aimed at income generation.

Nonetheless, the immediate survival needs of the injured, displaced, and traumatized population are those moving public opinion, the media, and, consequently, donors. Indeed, dramatic images of the immediate impact boost humanitarian fund-raising efforts, while, in fact, the bulk of funding requirements for assistance often emerges later, and humanitarian activities often end up addressing recovery needs.

The nature of relief activities and their duration vary according to the type of disaster. Earthquakes cause considerable trauma, while tsunamis

and tidal waves cause many deaths and leave most survivors physically unharmed but dispossessed.[5] The dispossed are generally ready and eager to recover their normal lives even before humanitarian organizations have shifted into a development mode.

Early Recovery Phase

Early recovery for some is delayed relief for others. It is a matter of perspective and ownership. Delayed relief is the responsibility of humanitarian responders, while early recovery will be claimed by development-oriented organizations. It is the grey zone between life-saving relief and recovery or reconstruction. Its duration is offer driven. In recent disasters, the emergency relief phase appears to have been extended because of the availability of generous humanitarian (relief) funding.

Basic needs already addressed through immediate relief—such as water, food, shelter, routine health care, and disease control—continue to be addressed through temporary postdisaster measures (new wells instead of water tankers or bottles, more comprehensive and nutritionally balanced food distribution, or barracks and temporary settlements instead of tents).

The provision of psychological and psychosocial assistance and education has become a standard response during early recovery. The importance of mental health care following natural disasters is now well recognized. In practice, cultural differences between relief workers and affected populations, the low state of development of local mental health services, and controversies over the differences between normal and pathological psychological reactions have opened the door for a large range of interventions that vary in quality and are often undertaken without the benefit of good information or an adequate database.

Education becomes a priority area if the duration of the humanitarian response (relief and early recovery) exceeds a few months. To resume schooling using temporary facilities is justified. In practice, the efforts of specialized agencies and nongovernmental organizations (NGOs) are usually aimed beyond merely restoring services. New permanent schools may be built during relief efforts, and this may improve the access to education among a large number of children. This should become an element in planning among recovery and reconstruction agencies.

Restoring livelihoods and, in particular, income-generating activities among families are traditionally part of reconstruction efforts and are also becoming an important activity in early recovery. It is often assumed that early recovery implies emergency or temporary measures. However,

early recovery is gradually coming to include permanent solutions such as the construction of housing or water systems and the establishment of primary health care centers or schools staffed by local people, thereby blurring the distinction between delayed relief and reconstruction. Emergency activities undertaken by relief agencies following hurricanes or earthquakes, which used to be run for only a few weeks or months, are now spanning years.

Recovery and Reconstruction Phase

This phase, in addition to addressing basic needs, including household livelihoods (income generation), aims at restoring heavy infrastructure and the normal life of business. It is a slow process of (re)development with a long-term vision.

Transition Issues

How smooth and timely is the transition back to normal life? Observation and surveys during recent, well-funded relief efforts after disasters such as the tsunami and the earthquake in India and Pakistan suggest that affected populations aspire to a return to normal (recovery) that is much earlier than expected by some relief agencies, which are therefore not yet prepared to operate on a nonemergency or charity basis. TEC reports underline how rare it is for beneficiaries to be consulted. Local governments generally recognize the need to end the relief phase early, but the humanitarian world, which is sometimes referred to as the largest unregulated industry (Walter 2004), often stretches out the relief phase (immediate or delayed) until the funds earmarked for relief have been exhausted.

Several issues affect the transition back to normality:

- A *cultural gap* often exists between disaster managers and development experts in the perception of disaster and therefore in the approaches they adopt. This somewhat philosophical difference influences the relative importance assigned to the speed of action versus the need for planning and the collection of information. The skills and approaches required for rapid life-saving responses are not necessarily the most useful for recovery. This is well illustrated by the diversity in the definition of standards (see below).
- *Mandates are split* at the multinational and bilateral levels. The United Nations, especially the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), coordinates relief, while the World

Bank leads in the recovery process. This separation in roles between relief and recovery is mirrored at the bilateral level. Donor offices providing life-saving humanitarian support are distinct from those involved in development or long-term reconstruction. This difference is also reflected in funding constraints. Most relief funds are not available for use in reconstruction. The terms *permanent* and *reconstruction* are banned from Flash Appeals (see page 45, below). There is no mechanism (joint or otherwise) for managing the transitional phase. Only two countries have identified a distinct source of funding for transition recovery.

- *Minimum standards vary*. Is the objective of relief and recovery to provide the bare minimum to save lives and avoid permanent secondary effects? Is it to restore the predisaster level of services, which may have been unacceptably low? Or is it to seize opportunities to provide the affected population (but not other groups) with commodities and services they may normally be entitled to receive (the rights-based approach).

A group of NGOs and the Red Cross have established a set of minimum standards, the Sphere standards, for humanitarian response (see Sphere Project 2004). The standards have been adopted by some donors in search of objective and measurable criteria. For instance, the minimum standards on water, food, sanitation, and medical care are meant to be global and therefore applicable regardless of the status before the disaster. The main issue is that these minimum standards are far above the standards being enjoyed by most of the unaffected local populations. The rationale for temporarily providing a high level of services to a select group at the significant cost associated with relief operations is controversial.

Development agencies tend to use local standards that are tailored (often to the expected results) and may reasonably be achieved. The set of quantifiable basic needs developed by humanitarian agencies is typically far more generous than the needs addressed in a long-term recovery project. A shared understanding of the nature of basic needs is critical in establishing a database and information systems spanning the phases of relief, recovery, and reconstruction.

Requirements for Data and Information Management

This section outlines the broad requirements for data management in each phase. Each phase and each activity within each phase require timely

information for evidence-based decision making. Two initial issues should be addressed as follows:

Whose disaster is it? Providing immediate relief or recovery to the population involved in a natural disaster is primarily the responsibility of the government of the country affected. Most countries have established a national disaster management authority to carry out this task. The contribution from the international humanitarian community should be seen as complementary to and supportive of such national efforts. Clearly, the international community may need to assume a more direct role in countries that do not have the minimum resources or management capacity, such as failed states. Nurturing and building national capacity should be the prime objective of foreign first responders.

Why collect data in an emergency? Data management and evidence-based decision making are important even in the aftermath of disasters for several reasons as follows:

- However generous the support provided to the affected populations, there is always a gap between needs and resources. Proper data management ensures that priorities are set and enforced. Cost-effectiveness is as important in emergency response as it is in development. The belief that costs and resources are not important in the immediate response is a fallacy. Indeed, gaps and duplications may have fatal consequences that are less excusable given the extraordinary generosity of the assistance from countries and individuals.
- Monitoring the outcomes of a response is essential. Too many well-intentioned postdisaster initiatives have generated unintended negative consequences and created additional social strains and inequities.
- Ensuring continuity and learning through experience are critical in a field of action characterized by frequent staff turnover. High turnover means that the same errors may be repeated.

In Relief or Response

Information needs

Table 2.3 illustrates some of the information needed to accomplish the various tasks following an earthquake.

Search, rescue, and evacuation are common relief tasks that require a solid system of data management to ensure that all communities and

TABLE 2.3 Relief Activities Following an Earthquake

Activity	Period	Needs in data management
Search and rescue	0–72 hours	database for matching buildings with possible survivors and the capabilities of search and rescue teams
Emergency trauma care	0–24 hours	assessment of residual hospital capacity, monitoring of bed availability, and tracking of evacuated patients
Secondary emergency trauma care	1–30 days	assessment of projected needs for specialized secondary care (burns, paraplegic, and so on)
Emergency routine care	ongoing from day 1	monitoring emergencies and essential drug stocks (insulin, cardiovascular drugs, and so on)
Primary health care	ongoing	assessment of needs for temporary essential primary health care
Identification and burial of dead	1–15 days	centralized list of identified and unidentified bodies, descriptions, photos, fingerprints, and possibly DNA
Tracking of missing persons	day 1 to day 90	centralized databases of missing persons and children with missing parents
Communicable disease control		epidemiological surveillance system based on presumptive symptoms or syndromes for each potential epidemic disease

(*continued*)

TABLE 2.3 (*Continued*)

Activity	Period	Needs in data management
Water	ongoing	database for matching needs, priorities, and resources
Food	initiated in the first week and ongoing	assessment of national stocks, needs, and pledges, combined with nutritional assessments among vulnerable groups
Shelter		assessment of housing damage and central database on the number and location of internally displaced persons
Psychosocial assistance	first month and beyond	assessment of needs for psychosocial assistance and medical mental health care

Source: Author compilation.

households at risk are adequately covered. These tasks are a potential textbook application for a geographic information system. In practice, searches are often disorganized and unsystematic; as a result, some buildings or sites may be visited by successive teams (foreign or national). The tendency of international teams to conglomerate around the most visible or productive sites was particularly flagrant in the earthquake in El Salvador in 1985. To counter this, donor countries that were providing search and rescue teams organized the International Search and Rescue Advisory Group to match bilateral offers with local search and rescue needs. The group fell short of developing a data collection system to provide supporting evidence for its recommendations. This led sometimes to oversupply, as was the case in Bam, Iran, in 2003. The international community should also improve significantly the data management capacity of receiving governments.

Few natural disasters create massive requirements for *initial trauma care*. Tsunamis and volcanic eruptions, for instance, leave survivors mostly uninjured. Dealing with mass casualties in the hours after an earthquake represents a formidable data management challenge. The data needs include information on the residual capacity of existing facilities, the hour-by-hour monitoring of the availability (beds, supplies, and so on) of remaining medical care services, a centralized registry of injured patients and the type of care they require, and a system to track patients and victims when they are transferred from hospitals to other facilities. The database should cover the many national or foreign field hospitals, most arriving too late for life-saving trauma care.

Such a system for monitoring medical resources and patients does not typically exist before a disaster. Under emergency conditions, preexisting data collection in hospitals collapses. As a result, a nominative listing of people injured is lacking; morbidity statistics are unreliable; and locating patients is time consuming and based on trial and error. Improvisation is the rule.

The remarkable medical air evacuation of 11,972 injured from Bam, Iran, to other parts of the country is an interesting case study (Abolghasemi et al. 2005). The evacuation was completed in less than 72 hours, long before the first of 12 foreign field hospitals dispatched to provide emergency trauma care arrived on site. The logistical performance was not matched by a similar success in database management. Detailed registries of patients, including information on the severity and type of injuries and on the whereabouts of patients during and after care, were unavailable or not

shared. The expectation that such an information gap may be bridged during the initial medical response should be tempered by the pragmatic recognition of the chaotic context during the first few days following a disaster. A patient tracking system was not developed during the first days after Hurricane Katrina, and it is probably unrealistic to anticipate that the situation will be different in the next large-scale disaster.

Routine emergencies, including routine pediatric or adult emergencies, continue to occur in the aftermath of a disaster. The procurement of life maintenance drugs (insulin, cardiovascular drugs, and so on) is also rapidly emerging as an unmet priority. Procurement should be part of the integrated data management system.

A projection of the need for specialized extended trauma care (or secondary trauma care, such as rehabilitation and care for burns, paraplegia, and complicated fractures) may not be required within the first few hours but soon becomes an urgent issue. Matching existing or pledged resources and estimated requirements should generally be feasible and is occasionally accomplished.

The proper identification of *the dead and missing* is a social, economic, and mental health imperative. The misconception that dead bodies are necessarily a public health risk has complicated the data management task by prompting the rapid disposal of remains without opportunity for identification. This aggravates the suffering of relatives.

In the disaster in Thailand, systematic and ongoing efforts were made to identify human remains and to compile descriptions and fingerprint and DNA data in a centralized government database. The data were matched with lists of people who had been reported missing. In the disasters under examination in other countries, no coordinated efforts were made to identify the deceased. The numbers of bodies recovered and the number of the reported missing were processed independently, leading to artificially inflated reports of fatalities.[6]

Human beings are unable to survive for long without access to a minimum amount of *water, food, and shelter*. The lack of sufficient shelter in cold climates (such as after the earthquake in Pakistan) also becomes an urgent problem. The effects of food shortages on morbidity or mortality are often felt only weeks later. Meeting such disaster-generated needs requires ready access to information on the numbers and locations of displaced populations by age group, on the availability of facilities and care, and on the gaps in resources. In the Asian tsunami of 2004, many of the early food requirements were generously met by unaffected neighboring

communities, and gross food availability was hardly reduced at the national level, a phenomenon not always taken into consideration in the assessment of food needs.

The spread of *communicable diseases* is one of the most exaggerated threats following natural disasters.[7] It is also the sector in which the use of information systems has been the most effective in the collection and interpretation of data. After the tsunami in Asia and the earthquake in Pakistan, the World Health Organization established an emergency surveillance system that was sustained through a massive infusion of funds and expatriate staff (de Ville de Goyet and Morinière 2006). The system was effective, but not particularly efficient, nor was it sustainable once the humanitarian funding ended.

Sources of Data and Initiatives

Data collection for immediate relief is time sensitive. A few mechanisms have been established for the assessment of immediate needs during large disasters. A preeminent, truly cross-sectoral exercise is conducted by the United Nations Disaster Assessment and Coordination (UNDAC) team and the field assessment and coordination team, a counterpart entity created subsequently through the Red Cross system. Providing a strategic picture of the needs at the international level is the responsibility of OCHA, which acts through UNDAC.

UNDAC is a stand-by team of disaster management professionals who are nominated and funded by member governments, OCHA, the United Nations Development Programme, and operational humanitarian United Nations agencies such as the World Food Programme, the United Nations Children's Fund, and the World Health Organization. Upon the request of a disaster-stricken country, the UNDAC team may be deployed within hours. It is trained to carry out rapid assessments of priority needs and support national authorities and the United Nations resident coordinator in organizing international relief on site. Although, in principle, the assistance of the team is requested by the affected country, the team is, in practice, a tool that is considered indispensable within the donor community. OCHA makes substantial efforts to include team members who are from the affected country or its neighbors. For practical reasons, the mobilization of United Nations staff already in the country is part of the process in most instances, and the team is joined later by relief officials from donor countries. UNDAC in Latin America is an exception; there, the team consists predominantly of nationals from the region. NGO participation in UNDAC is limited. The International Red Cross and Red Crescent

Movement is focusing on its own independent mechanism: the field assessment and coordination team, which has ostensibly the same objective and similar operational capacity. The detailed data and reports produced by this team are not made available outside the movement.

The effectiveness of UNDAC and the field assessment and coordination team in influencing decision making is still a point of debate.

In moderate-severity disasters such as a small earthquake or large flood, UNDAC usually provides a reasonably comprehensive and accurate picture of the situation within a week. This is too long; the delay means that meeting the most pressing needs (medical care for trauma victims, search and rescue, evacuation, early shelters, and so on) must rely on other, better targeted and more timely sources of information.

In large disasters or, more precisely, during disasters of a nature to spark significant media attention and massive intervention by the international community, the information made available often does not respond to international requirements, as was shown by the TEC evaluation of the effectiveness of needs assessments in the aftermath of tsunamis (de Ville de Goyet and Morinière 2006). The scope of the task tends to outstrip the limited human resources available for this mechanism.

In recent major disasters, the Red Cross field assessment and coordination team has also failed to obtain the dispatch of the emergency response units available in most of the developed countries.

In disasters in recent years, the immediate response from the humanitarian system has predominantly been driven by reliance on the supply side, and it has been insensitive to evidence. The influence of the media in the decision-making process seems to be far superior to that of any collective assessment effort or database product. During the Asia tsunami and in Pakistan, the entire disaster response system was found lacking in commitment to evidence-based response, transparency, and data sharing. In such well-funded operations, a lack of funding is not a credible explanation for shortcomings in data management.

The following extracts from the TEC evaluation illustrate the extent of this problem:

> On the humanitarian side, there were many, perhaps too many, informal assessments, a few available publicly, others not. Affected individuals felt "assessed to death": too frequently interviewed and yet not truly consulted. Despite the number of assessments, decision makers remained desperately short of information on the "big picture";

> guidance on what to do and more importantly on what not to do was not forthcoming. (de Ville de Goyet and Morinière 2006, 48)

Even among those agencies sharing their basic data, problems of compatibility emerged, as noted in the TEC evaluation:

> Most of the agencies participating in the cross-sectoral rapid assessment have sectoral or thematic responsibility. They do not find that the [UNDAC] standard cross-sectoral formats meet their needs, nor do they see the benefit or added value to their programmes of setting aside their custom-made formats to adopt a common approach to assessment. (de Ville de Goyet and Morinière 2006, 49)

The issue of standards and lack of agreement on what we are measuring are common to all disasters but were particularly obvious after the tsunami:

> Assessments reviewed by the evaluators failed to differentiate between tsunami-induced immediate needs and those resulting from long-standing poverty and conflict. A few assessments, mostly those from agencies with developmental or recovery activities, did attempt to collect or use baseline data. (de Ville de Goyet and Morinière 2006, 50)

The fundamental question is *whether a common database on needs is feasible* and would facilitate the arrival of early assistance among the disaster-affected population. Major actors (donors or NGOs) do rely on their own vertical, independent assessments (through fact-finding teams). During the tsunami, "the few cross-sectoral assessments that were conducted in time exercised their influence on the decision-making process more through field-level dialogue with bilateral counterparts than through the production of written reports" (de Ville de Goyet and Morinière 2006, 52).

The above shortcomings do not apply to countries such as India, Thailand, and, to a lesser extent, Maldives that have strong leadership and a clear policy of establishing national parameters and priorities during an international response. In these countries, there is a centralized source of data on needs, however imperfect. In other countries, "the disaster-management office in the affected country, often weak prior to the disaster, is further

marginalized and out-resourced by the international community" (de Ville de Goyet and Morinière 2006, 49).

As recommended in the TEC evaluation, the international community "should either significantly invest politically and financially in a permanent rapid assessment capacity, or abandon the pretence that initial cross-sectoral assessments by external teams guide the immediate international response of governments, the public, or humanitarian organizations" (de Ville de Goyet and Morinière 2006, 62). The evaluation adds that "dysfunctional competitive needs assessment is not sustainable. Victims are overassessed and decision makers underinformed" (de Ville de Goyet and Morinière 2006, 64).

On the positive side, many assessments and databases have been established successfully at the agency, sectoral, or discipline levels; these include the results of public health studies, food surveys, school assessments, and fisheries evaluations. Larger humanitarian organizations also organize effective data collection and assessment mechanisms that are narrowly tailored to their missions and potential resources. Databases are useful when they are established by the people and organizations that are making the decisions. Influencing the decisions of partners is a more difficult challenge among the agencies responsible for overall coordination.

Delayed Relief and Early Recovery

Information Needs

Because most basic needs are addressed during the immediate relief effort, data collection may be consolidated during the period after the arrival of delayed relief or during early recovery. Information systems that were unrealistic or rudimentary in the first weeks following the disaster may be set up or strengthened during early recovery. Nonetheless, various factors affect the establishment of consolidated systemwide databases on health, water, food, and shelter as follows:

- Lack of a centralized, detailed registry of all households in need of assistance (miniregisters at the agency level are no substitute)
- Little true consultation with beneficiaries (assistance is still driven by supply rather than demand)
- Lack of realistic standards acceptable to humanitarian workers and development planners (needs-based approaches or rights-based approaches)

- Limited specific information sharing on who is doing what and with what resources (lack of transparency)
- Ongoing marginalization of the national coordinating mechanism because many actors are directly accountable to the sources of funding

Projects to create durable, if not permanent, shelters require a broader range of information. Data are needed on the availability of water, schools, and health facilities; levels of vulnerability to natural disasters; the prior and projected economic activities of the relocated beneficiaries; and the status of land ownership. The last two are important and also difficult to examine in sufficient detail through national surveys.

Psychosocial assistance would be enhanced as a result of the development of mental health care and more systematic surveys based on suitable criteria adapted to local cultures. It would also be enhanced by reliance on the considerable resilience (often overlooked) of communities and individuals. The percentage of the population requiring professional mental health assistance might then be reduced to manageable and credible levels.[8]

The database on needs in education should include the results of a census among school-age children in temporary settlements, and lost teachers, and an assessment of surviving school facilities. The working assumption in the humanitarian sector is that every displaced or disaster-affected child is in need of education, and this facilitates the processing of information relative to medical care or psychosocial assistance where the proportion of those actually in need is open to question. Whether the need for education has been caused by the disaster or by chronic underdevelopment should be taken into account to avoid creating inequities or discouraging the rapid resettlement of displaced populations.

The information needs of projects focused on income generation are complex. The humanitarian community is not particularly equipped to carry out industry- or sectorwide surveys (for instance, in agriculture, fishing, and so on). These vertical studies are generally undertaken most effectively by the respective government ministry, with the support of international financial institutions, specialized international agencies, and NGOs.

At the community and household levels, livelihoods depend on many factors and activities. Focus group discussions and the participation of host communities are critical to the success of livelihood projects (for example, see USAID, IOM, and Indonesia 2005). Although such surveys may not be feasible on a countrywide, centralized basis, the standardization of methodologies and questionnaires should remain a goal.

Sources of Data and Initiatives

The United Nations Joint Logistics Center and the Humanitarian Information Centers (HICs) have been established through the United Nations system to provide data for early recovery. The International Red Cross and Red Crescent Movement has developed a recovery assessment team. The Flash Appeal process provides a potential forum for the consolidation of existing information for decision making.

The United Nations Joint Logistics Center is a common interagency humanitarian service that provides support for logistics information management. This involves offering an information platform for gathering, collating, analyzing, and distributing logistics information and supplying commodity tracking and prioritization services. The World Food Programme is responsible for administrative and financial oversight of the center. The center's highly specialized area of expertise is one of the key factors in its success. The center is using the logistics support system for its database on incoming supplies.[9]

Another United Nations common service is the HICs. The HICs aim to ensure that individuals and organizations involved in humanitarian operations benefit from the advantages of information management tools in assessing, planning, implementing, and monitoring humanitarian assistance. Initially created in 1999 to help address complex emergencies, the HICs were deployed in the aftermath of the tsunami and the Pakistan earthquake. The broad objective is generally to form the HICs into a super database of all data and sources of information. Independent evaluations following complex disasters such as the tsunami suggest that the mandate is far too broad relative to the scale of human and financial resources assigned by OCHA—the organization responsible for HICs management—and the donor community (Telford, Cosgrave, and Houghton 2006).

> The full potential of the HIC in the area of supporting decision making has rarely been achieved [in the three complex disasters reviewed by the evaluators]. Information management projects have their best success when they are discrete projects meeting clear demands. Collecting and combining many types of information provides a repository, but does not necessarily achieve the next step of informing decision makers. (Sida and Szpak 2004, 4)

Although HICs have provided a valuable service once they have been established during natural disasters (usually weeks after the initial impact),

the unwillingness of major actors (the Red Cross and NGOs) to share and file actionable data has limited their usefulness as an information source for strategic decision making. A search by the TEC team of the HIC-Sumatra database in 2005 using "field hospitals" as keywords produced 89 documents, few of which had any technical value. Most were press releases or other public relations material.

The International Federation of Red Cross and Red Crescent Societies and the International Committee of the Red Cross set up a special recovery assessment team with the objective of assessing post-tsunami recovery needs from a Red Cross perspective. The team was distinct from the field assessment and coordination team in terms of mandate, period of activity, and expertise. Its scope was limited to the formulation of priorities and projects for the International Red Cross and Red Crescent Movement.

Ultimately, the framework for early recovery at the macrolevel should be provided through a preliminary damage and loss assessment carried out by government authorities with the massive technical support of international financial institutions (see the next section).

The Flash Appeal led by the United Nations is an interagency mechanism for joint fund-raising during the early phase of a natural disaster (the first three or four weeks). The related document provides the most comprehensive strategic view of needs as perceived by international agencies submitting projects for support (mostly within the United Nations). Needs of beneficiaries that do not fall under the mandate of one agency may be overlooked. The perspectives of the host government are indirectly reflected to the extent that the specialized United Nations agencies have consulted their counterparts. Time constraints and other constraints generally do not permit critical screening and prioritization among the claims and requests made by participating partners. These factors limit the usefulness of the Flash Appeal as a comprehensive information tool on disasters and the related needs.

Recovery and Reconstruction

The reconstruction of major infrastructure and the restoration of macroeconomic life are new activities. The scope of recovery does not differ drastically from that of early recovery in the sense that both address the same basic needs.

As early as possible following a disaster, a nationwide assessment of the impact of the disaster should be undertaken, along with an economic valuation of the magnitude of the losses in the public and private sectors.

This macroassessment is usually carried out during the first few weeks by international financial institutions, including the World Bank Group and the corresponding regional development banks. The professional assessment uses the methodology developed by the United Nations Economic Commission for Latin America and the Caribbean. This methodology has been refined during application in many natural disasters across three decades.

A distinction should be made between the evaluation of the economic impact of a disaster and the assessment of specific recovery needs. The economic valuation provides an overall framework; it should not be used to replace an in-depth assessment of the needs in each area, community, or household.

Information Needs

Each ministry, with the support of its partners (the United Nations and NGOs), usually carries out its own vertical survey and constructs its own database of needs by locality and household. Independently, relief agencies, through well-funded interventions, may survey part of the population to identify and register the potential beneficiaries of the types of services they are providing, including temporary housing, cash, boats, fishing nets, and food for work. The formats of the resulting databases are often incompatible; the importance of this is relatively minor given that raw data of this sort may otherwise be unavailable for sharing with other actors.

However, in addition to the wastage of resources because of the duplication of efforts, this approach requires disaster survivors to undergo countless interviews and fill out numerous questionnaires that, in any case, frequently do not have a clear link to follow-up measures. Following the tsunami, this phenomenon contributed to a sense of resentment and a feeling of exploitation among the population.

Databases on losses related to disasters and the needs created may include information on the following:

- Housing losses per household, with specifications (type, cost, location, land ownership)
- Business losses (small or large)
- Losses in monthly household income and its sources over time
- Crops and agricultural land losses (salination or erosion) per household
- Losses in boats and fishing equipment (per locality or household)

- Ruined roads, bridges, and other infrastructure in each community or municipality
- Food stock inventory, food consumption per household, and the additional food distribution requirements
- Public health and education infrastructure, as well as losses in equipment and supplies
- Water supply losses

The surveys and databases aim to identify more precisely who needs what, while the economic valuation provides an overall picture (a bottom line) of the economic impact of the disaster at a national level. Not all these databases are comprehensive; some are not even available on computers. Data do not necessarily need to be available down to the household level, but groups of beneficiaries must be identified and carefully defined.

Most agencies active in recovery efforts collect large amounts of data from a predetermined group of beneficiaries, but few are transparent and open in processing these data so as to permit monitoring.

Assessing needs at the start of a project or program is only one step in the process of data management for recovery. Data must also be collected in each area of interest or discipline to allow monitoring of the recovery effort and the effectiveness in meeting specific needs.

Sources of Data and Initiatives

A promising source of data on recovery is the Tsunami Recovery Impact Assessment and Monitoring System (TRIAMS), an ambitious multisectoral project developed by the World Health Organization and the International Federation of Red Cross and Red Crescent Societies (WHO and IFRC 2006). TRIAMS is a conceptual effort to monitor the recovery from the tsunami by asking the right questions:

- To what extent are baseline data available on the four main areas in which tsunami recovery efforts may be grouped (vital needs, basic social services, infrastructure, and livelihoods)?
- To what extent have the losses and disruption in these areas been redressed?
- Are recovery interventions targeting the poorest populations and communities?
- Are recovery interventions effectively addressing inequalities (building back better versus only building back)?

- Have recovery interventions generated new inequalities within countries or within affected districts?

The TRIAMS approach, which is more social or people oriented than macroeconomic, also involves an examination of the way recovery may contribute to and is supportive of the goal to achieve poverty reduction. TRIAMS attempts to classify needs, data, and indicators into four areas: vital needs, basic social services, infrastructure, and livelihoods. Table 2.4, adapted from a final TRIAMS concept paper presented at a regional workshop in Bangkok in May 2006, outlines the content of each area through a list of selected indicators. These indicators are relevant during the early recovery phase and through to the final reconstruction phase of a disaster response. The table provides an illustration of the difficulty of differentiating between relief (search and rescue), early recovery (basic needs), and reconstruction (infrastructure and housing), as well as the difficulties involved in identifying proper indicators.

Achieving consensus among the five most affected countries (India, Indonesia, Maldives, Sri Lanka, and Thailand) has been a success of this project (UN, WHO, and IFRC 2006). Actual data collection and database management will be the test during the five years of the projected duration of TRIAMS. Data will be collected through random household surveys and routine information systems. The joint concept paper recognizes that:

> the main challenge is to ensure that systematic and standardized data collection, management and analysis take place at peripheral level and that the results are used to adjust and plan new recovery program activities. The breakdown of data and indicators to the smallest administrative units within the affected districts is mandatory in order to address the key questions presented above, and in particular the ones on the inequalities. (WHO and IFRC 2006, 4)

TRIAMS has required a general reflection on the process of assessing and monitoring recovery needs, as follows:

- First, the four thematic areas of recovery, together with basic societal functions and indicators, are similar for all large, destructive disasters. Table 2.4 might as easily refer to the recovery following Hurricane Mitch or the earthquake in Pakistan. Why should the approach be rediscovered *after* each disaster?

TABLE 2.4 Selected Indicators of Recovery and Reconstruction, by Area of Recovery

Areas	Basic societal functions	TRIAMS recovery output indicators
Vital needs	search and rescue, water and sanitation, food, shelter and clothing, medical care, security	% of population with access to water from an improved source, by administrative level % of population without basic sanitation facilities, by administrative level household food consumption, 24-hour recall proportion of the tsunami-affected population with damaged or destroyed housing, living in emergency shelters or temporary or permanent houses, by subdistrict, by time period measles immunization coverage, by administrative level number of titles to land issued, by economic status, by gender, by district
Basic social services	public health, education	number of primary-school children per school, by subdistrict number of primary-school children per teacher, by subdistrict

(continued)

TABLE 2.4 (*Continued*)

Areas	Basic societal functions	TRIAMS recovery output indicators
		number of hospital beds per 10,000 population (inpatient and maternity), by subdistrict or district number of outpatient consultations per person per year, by administrative level % of children 12–23 months of age who are fully immunized against all antigens, by administrative level number of health facilities with emergency obstetric care per 10,000 population, by subdistrict or district adequate antenatal coverage (at least four visits during a pregnancy), by subdistrict % of subdistricts covered by mobile psychological support workers, by district
Infrastructure	public works and engineering, energy supplies, logistics and transport, communications, environment	number of kilometers of repaired or new road, by type of road, by district number of bridges repaired, by district number of harbors and jetties rehabilitated, by type, by district % of destroyed or damaged schools rebuilt or rehabilitated, by category, by subdistrict % of destroyed or damaged health facilities rebuilt or rehabilitated, by category, by subdistrict

		number of square kilometers of natural habitat restored, by type number of kilometers of coastal protection, by type (biofencing, seawalls, quay walls, breakwaters), constructed or repaired, by district
Livelihoods	economy	number of square kilometers of land returned to crops, by district % of tsunami-affected population that has received loans, by administrative level, by gender % of tsunami-affected population enrolled in social protection programs, by gender, by subdistrict number of people employed, by sector, by district, by gender % of damaged or destroyed boats repaired or replaced, by use (fishing, tourism, ferrying, and other income-generating activities), by district

Source: Adapted from WHO and IFRC 2006.

- Agreeing on and developing the core TRIAMS indicators represented a major undertaking that lasted more than 18 months. Meanwhile, in each country, sectoral surveys and databases were being developed vertically and independently of each other. Methods for reconciling or matching these baseline data with the core indicators that have recently become standardized for monitoring deserve attention in the examination of the lessons learned through this process.
- Funding for the five-year TRIAMS project is an unresolved issue. Monitoring the proposed set of indicators will be expensive, albeit cost effective. If the donor support for the rapid assessment of *emergency* needs has been lukewarm, how determined will it be in a more costly and lengthy venture to collect and analyze *recovery* information? There is a definite preference for hard projects that reach people directly. This translates into insufficient monetary support for projects such as TRIAMS.

In brief, a standard methodology for impact assessment and economic valuation has been developed regionally and has now been adopted globally. A needs assessment and monitoring methodology that may be used during any disaster should be designed in a similar manner, with the participation of the agencies in charge of recovery. As this volume shows, a few examples exist of disaster databases and information systems designed in advance of disasters. The disaster-prone countries must be prepared, but so must the donor community.

Conclusions

Information systems are required in addressing needs, including the following:

- Life-saving needs: search and rescue; primary medical care; evacuation; food, water, and shelter for immediate survival
- Societal needs: offsetting the economic losses collectively incurred
- Individual recovery needs as perceived by the affected households: prioritizing among categories of needs is best done by the beneficiaries themselves
- Special needs of certain groups: fishermen, women, and so on
- Collective needs (in addition to those perceived by individual families): disease control and repair of roads, bridges, and other infrastructure

During the Immediate Relief Effort

When assistance is truly a matter of life or death, time pressure does not permit the collection and analysis of all data to the extent required for wise decision making. The first responders to disasters place the utmost priority on the speed of the response, and this is rightly so. However, it is also crucial to ascertain that the needs are not preexisting and that they are likely to persist until assistance reaches the intended beneficiaries. There are too many examples of inappropriate responses that might have been prevented had there been a rapid search for relevant information.

A speedy, cross-sectoral needs assessment should be conducted jointly by responding agencies to replace the multitude of mostly proprietary assessments and fact-finding missions that are now characteristic of relief efforts. Donors and financial institutions should show political commitment and provide the resources for this joint undertaking. More importantly, they should actually use the data in reaching decisions. The media currently have a much greater impact on the resource allocation process than do fact-finding missions and field teams. Perhaps the media should become involved in this joint assessment.

Initial assessments of relief needs should differentiate between acute needs generated by the natural hazard and those resulting from chronic poverty. Failure to adopt this approach in the past was not a technical oversight, but a philosophical preference among humanitarian organizations. as well as a pragmatic choice aimed at more effective fund-raising. However, this failure does not serve the best interests of the affected populations or the humanitarian community in the long term.

Early assessments are often carried out independently of local or national authorities. The sophistication of the emergency effort of the international community (the deployment of vehicles and telecommunications systems) and the use of English as a working language contribute to the disenfranchisement of national coordinating mechanisms, thereby weakening the information management capacity of local agencies. The humanitarian reform under way in the United Nations system should address this issue.

During Early Recovery or Delayed Relief

During early recovery, the priority should be on facilitating the process of returning to an improved state of normality.

Any confusion should be avoided between the economic valuation of the impact of the disaster and the creation of information systems on the needs of the affected population. Both are essential. Information systems for the management of needs during recovery must contain data disaggregated to reflect the needs of specific social groups, such as small-scale fishermen, school-age children, and HIV-positive individuals, or well-defined groups of households (according to location or community). A centralized system is not an alternative unless it is complemented by databases that are on specific groups and that rely on common or compatible formats. This is impossible to improvise during an emergency.

The global standards used to determine humanitarian requirements are based on rights rather than needs. Minimum standards should be adapted locally at the earliest stage of a disaster to offer realistic short-term targets that are compatible with the targets of long-term reconstruction. The establishment of minimum standards that are unattainable during normal times automatically eliminates the possibility of using any results as a baseline for long-term recovery. Notions of sustainability, cost-effectiveness, and the proper equity and equality between the disaster-affected population and the host population should temper the understandable desire to seize the opportunity of a disaster to provide the affected population and only the affected population with all they never had, but were always entitled to.

Information systems are essential, but should not have to be improvised after each disaster. They should be part of preparedness at the global and regional levels.

During Recovery and Reconstruction

There is an increasing overlap between the relief (humanitarian) phase and the recovery (redevelopment) phase during recent natural disasters. Humanitarian organizations, hard pressed to spend generous, but narrowly earmarked relief funds, tend to focus also on long-term recovery and reconstruction. Their lack of development expertise has resulted in ill-designed projects.

The first database needed for long-term recovery and reconstruction should perhaps be developed by one of the agencies, NGOs, or other actors that has proven expertise in recovery.

Notes

1. Since 1988, the Center for Research on the Epidemiology of Disasters has been maintaining the EM-DAT Database. EM-DAT was created with the initial support

of the World Health Organization and the Belgian government (see CRED 2007). It contains essential core data on the occurrence and effects of more than 12,800 mass disasters in the world from 1900 to the present. The database is compiled from various sources, including United Nations agencies, nongovernmental organizations, insurance companies, research institutes, and media outlets.

2. The report states in part as follows (World Bank 2006, 4): (a) "Increases in relief and reconstruction assistance have encouraged international reporting of more disasters. This is particularly the case for smaller events, which were previously treated as a local concern." (b) "More specialized agencies are tracking natural events and their disastrous impacts. Many country governments have now developed specialized agencies for tracking and reporting on natural disasters. The increased accuracy of observation and reporting on the weather contributes to the increase in reported extreme weather events: a 50 percent increase each decade from the 1950s to the 1990s." (c) "Sea temperatures have risen. A rise in tropical sea temperatures of up to 2 degrees Fahrenheit over the past century has contributed to an increase in weather-related disasters, some of which may be cyclical in nature."
3. Except for the last sentence, on sustainable development, this definition, found in UNISDR (2004), has been adopted in the report of the International Evaluation Group (World Bank 2006).
4. This definition, found in UNISDR (2004), has been adopted in the report of the International Evaluation Group (World Bank 2006).
5. The tidal wave in Bangladesh in 1970 killed an estimated 400,000 individuals, mostly children, the elderly, the sick, and women, while leaving the surviving population relatively uninjured and statistically in better health even than those people in nonaffected villages. The needs assessment is one of only a few that have included nonaffected villages as a control group. See Sommer and Mosley (1972). The findings of Sommer and Mosley have also been applied to the tsunami (observed but not formally published), though not in Banda Aceh, where the waves deposited or displaced an enormous amount of urban debris that physically injured many survivors.
6. The media and fund-raisers are frequently the sources of more accurate counts of the dead (including unidentified bodies recovered) and stable (unadjusted) counts of the missing. Meanwhile, downward revisions in death statistics are rare. The number of reported deaths following the Iranian earthquake rose to 41,000. The country's statistics office subsequently conducted a census to determine the exact number killed and missing (26,271 and 525, respectively). This case of downward revision is exceptional in developing countries.
7. No massive outbreak of infectious diseases has occurred that has been attributed to the sudden onset of a natural disaster, though there has been intense interest and surveillance for the last 30 years (de Ville de Goyet, Zapata Martí, and Osorio 2006).
8. Following the tsunami in Indonesia, the World Health Organization projected the needs in mental health assistance. These "predictive 12-month estimates were somewhat high and subject to question (with 25 percent of the affected population suffering from clinical mental disorders and an additional 50 percent who may present moderate or severe distress requiring psychological support)" (de Ville de Goyet and Morinière 2006, 101).

9. The logistics support system is based on the supplies management system developed initially by the Pan American Health Organization. Two of the case studies in this volume review the application of the system.

References

Abolghasemi, Hassan, Gholamreza Poorheidari, Ali Mehrabi, and Ghasem Foroutan. 2005. "Iranian Military Forces in the Bam Earthquake." *Military Medicine* 170 (10): 859–61.

Bennett, Jon, William Bertrand, Clare Harkin, Stanley Samarasinghe, and Hemantha Wickramatillake. 2006. *Coordination of International Humanitarian Assistance in Tsunami-Affected Countries*. London: Tsunami Evaluation Coalition.

Christoplos, Ian. 2006. *Links between Relief, Rehabilitation, and Development in the Tsunami Response: A Synthesis of Initial Findings*. London: Tsunami Evaluation Coalition.

CRED (Center for Research on the Epidemiology of Disasters). 2007. "About EM-DAT." Center for Research on the Epidemiology of Disasters, Department of Public Health, Université Catholique de Louvain, Brussels. http://www.em-dat.net/who.htm.

de Ville de Goyet, Claude, and André Griekspoor. 2007. "Natural Disasters: The Best Friend of Poverty." *Georgetown Journal on Poverty Law and Policy* 14 (1): 61–94.

de Ville de Goyet, Claude, and Lezlie C. Morinière. 2006. *The Role of Needs Assessment in the Tsunami Response*. London: Tsunami Evaluation Coalition.

de Ville de Goyet, Claude, Ricardo Zapata Martí, and Claudio Osorio. 2006. "Natural Disaster Mitigation and Relief." In *Disease Control Priorities for Developing Countries*, 2nd ed., ed. Dean T. Jamison, Joel G. Breman, Anthony R. Measham, George Alleyne, Mariam Claeson, David B. Evans, Prabhat Jha, Anne Mills, and Philip Musgrove, 1147–62. New York: Oxford Press; Washington, DC: World Bank.

Dilley, Maxx, Robert S. Chen, Uwe Deichmann, Arthur L. Lerner-Lam, and Margaret Arnold. 2005. *Natural Disaster Hotspots: A Global Risk Analysis*. Disaster Risk Management Series 5. Washington, DC: World Bank.

EM-DAT (OFDA-CRED [Office of U.S. Foreign Disaster Assistance–Center for Research on the Epidemiology of Disasters] International Disaster Database). Center for Research on the Epidemiology of Disasters, Université Catholique de Louvain, Brussels. http://www.em-dat.net/ (accessed July 8, 2007).

Flint, Michael, and Hugh Goyder. 2006. *Funding the Tsunami Response: A Synthesis of Findings*. London: Tsunami Evaluation Coalition.

FTS Database (Financial Tracking Services Database). United Nations Office for the Coordination of Humanitarian Affairs, New York. http://ocha.unog.ch/fts2/ (accessed June 28, 2007).

GTZ (German Agency for Technical Cooperation), DKKV (German Committee for Disaster Reduction), and University of Bayreuth. 2005. *Linking Poverty Reduction and Disaster Risk Management*. Eschborn, Germany: GTZ. http://www.dkkv.org/DE/publications/ressource.asp?ID=154.

Munich Re (Munich Reinsurance Company). 1999. *Topics 2000: Review of Natural Catastrophes of the Last Millennium*. Munich: Munich Re Group.

PAHO (Pan American Health Organization). 2001. "Natural Disasters: Myths and Realities." Emergency Preparedness and Disaster Relief Coordination Program, PAHO, Washington, DC. http://www.paho.org/English/PED/myths.htm.

Scheper, Elisabeth, Arjuna Parakrama, and Smruti Patel. 2006. *Impact of the Tsunami Response on Local and National Capacities*. London: Tsunami Evaluation Coalition.

Sida, Lewis, and Chris Szpak. 2004. "An Evaluation of Humanitarian Information Centers, Including Case Studies of HICs for Iraq, Afghanistan, and Liberia." Office of U.S. Foreign Disaster Assistance (U.S. Agency for International Development, Washington, DC) and the U.K. Department for International Development, London.http://www.usaid.gov/our_work/humanitarian_assistance/disaster_assistance/resources/pdf/Evaluation_HIC2004.pdf.

Sommer, Alfred, and Wiley A. Mosley. 1972. "East Bengal Cyclone of November 1970: Epidemiological Approach to Disaster Assessment." *Lancet* 299 (7759): 1029–36.

Sphere Project. 2004. *The Sphere Project: Humanitarian Charter and Minimum Standards in Disaster Response*. Geneva: Sphere Project. http://www.sphereproject.org/content/view/27/84/lang,English/.

Telford, John, John Cosgrave, and Rachel Houghton. 2006. *Joint Evaluation of the International Response to the Indian Ocean Tsunami: Synthesis Report*. London: Tsunami Evaluation Coalition.

UN (United Nations), WHO (World Health Organization), and IFRC (International Federation of Red Cross and Red Crescent Societies). 2006. "(TRIAMS) Workshop, Bangkok, 3–5 May 2006: Tsunami Recovery Impact Assessment and Monitoring System." Workshop report, United Nations, WHO, IFRC, and Swedish International Development Cooperation Agency, Geneva.

UNDP (United Nations Development Programme). 2004. *Reducing Disaster Risk: A Challenge for Development*. New York: Bureau for Crisis Prevention and Recovery, UNDP. http://www.undp.org/bcpr/disred/documents/publications/rdr/english/rdr_english.pdf.

UNISDR (United Nations International Strategy for Disaster Reduction). 2004. *Living with Risk: A Global Review of Disaster Reduction Initiatives*. Geneva: Inter-Agency Secretariat, UNISDR. http://www.unisdr.org/eng/about_isdr/bd-lwr-2004-eng.htm.

UNISDR (United Nations International Strategy for Disaster Reduction) and CRED (Center for Research on the Epidemiology of Disasters). 2007. "Occurrence, Trends-Century: Disaster Statistics." United Nations International Strategy for Disaster Reduction. http://www.unisdr.org/disaster-statistics/pdf/isdr-disaster-statistics-occurrence.pdf.

USAID (United States Agency for International Development), IOM (International Organization for Migration), and Indonesia, Ministry of Justice and Human Rights. 2005. *Settlement and Livelihood Needs and Aspirations Assessment of Disaster-Affected and Host Communities in Nanggroe Aceh Darussalam, 2005*. Banda Aceh, Indonesia: USAID.

von Oelreich, Eva. 2002. "Disasters Need Not Destroy Development." News stories, June 19, International Federation of Red Cross and Red Crescent Societies, Geneva. http://www.ifrc.org/docs/news/02/061901/.

Walter, Jonathan, ed. 2002. *World Disasters Report 2002: Focus on Reducing Risk*. Geneva: International Federation of Red Cross and Red Crescent Societies; Bloomfield, CT: Kumarian Press.

———. 2004. *World Disasters Report 2004: Focus on Community Resilience*. Geneva: International Federation of Red Cross and Red Crescent Societies; Bloomfield, CT: Kumarian Press.

WHO (World Health Organization) and IFRC (International Federation of Red Cross and Red Crescent Societies). 2006. "Tsunami Recovery Impact Assessment and Monitoring System (TRIAMS)." Joint WHO-IFRC concept paper, May. Geneva: WHO and IFRC.

World Bank. 1995. "BP 8.50: Emergency Recovery Assistance." *World Bank Operational Manual*. Washington, DC: World Bank.

———. 2006. *Hazards of Nature, Risks to Development: An IEG Evaluation of World Bank Assistance for Natural Disasters*. Washington, DC: Independent Evaluation Group, World Bank. http://www.worldbank.org/ieg/naturaldisasters/docs/natural_disasters_evaluation.pdf.

3

United Nations' Efforts to Strengthen Information Management for Disaster Preparedness and Response

Brendan McDonald and Patrick Gordon

> Information itself is very directly about saving lives. . . . If we take the wrong decisions, make the wrong choices about where we put our money and our effort because our knowledge is poor, we are condemning some of the most deserving to death or destitution.
>
> *John Holmes, United Nations Under-Secretary-General, OCHA*

Introduction

In the years since the Symposium on Best Practices in Humanitarian Information Exchange, in Geneva in February 2002, the broader humanitarian community and the members of the Inter-Agency Standing Committee (IASC)—a forum for coordination between the United Nations (UN) and other humanitarian agencies—have made substantial improvements in humanitarian information management (OCHA 2002). These improvements have been undertaken to ensure a common understanding of the humanitarian situation in responding to disasters and to facilitate coordinated approaches in disaster preparedness. Understanding that reliable information supports strategic and operational decisions, as well as

providing a basis for gap analysis and in setting priorities, humanitarian partners have been working collaboratively to establish common standards, methodologies, and interoperability mechanisms. This collaborative effort was demonstrated when the humanitarian community responded to several major challenges, including a number of large-scale disasters (the 2003 Bam earthquake in Iran, the 2004 Asian tsunami, the 2005 South Asia earthquake, and the 2006 Yogyakarta and Central Java earthquake). Although the number of crossborder conflicts and complex emergencies has declined over the last decade, the increasing impact of internal conflict and natural disasters, coupled with the abundance of new actors, has led to a comprehensive initiative of humanitarian reform. The "reform seeks to improve the effectiveness of humanitarian response by ensuring greater predictability, accountability, and partnership" (OCHA 2008, 1). The key to developing and sustaining common approaches to disaster preparedness and response is improved humanitarian information management.

This chapter describes recent efforts made by the UN to address these challenges.[1] It focuses specifically on information management and data preparedness within the context of the humanitarian reform agenda.

Humanitarian Response Review 2005

In 2005, the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) released the Humanitarian Response Review 2005 (UN 2005). The report attempted to address the perception that coordinated humanitarian responses to emergencies have not met the basic needs of the affected populations and that the responses may vary considerably from crisis to crisis. The aim of the review was to identify the humanitarian response capacities of the UN, nongovernmental organizations (NGOs), the International Red Cross and Red Crescent Movement, and other key humanitarian actors, gauge the gaps in capacities, and make recommendations on ways to fill the gaps. The report found that the humanitarian response has not been good enough and that the long-standing gaps are well known, but the system has failed to address them. It identified as a major weakness the lack of adequate preparedness of humanitarian organizations in terms of human resources and sectoral capacities. It noted that humanitarian organizations require a global vision that is supported by a plan of action for an agreed, shared response. The report therefore recommended the establishment of a more accountable, predictable response procedure with emphasis on partnerships. The report made reference to

the need to develop tools for preparedness, needs assessments, and mapping, but failed to examine information management in more detail.

The Cluster Approach

The cluster approach was first rolled out during the response to the Pakistan earthquake in 2005. Subsequent evaluations of the approach revealed that there were disconnects in cross-cluster information management and that common standards and methodologies needed to be adopted to yield information in support of analysis, coordination, and strategic decision making (DFID et al. 2006). Therefore, in June 2006, the IASC agreed to be responsible for integrating and strengthening information management practices through the newly developed cluster approach (box 3.1).

The cluster approach is one component of a broader humanitarian reform agenda designed to contribute to enhanced humanitarian response capacity, predictability, accountability, and partnership. The cluster approach seeks to improve the strength and effectiveness of the overall humanitarian response at five points.

First, the approach aims to develop and maintain adequate global capacity in key areas to ensure that the responses to new crises are timely and effective.

Second, the approach seeks to provide predictable leadership in areas of response in which there are gaps in capacity or resources. The global cluster or sector leads are responsible for ensuring that response capacity is in place and that assessment, planning, and response are executed with partners according to agreed standards.

Third, the approach is conceived on the basis of partnership among UN agencies, NGOs, international organizations, and the International Red Cross and Red Crescent Movement.[2] This means that the actors in the response effort must work collectively toward common humanitarian objectives, which should, in turn, reinforce interagency complementarities.

Fourth, accountability is reinforced through the approach. The global cluster or sector leads are accountable to the emergency relief coordinator for building a predictable and effective response capacity in line with agreements with the IASC. The cluster and sector leads at the field level, in addition to their normal responsibilities, are also accountable to humanitarian coordinators in meeting the roles and responsibilities of cluster leadership. Accountability toward beneficiaries is bolstered through commitments to participatory

BOX 3.1 The Cluster Approach

Following recent humanitarian reforms, the cluster approach has been adopted as a coordinated mechanism for responding in the event of a large-scale emergency. There are now globally managed emergency stockpiles, trained experts, and other resources that governments may call on to complement their own initiatives.

Activating the cluster approach means that governments will (a) be able to deal with a single counterpart within the international humanitarian community for each area of humanitarian response, (b) gain access to material support and other resources, (c) obtain support, if needed, to coordinate an activity within a given sector.

Internationally available resources for individual areas of response, such as emergency shelters or emergency nutrition kits, are managed at the global level by key organizations in each of the areas, for example, the World Health Organization, the International Organization for Migration, and the International Federation of Red Cross and Red Crescent Societies. These key organizations are called global cluster or sector leads. Over the past two years, these global lead organizations have worked with other large-scale organizations with expertise in a given sector as follows: (a) to harmonize and pool global stocks and expert staff capacity; (b) to agree on operational standards and other tools and guidelines for the sector; and (c) in the event of an emergency, to provide material support and support in coordination to the government of the affected country to ensure that international humanitarian assistance in a given sector is appropriate, relevant, well coordinated, and of uniformly high standards.

Source: Humanitarian Reform Support Unit.

and community-based approaches, improved approaches to needs assessment and priority setting, and enhanced monitoring and evaluation.

Finally, the approach ought to enrich coordination in the field by placing responsibility for leadership on sectoral issues with a corresponding specialized operational agency of competence.

Some of the IASC membership anticipated that the humanitarian community would have to adapt existing humanitarian information management systems to support the cluster approach. This was particularly

so because of the critical role of information in coordination and the requirement that coordination be conducted by lead agencies in specific clusters. Information management practices would therefore have to be effectively mainstreamed into humanitarian actions if operational coordination and strategic decision making are to be improved during the response to a disaster. The cluster system offered IASC members, especially the cluster or sector lead agencies and OCHA, an opportunity to work with partners to achieve a consensus in addressing long-standing challenges in humanitarian information management, such as data preparedness and agreed data standards.

As part of the discussions on broader humanitarian reform, IASC members, meeting as a working group in Rome on March 14–16, 2006, asked information management practitioners at OCHA and the UN agencies to make recommendations concerning the most effective ways to manage and exchange information in the humanitarian context. The practitioners emphasized the need for smoother links between information management and decision making, greater standardization, clearer divisions of responsibilities among agencies, and closer ties among information management efforts among the clusters and sectors and at the macro and strategic levels.

Recognizing the strategic value of information, IASC members encouraged wider consideration of humanitarian information management at three strategic levels, all of which would necessitate the collaboration and cooperation of humanitarian partners (see IASC 2006a).

First, data standards must be considered within an agreed framework that would apply within and among clusters and sectors. The framework should be based on needs assessment. It should be developed as part of disaster preparedness and response initiatives. It should seek to ensure that the decisions of all actors during a response are grounded on established baseline indicators uninfluenced by the specific demands and pressures of an emergency. This common needs assessment framework should be authoritative. It should also be sufficiently flexible to allow changes if new data requirements arise that may be specific to an individual disaster.

Second, cluster and sectoral actors should consider how the use of information management standards, methodologies, and indicators might support their shared responsibility to monitor the delivery of assistance, identify and address gaps, and track who is doing what and where. Appropriate quality control mechanisms might be required to

ensure that information products and outputs facilitate coordination, help cluster and sector leaders in decision making during response actions, and support accurate impact analysis.

Third, data must be harmonized systemwide among clusters and sectors to support situation analyses and strengthen coordination and strategic decision making. This is critical in bridging the gap between the data gathered by information professionals and the analyses required by decision makers and operational actors.

To translate this three-pronged strategic approach into actionable recommendations, the IASC working group convened an interagency workshop on information management in Geneva on June 7–8, 2006. The aim of the June workshop was to identify key characteristics of a systemwide approach to information management in support of a humanitarian response. The June workshop produced conclusions that were encapsulated in a statement on the role of information management within the cluster approach:

> Information management is a central element of the collaborative approach responding to humanitarian crisis situations, in particular at a time when a stronger and more predictable humanitarian response system is being set up. Information management needs to support and reflect the modi operandi of the collaborative approach, whereby different agencies have operational responsibility and accountability on the basis of their respective mandates and under the leadership of the Humanitarian Coordinator and the IASC Country Team.
>
> In any emergency, there is a variety of data and information available from the point of delivery which is directed to the country level and to the global level. This includes, inter alia, data on damage and losses, societal impacts, the needs of beneficiaries and others of concern, program activities and outcomes. To meet the information challenges posed by these needs, clusters and sectors should collect and manage data and information for both operational and strategic analysis and decision-making. In support of the Humanitarian Coordinator's functions and recognizing that there are specific (and often) different information management needs at the strategic and operational levels, OCHA should actively promote and support cross-cluster and

cross-sectoral information management and analysis, in particular at the strategic level [IASC 2006b, 1].

To translate this statement into action, the June workshop made 10 recommendations. The recommendations were subsequently endorsed by IASC members, meeting as a working group in Geneva on July 5–7, 2006, for action by OCHA, the global cluster or sector leads, other partners, and the IASC (IASC 2006c). The recommendations may be summarized as follows (see IASC 2006b):

1. The generic terms of reference for cluster lead agencies, cluster participants, and other stakeholders should be made more specific in respect of their roles in the management of information at country and global levels.
2. OCHA should work with cluster and sector lead agencies on a stocktaking exercise of the information management capacities of cluster lead agencies and other relevant partners, including national authorities where appropriate, and related country-based planning frameworks, such as the United Nations Development Assistance Framework, to clarify their capacity to manage information in humanitarian response and early recovery, as well as national and international nongovernmental organizations.
3. After consultation with partners, clear terms of reference should be issued by OCHA on its information management responsibilities in relation to clusters and sectors.
4. The role and function of the Humanitarian Information Center should be redefined on the basis of the results of the stocktaking exercise.
5. The common humanitarian information service entity should act as an information exchange platform for clusters and sectors and should proactively address the capacity-building needs of those entities, including development and application of standards. Where a Humanitarian Information Center is not deployed, OCHA should undertake information management responsibilities in accordance with its mandated role.
6. Clusters should incorporate an information management capacity or unit to manage information within the cluster and act as the link between clusters and sectors and between the cluster and, where deployed, the common humanitarian information service.

7. OCHA, together with cluster and sector lead agencies, should examine existing information management tools that may be useful for adaptation by cluster and sector leads for the promotion of standardized information management practices.
8. Cluster lead agencies and OCHA should develop guidance (protocols, agreements) on information sharing within and between clusters and between clusters and the common humanitarian information service. Concrete actions to ensure read-only existing data and information exchange, as a first step toward interoperability, should be undertaken as a priority.
9. OCHA should provide clarification on the analytical scope and expectations within and between clusters and sectors. Consideration should be given to best practices of analysis. In particular, links with the Integrated Food Security and Humanitarian Phase Classification of the Food and Agriculture Organization's Food Security Analysis Unit should be explored. Appropriate dissemination channels of analysis should be identified. OCHA should compile cluster and sectoral information and analysis into comprehensive analytical outputs to support decision makers.
10. Emphasis should be placed by all partners involved in humanitarian action on the need to communicate information requirements among senior managers.

In October 2006, OCHA convened the ad hoc Inter-Agency Information Management Working Group to implement the 10 IASC recommendations systematically. Although not an endorsed IASC subsidiary body, the group included representatives of most global cluster and sector leads. Over the next 17 months, the group undertook a series of activities that resulted in the partial implementation of the recommendations. These activities, which, from the OCHA side, were primarily funded through the Humanitarian Aid Department of the European Commission, involved substantive policy discussions that were difficult to translate into initiatives in the field. One of the main impediments to a more expedited solution was the differences in capacity and in resources among the cluster and sector lead organizations. Moreover, there were also differences in institutional commitments to an information management system and the use of information management in all phases of a disaster response. Challenges remain in mainstreaming information management sustainably within the clusters beyond the Appeal for Building Global Humanitarian Response Capacity 2007 (OCHA 2007a).

The key outputs of the Inter-Agency Information Management Working Group were as follows:

- A stocktaking report in June 2007 on the information management capacities of global cluster or sector leads (see Larsen 2007)
- A draft revision of the terms of reference of the Humanitarian Information Center was endorsed by the IASC on May 26, 2008
- Enhanced information management capacity within the global cluster leads
- An agreement on the promotion of common intercluster tools, including GeoNetwork (http://geonetwork-opensource.org/) and 3W, the Who Does What Where Database and Contact Management Directory (http://3w.unocha.org/WhoWhatWhere/)
- Agreement on country-level minimum common operational data sets (OCHA 2007b)
- Improved integration of information management into global cluster and sector lead training
- Improved awareness of information management at the global level among the cluster and sector leads

To a large extent, the culmination of the recommendations is most visible in the note on "Operational Guidance on Responsibilities of Cluster/Sector Leads and OCHA in Information Management" that was approved by the IASC Task Team on the Cluster Approach in October 2007 (OCHA 2007c). The note is intended to help cluster and sector leads, OCHA, and humanitarian partners ensure that, during a humanitarian emergency in a country, relevant information is provided to the right person at the right time and in a usable form so as to facilitate situational understanding and decision making. The primacy of national authorities is recognized in that cluster and sector leads and OCHA are to make sure that disaster response information management activities support national information systems, follow standards, build local capacities, and maintain appropriate links with relevant local, regional, and national government authorities. Cluster and sector leads and OCHA should thus seek to strengthen, not replace or diminish, national efforts, including the efforts of institutions not part of the cluster or government (OCHA 2007c).

The guidance note also lays out a clear division in responsibilities for information management within the humanitarian community during

emergencies. The responsibility for ensuring proper intracluster information management lies with the cluster or sector lead, while the responsibility for ensuring proper intercluster information management lies with OCHA. In implementing the 10 recommendations, OCHA and the cluster and sector leads recognize there are other initiatives within the UN system, particularly in the area of advocacy and geographic information systems, that complement and reinforce activities undertaken within the humanitarian sphere. Of specific interest for the topic of the use of data during the response to disaster is the United Nations Geographic Information Working Group (UNGIWG) (see http://www.ungiwg.org) and the 2007 Global Symposium +5, "Information for Humanitarian Action" (see http://www.reliefweb.int/symposium/).

Real-time evaluations conducted after the response to the floods in Mozambique and Pakistan indicate that cluster and sector leadership requires investment in human resources and in systems by the leads to ensure that information flows within the cluster. The Mozambique real-time evaluation noted that cluster and sector leads that lacked a presence in the field limited their ability to capture information and support coordinated action (Cosgrave et al. 2007). The evaluation also identified proper information management practices and commitment to adequate resources as essential to effectiveness. In addition, it was suggested that OCHA should quickly develop teams to support cluster roll-out by providing sufficient staff for information management and the establishment of a field presence within a country during an emergency.

The UN Spatial Data Infrastructure

In October 2005, the UNGIWG proposed the creation of a spatial data infrastructure initiative within the UN to improve humanitarian and peacekeeping operations. Spatial data are information about places, geographical characteristics, and other features and elements that may be referenced through a map. A spatial data infrastructure is a framework of spatial data, metadata, users, and tools that are connected interactively to allow the use and reuse of spatial data in a flexible and efficient fashion. A spatial data infrastructure is "the technology, policies, standards, human resources, and related activities necessary to acquire, process, distribute, use, maintain, and preserve spatial data" (OMB 2002, 2).

In proposing to implement the United Nations Spatial Data Infrastructure (UNSDI), participating agencies within the UN system have

stressed that the infrastructure must abide by the principles of sharing and reciprocity. Operating within a common environment of standards and tools, the proposed UNSDI should maximize the impact of all available resources for geospatial activities through cooperation within the UN system and beyond. It is possible that without the foundation of a UNSDI, some of the resources that the UN system spends on geographic information systems may go toward duplicating the data collection and processing efforts of other organizations. This means that the same geographical data themes on the same areas are collected again and again at great expense. Through the sharing of data and technical capacity, the full benefits of geospatial data and information to stakeholders around the globe may become optimized.

If the UNSDI vision is to be realized, an overarching governance framework needs to be established to improve the use of geospatial data within the UN system and among its partners. The governance mechanism should seek to enhance the effectiveness of the operations and executive management of the UNSDI. The scope of the governance framework should be limited to the implementation and coordination of the UNSDI and, to a lesser extent, to informing the spatial data infrastructure of participating and partner organizations (Henricksen 2007). Nonetheless, much of what might be achieved through a UNSDI might also be achieved through more harmonization in practices and operations and through strengthened coordination. Within the UN system, this is already occurring; it has been brought about, in part, by the discussions on the UNSDI.

The various elements of the UNSDI must be considered in relation to the governance framework as a prerequisite for meeting the needs of data users. The governance framework should define and encompass the human resources, standards, tools, and metadata required to manage data effectively prior to and during a humanitarian crisis. During the initial response to an emergency, obtaining accurate and timely information on the needs of the affected populations is critical. Without shared baseline information, information management resources that would otherwise be allocated for rapid assessments and the development of core data products must be spent on the identification and collection of information on the situation *before* the disaster. Conflict and disasters often invalidate large amounts of available (baseline) data as populations move, social infrastructure is destroyed, and new needs emerge. Without the baseline data, however, one will be hard-pressed to understand the extent of the disaster or the needs of the population accurately. If an environment in which accurate information

may be obtained, maintained, and made widely available has not been established, the delivery of effective, precisely targeted assistance through disaster response may be significantly undermined (OCHA 2006).

The value of data preparedness was demonstrated in Kosovo in 1999. The Humanitarian Community Information Center in Kosovo, the first such center ever established, was able to utilize a wide range of available baseline data that had been compiled in the six months before the operation began, including the original place codes, geographical data standards, and numerous sectoral databases. These data were used as the foundation for a coordinated information management strategy that saw hundreds of organizations collaborate on common assessments, work from common baseline data, and exchange comparable and compatible information. This was possible because the essential data sets already existed and were being promoted among the humanitarian actors. Although the humanitarian information center model was adopted and replicated in subsequent humanitarian operations, many have suffered from the absence of these preparatory data and the collaborative information environment such data facilitate.

The need for data preparedness was recognized during the Symposium on Best Practices in Humanitarian Information Exchange, held in Geneva on February 5–8, 2002, where the benefits of preparedness were noted through real-world examples in Kosovo and Mozambique (OCHA 2002). This was reiterated during Global Symposium +5 "Information for Humanitarian Action" that was held in Geneva five years later (+5), on October 22–26, 2007. The 2007 symposium noted that preparedness is one of the most critical aspects of humanitarian information management and analysis (OCHA 2007d). It therefore recommended that the humanitarian community should promote the availability and accessibility of minimum common operational data sets during the preparedness phase, particularly in data project activities involving UN agencies and national institutions and statistical systems. It also noted that data collected during a disaster response should be available and discoverable among users, particularly institutions and individuals within the affected country, as well as in support of relief and recovery efforts by others (see elsewhere below).

Although the task of data preparedness is vast, the implications for improving the quality of specific UN agency outputs and facilitating the interoperability of data among UN agencies justify the investment. The development of a road map to data preparedness and interoperability facilitates the achievement of these objectives.

The UN, with its partners, has undertaken various initiatives to ensure data preparedness and interoperability at the onset of an emergency. Various forums have been instituted so that the humanitarian community is working with common taxonomies and baselines and under agreed frameworks for information exchange, including the geographic information support team (GIST) and the UNGIWG. Within these frameworks, emphasis has been placed on defining common approaches and reaching agreements on ways of sharing that encompass interoperability among tools and services, policy, and arrangements to promote coordination in action. The aim is to ensure that data, once collected, may be used and reused by the humanitarian community and that authoritative institutions are in place to define and identify common baseline data prior to the onset of an emergency.

The GIST is an interagency entity that promotes geographical data standards and geographic information systems in support of humanitarian relief operations. To support preparedness and emergency response, GIST members collaborate at the onset of a disaster and during the emergency to identify data resources. GIST members are technical experts, geographic information specialists, and information management officers in UN and donor agencies involved in disaster management or humanitarian assistance.

The GIST is based on the assumption that common approaches to sharing information will result in improved information exchange and bolster the capacity of the humanitarian community to coordinate emergency response. The GIST provides a forum for the exchange of geographical and geo-referenced information and data among donors and humanitarian response agencies. In support of meeting GIST global data management and integration needs, the GIST Data Repository has been created, in collaboration with Information Technology Outreach Services of the University of Georgia and with the United States Agency for International Development. The repository is associated with a data exchange platform where GIST members may share data during an emergency (GIST Data Repository 2008).

The UNGIWG is a network of UN professionals in cartography and geographical information science. The UNGIWG was formed in 2000 to address common geospatial issues—maps, boundaries, data exchange, standards—that affect the work of the UN system and partners. The UNGIWG also provides a forum for nongovernmental organizations, research institutions, and industry to exchange information on geospatial technologies to try to enhance normative and operational capabilities. The UNGIWG occasionally submits ad hoc reports to the UN System

Chief Executives Board for Coordination; the last report was issued in February 2006.

Specifically, the UNGIWG aims to facilitate the efficient use of geographical information for decision making; promote standards and norms for maps and other geospatial information; develop core data sets to avoid duplication; build mechanisms for sharing, maintaining, and ensuring the quality of geographical information; provide a forum for discussing common issues and emerging technological changes within the UN system and in close cooperation with member states, NGOs, research institutions, and industry; and develop and maintain a common geographical database to enhance normative, planning, and operational capabilities and efficiency within the UN system.

Although there has not been an evaluation of the effectiveness of the UNGIWG, it is clear the group has facilitated a conversation among practitioners in geographic information systems and data sharing. An output of this conversation is the World Health Organization's Second Administrative Level Boundaries Project. The global digital data set created through the project consists of digital maps and codes on individual countries. The data set may be downloaded freely (see SALB Data Set 2007). To ensure consistency, the data set relies on an international borders template that has been developed by the UN Cartographic Section. The aim is to create a global data set in which each country map is compatible in scale, content, and detail with the maps of neighboring countries. The project has recently moved beyond its original objective—the creation of a standardized layer of geographical information on administrative units down to the second subnational level as of January 2000—and now provides a working platform for the collection, management, analysis, and visualization of national boundary information. The project represents an excellent example of interagency data coordination in the field of geographical information.

The humanitarian community has also begun coordinating the acquisition of space data for use in emergencies on the basis of the International Charter Space and Major Disasters (http://www.disasterscharter.org/charter_e.html). The charter aims to facilitate a unified system of space data acquisition and delivery for organizations making data requests in countries affected by disasters. The charter was declared formally operational on November 2000. An authorized user may now make a call to a single, special number to request the mobilization of the space capability and the associated ground resources of the member agencies to obtain data and

information on a disaster occurrence. These resources include the following satellites: ALOS (Japan Aerospace Exploration Agency); Envisat and ERS (European Space Agency); FY, SJ, and ZY (China National Space Administration); GOES and POES (National Oceanic and Atmospheric Administration, United States); IRS (Indian Space Research Organization); Landsat (United States Geological Survey); Radarsat (Canadian Space Agency); Spot (Centre national d'études spatiales, France); and SAC-C (Comisión Nacional de Actividades Espaciales, Argentina). It also includes the satellites and other systems of the disaster monitoring constellation, such as the British National Space Center and DMC Imaging International, United Kingdom (UK-DMC); the Centre National des Techniques Spatiales, Algeria (ALSAT-1); National Space Research and Development, Nigeria (NigeriaSat); and Tübitak-BILTEN, Turkey (BILSAT-1). The United Nations Office for Outer Space Affairs is the lead organization within the UN for activating the space charter.

The UN General Assembly established the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) "to provide universal access to all countries and all relevant international and regional organizations to all types of space-based information and services relevant to disaster management to support the full disaster management cycle" (UN 2007, 2). Effectively, the program supports coordination in the use of space-based imagery for disaster management and acts as a mediator between the disaster management and space communities. Through a network of national and regional focal points, the program carries out a variety of institutional capacity-building activities with member states in an effort to advocate for the use of space-based technologies and to strengthen national capacities within the context of disaster management and response.

Also important in data preparedness is the availability of an agreed, shared data set and the identification of focal points in each country prior to the onset of an emergency. Within the framework of the Inter-Agency Information Management Working Group, OCHA and cluster and sector leads have identified the core data sets. In partnership with the cluster and sector leads, OCHA is committed to sourcing and maintaining minimum operational geospatial data sets at the country and regional levels. OCHA has taken this initiative because it is responsible within the UN system for developing and improving baseline data on countries and regions affected by humanitarian crises (UN 1991). A core component of this responsibility is the use, exchange, and management of information relating to the

location of and relationships among geographical features using spatial information technology tools such as geographic information systems, satellite imagery, image processing software, and global navigation satellite systems.

To harmonize the use of spatial data in countries and among the field, regional, and agency headquarters, authoritative spatial data sets are to be progressively compiled and maintained by OCHA field and regional offices on behalf of the humanitarian community. OCHA regional offices also have the responsibility to compile data sets within their regions for countries that do not have a geographic information system capacity (OCHA 2007e).

A list of core data sets, which have been identified as a required minimum, is provided in table 3.1. The major themes for this minimum core set of authoritative spatial data are settlements and demographics, government administrative infrastructure (boundaries and administrative centers), and accessibility (road networks, ports, railroads, and so on).

In addition, OCHA, in consultation with cluster and sector leads, may source and maintain a number of optional data sets on countries on behalf of the humanitarian community. The types of optional data sets are listed in table 3.2. The capacity of OCHA to accomplish this will depend on the quality of the available data and the prevailing spatial information management environment in each country.

Likewise, OCHA is advocating the development of standardized p-codes (place codes) to identify administrative levels and population centers. P-codes are similar to postal codes. They may form part of a data management system that provides unique reference codes to thousands of place locations. These codes offer a systematic means of linking to additional data, exchanging data, and analyzing relationships among data. P-codes support predictable and accountable information exchanges during an emergency response. They allow various actors to share information available in p-code format, including information on population, housing and housing damage, infrastructure and infrastructure damage, agriculture, and assistance and supply distribution points. Through a variety of forums, such as the United Nations Conference on the Standardization of Geographical Names, OCHA is seeking to ensure that national initiatives, such as national gazetteers, are reflected in the development of p-codes (OCHA 2007e; UNESCAP and UNISDR 2006; UN Statistics Division 2008).

Within the context of the proposed UNSDI, common data sets would have to be stored on a platform that would enable the data to be discoverable to other actors. The platform would be based on international standards,

TABLE 3.1 Minimum Common Operational Data Sets

Category	Data layer	Recommended scale of source material
Political, administrative boundaries	country boundaries administrative level 1 administrative level 2 administrative level 3 administrative level 4	1 : 250,000
Populated places, including latitude and longitude, alternative names, population figures, classification	settlements	1 : 100,000– 1 : 250,000
Transportation network	roads, railways	1 : 250,000
Transportation infrastructure	airports, helipads, seaports	1 : 250,000
Hydrology	rivers, lakes	1 : 250,000
City maps	computer-scanned city maps	1 : 10,000

Source: OCHA 2007e.

TABLE 3.2 Optional Common Operational Data Sets

Category	Data layer	Recommended scale of source material
Marine	coastlines	1 : 250,000
Terrain	elevation	1 : 250,000
National map series	scanned toposheets	1 : 50,000– 1 : 250,000
Satellite imagery	Landsat, ASTER, Ikonos, Quickbird imagery	various
Natural hazards[a]	various	various
Thematic	various	various

Source: OCHA 2007e.

a. For an example of natural hazard mapping, see OCHA ROAP Map Center.

specifically, ISO 19115, and would be interoperable to allow for data exchanges with other platforms.[3] To this end, the Food and Agriculture Organization of the United Nations, OCHA, the United Nations Environment Programme, and the World Food Programme have combined their research and mapping expertise to develop GeoNetwork Opensource as a common environment for sharing their spatial databases, including digital maps, satellite images, and related statistics. GeoNetwork Opensource adheres to standards and protocols based on ISO 19115, ISO/TC211, and the Open Geospatial Consortium. Though ISO 19115:2003 is applicable to digital data, its principles may be extended to nongeographical data and to other forms of geographical data, such as maps, charts, and text documents. Thus, for example, the OCHA GeoNetwork Database is designed to enable access to geo-referenced databases, cartographic products, and related metadata from a variety of sources and to enhance spatial information exchange and sharing between organizations and their audiences using the capacities of the Internet (see OCHA GeoNetwork Database 2008). The approach aims to offer a wide community of spatial information users easy and timely access to available data and existing thematic maps that might support informed decision making.

Data preparedness may build on, support, and utilize these activities and technologies to strengthen OCHA's efforts at coordination and improve the overall effectiveness of the actors responding to humanitarian emergencies. In addition, it is the stated aim of these initiatives to foster an appreciation of the value of improved information management among humanitarian actors. This has a value beyond emergency response. It leads to a longer-term transition by enabling information collected in the emergency relief phase to be reused for early recovery and for recovery and reconstruction initiatives.

The Global Symposium +5, Information for Humanitarian Action

It was in this environment of humanitarian reform and efforts to improve interagency information management that Global Symposium +5, Information for Humanitarian Action was held at the Palais des Nations, Geneva, in October 2007 (OCHA 2007f). The symposium built on the Symposium on Best Practices in Humanitarian Information Exchange, held in 2002 (OCHA 2002), and successive regional workshops in Bangkok (September 2003), Panama City (August 2005), and Nairobi

(May 2006). Global Symposium +5 was convened by ReliefWeb; the Field Information Services Unit, Advocacy Information Management Branch, OCHA, New York; and the Emergency Services Branch, OCHA, Geneva. The symposium brought together a community of practice to review the principles agreed on at the 2002 symposium and the best practices developed since then. The goal was to identify information standards that would facilitate information management and exchange and support preparedness and effective humanitarian response.

The symposium discussed recent initiatives in support of data preparedness. These include the HewsWeb Humanitarian Early Warning Service (http://www.hewsweb.org), a global multihazard Web service developed by the World Food Programme on behalf of the IASC; PreventionWeb (http://www.preventionweb.net), a project of the United Nations International Strategy for Disaster Reduction that is being piloted as an information service to increase knowledge about disaster risk reduction; and RedHum (http://www.redhum.org), developed following the regional workshop, Humanitarian Information in Latin America and the Caribbean, held in Panama City in August 2005 and built around a Web site providing timely and reliable documents, maps, and resources in Spanish.[4]

Among the recent initiatives for improving disaster response is the Health and Nutrition Tracking Service (http://www.who.int/hac/techguidance/hnts/Intro/en/index.html), a common data exchange platform driven by the World Health Organization. Another significant initiative in the last five years is the Emergency Capacity Building Project (http://www.ecbproject.org), which is operated by the Interagency Working Group on Emergency Capacity—CARE International, Catholic Relief Services, International Rescue Committee, Mercy Corps, Oxfam, Save the Children US, and World Vision International—and is aimed at enhancing staff capacity, accountability, impact measurement, risk reduction, and the use of information and communications technology in response actions. Geographical information and mapping have advanced significantly at all phases of humanitarian action. Web-based mapping tools, such as Google Earth (http://earth.google.com), have introduced mapmaking among the public, and satellite imagery has supplied a means to share information on vulnerable populations in remote areas.[5] The NGO community is also designing initiatives looking to the future. The HumaniNet Maps 2.0 initiative (http://www.humaninet.org/maps20.html) is building a community of practice for NGO geographic information system experts, and

OneWorld has developed OneClimate.net (http://www.oneclimate.net), a Web 2.0 space aimed at tackling climate change.

Conclusion: Future Strategy

The humanitarian reform process, which is designed to improve the implementation and coordination of humanitarian assistance, is providing a unique opportunity to integrate information management into humanitarian action. While the attention paid to information management has appeared a little late in the process, it is anticipated that the centrality of the effective management of information to the success of the reform process will assist in creating stronger links between immediate relief activities and longer-term strategies and programs. Although this is considered self-evident among information management practitioners, the challenge remains in convincing humanitarian professionals who have not yet been involved in the conversation. In coming years, OCHA, in partnership with the humanitarian community, will continue to focus on building common approaches to disaster preparedness and response through information management.

There has been progress, but the humanitarian community still faces many of the same challenges highlighted in 2002 at the Symposium on Best Practices in Humanitarian Information Exchange and in subsequent reviews and evaluations. Information practitioners are still grappling daily with information overload, incompatible technologies, nonstandard data sets, lack of resources, and competing policies and mandates. Information sharing among various partners remains voluntary and is based on goodwill. Nonetheless, through the cluster approach and humanitarian reform, there is now accountability.

Notes

1. The UN does not represent or endorse the accuracy or reliability of any information contained in this chapter. Reliance upon any such advice, opinion, statement, or other information shall be at the user's own risk. The views expressed and the accuracy of the information on which they are based are the responsibility of the authors. Some sources for the chapter are reports of various committees and working groups and do represent the consensus of the individuals involved; whether or not they also represent the opinions or policies of the sponsoring organizations is expressly stated.
2. The International Committee of the Red Cross is not taking part in the cluster approach. Nonetheless, coordination between the committee and the UN

continues, to the extent necessary, to achieve efficient operational complementarity and a strengthened response for people affected by armed conflict and other situations of violence. At the global level, the committee participates as an observer in many of the cluster working group meetings. The International Federation of Red Cross and Red Crescent Societies has been participating in a number of cluster working groups. It has made a commitment to provide leadership to the broader humanitarian community in disaster situations, to consolidate best practice, map capacity and gaps, and lead coordinated response. It continues to convene the emergency shelter cluster during natural disasters rather than acting as a global cluster lead. It remains committed to effective coordination to achieve efficient operational complementarity and a strengthened response for people affected by natural disasters.

3. ISO 19115:2003 defines the schema required for describing geographical information and services. It provides information about the identification, extent, quality, spatial and temporal schema, spatial reference, and distribution of digital geographical data. ISO 19115:2003 is applicable to the cataloguing of data sets, geographical data sets, data set series, and individual geographical features and feature properties. See ISO (2003).
4. While the current version of RedHum is focused mainly on Central America and the Caribbean, the project's subsequent phases involve expanding to the countries of the Andean Community and the Southern Common Market. RedHum is supported by the Central American Coordination Center for Natural Disaster Prevention and the IASC. It is hosted by the OCHA Regional Office for Latin America and the Caribbean.
5. The Operational Satellite Applications Program of the United Nations Institute for Training and Research is supplying access to satellite imagery and geographic information system services and products for humanitarian relief, disaster prevention, and postcrisis reconstruction. Through their use of satellite imagery in remote areas, organizations such as Amnesty International provide evidence of the usefulness of satellite imagery for humanitarian advocacy.

References

Cosgrave, John, Célia Gonçalves, Daryl Martyris, Riccardo Polastro, and Muchimba Sikumba-Dils. 2007. "Inter-Agency Real-Time Evaluation of the Response to the February 2007 Floods and Cyclone in Mozambique, May 2007." Report, Inter-Agency Standing Committee, Geneva.

DFID (U.K. Department for International Development), ECHO (Humanitarian Aid Department, European Commission), OCHA (United Nations Office for the Coordination of Humanitarian Affairs), and USAID (United States Agency for International Development). 2006. "Humanitarian Information Centre in Pakistan: Joint Review Mission Report." Report, OCHA, Islamabad.

GeoNetwork Opensource Database. GeoNetwork Opensource Community. http://geonetwork-opensource.org/.

GIST Data Repository (Data Repository of the Geographic Information Support Team). United Nations Office for the Coordination of Humanitarian Affairs. https://gist.itos.uga.edu/index.asp (accessed April 11, 2008).

Henricksen, Barry. 2007. *UNSDI Compendium: A UNSDI Vision, Implementation Strategy, and Reference Architecture*. Rome: United Nations Geographic Information Working Group. http://www.ungiwg.org/docs/unsdi/UNSDI_Compendium_13_02_2007.pdf.

Humanitarian Reform Support Unit. "Humanitarian Reform." United Nations Office for the Coordination of Humanitarian Affairs. http://www.humanitarianreform.org/.

IASC (Inter-Agency Standing Committee). 2006a. "Final Summary Notes and Revised Action Points: IASC Working Group Meeting, Rome, 14–16 March 2006." Report, IASC, Geneva.

———. 2006b. "Report on the Outcome of the Information Management Workshop." Report, June 20, IASC, Geneva.

———. 2006c. "Final Summary Record and Revised Action Points/Conclusions: 65th IASC Working Group Meeting, Geneva, 5–7 July 2006." Report, IASC, Geneva.

———. 2006d. "Guidance Note on Using the Cluster Approach to Strengthen Humanitarian Response." Note, IASC, Geneva.

ISO (International Organization for Standardization). 2003. "ISO 19115:2003 Geographic Information-Metadata." Report, ISO, Geneva. http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=26020.

Larsen, Lynnette. 2007. "Strengthening Humanitarian Information Management: A Status Report." Report, Field Information Services Unit, United Nations Office for Coordination of Humanitarian Affairs, Geneva.

OCHA (United Nations Office for the Coordination of Humanitarian Affairs). 2002. "Symposium on Best Practices in Humanitarian Information Exchange: Final Report." Relief Web. http://www.reliefweb.int/symposium/2002_symposium/final_report.pdf.

———. 2006. "Data Preparedness and Emergency Response: No Good Decisions without Good Information." Paper presented at the "Seventeenth United Nations Regional Cartographic Conference for Asia and the Pacific," Bangkok, September 18–22. http://unstats.un.org/unsd/geoinfo/17thunrccapIP1.pdf.

———. 2007a. *Appeal for Building Global Humanitarian Response Capacity 2007: 1 April 2007-31 March 2008*. Geneva: United Nations. http://ochaonline.un.org/cap2005/webpage.asp?Page=1566.

———. 2007b. "Country Level Minimum Common Operational Datasets." Note, OCHA, Geneva.

———. 2007c. "Operational Guidance on Responsibilities of Cluster/Sector Leads and OCHA in Information Management." Note, OCHA, Geneva.

———. 2007d. "Global Symposium +5, Information for Humanitarian Action: Outcomes." Report, version 7 (November 30), Relief Web. http://www.reliefweb.int/symposium/docs/Symposium%20Outcomes.pdf.

———. 2007e. "Geographic Information Systems and Geospatial Data Management." Policy instruction, October 29, OCHA, Geneva.

———. 2007f. "Global Symposium +5, Information for Humanitarian Action: Final Statement." Report, version 0.8 (November 30), Relief Web. http://www.reliefweb.int/symposium/docs/Symposium%20Final%20Statement.pdf.

———. 2008. "Humanitarian Reform: Accountability, Predictability, Leadership, Partnership." Humanitarian Reform Support Unit, OCHA. http://www.humanitarianreform.org/.

OCHA GeoNetwork Database. United Nations Office for the Coordination of Humanitarian Affairs. http://geonetwork.unocha.org/mapsondemand/srv/en/main.home (accessed April 2008).

OCHA ROAP Map Center. Regional Office for Asia and the Pacific, United Nations Office for the Coordination of Humanitarian Affairs. http://ochaonline2.un.org/Default.aspx?tabid=3780.

OMB (Office of Management and the Budget). 2002. "Circular No. A-16, Revised." Information circular, Office of Management and the Budget, Executive Office of the President, White House, Washington, DC. http://www.whitehouse.gov/omb/circulars/a016/a016_rev.html.

SALB Data Set (Second Administrative Level Boundaries Data Set). United Nations Geographic Information Working Group. http://www.who.int/whosis/database/gis/salb/salb_home.htm (accessed 2007).

UN (United Nations). 1991. "Strengthening of the Coordination of Humanitarian Emergency Assistance of the United Nations." Document A/RES/46/182 (December 19), United Nations General Assembly, New York.

———. 2005. "Humanitarian Response Review: An Independent Report Commissioned by the United Nations Emergency Relief Coordinator and Under-Secretary-General for Humanitarian Affairs, Office for the Coordination of Humanitarian Affairs (OCHA)." Report, United Nations, Geneva.

———. 2007. "United Nations Platform for Space-based Information for Disaster Management and Emergency Response." Document A/RES/61/110 (January 15), United Nations General Assembly, New York.

UNESCAP (United Nations Economic and Social Commission for Asia and the Pacific) and UNISDR (United Nations International Strategy for Disaster Reduction). 2006. "Regional Workshop on Mitigation, Preparedness, and Development for Tsunami Early Warning Systems in the Indian Ocean Region, Bangkok, June 14–16." Draft conclusions and recommendations, UNISDR, Geneva. http://www.unisdr.org/ppew/tsunami/pdf/bkk-MDP-June06-conclusion-recommendations.doc.

UN Statistics Division. 2008. "United Nations Conferences on the Standardization of Geographical Names." Statistics Division, Department of Economic and Social Affairs, United Nations. http://unstats.un.org/unsd/geoinfo/uncsgn.htm.

4

The Use of a Logistics Support System in Guatemala and Haiti

Claude de Ville de Goyet

This case study reviews the lessons learned during the implementation of a support system that has been designed for the management of supplies in the aftermath of disasters. The system exists independently of the actual occurrence of a disaster. This case study therefore first reviews the background and the features of the system and then examines the lessons learned in applications in two countries with distinct problems and distinct levels of success with the system.[1]

The Information System

Two generations of logistics systems are reviewed: the humanitarian supply management system (SUMA) and the logistics support system (LSS).

The Development of SUMA

The need for a computerized information system for the management of humanitarian supplies was first identified in Guatemala over 30 years ago. In the aftermath of the 1976 earthquake that killed 23,000 people, large amounts of donated goods were accumulating at the airport, overwhelming

the limited capacity of the National Emergency Committee. Many of the donations were unsolicited and of dubious value. Expired drugs and useless articles of clothing competed with critical relief items for space in storage facilities and on trucks for transport. Despite the voluntary assistance of more than 40 pharmaceutical students and several foreign teams, particularly from the República Bolivariana de Venezuela, the task of sorting out the urgently needed items from the rest could not be completed in time. Authorities were unaware of what had been received or what was at hand and were unable to make a proper account to donors.

As the decade passed, it was understood that the problem had not been unique to Guatemala, but was a regular part of the challenge faced by all disaster-affected countries in the Western Hemisphere.

In the late 1980s, in consultation with close partners (including its member countries, the Red Cross system, and the Office of U.S. Foreign Disaster Assistance), the Pan American Health Organization (PAHO), which also serves as the regional office for the Americas of the World Health Organization, agreed to take the lead in the development of a database management system to monitor humanitarian supplies arriving in disaster-affected countries.

Initially, PAHO envisaged a system focused exclusively on medical and health supplies. However, following visits by a former assistant director of PAHO to selected member countries in Latin America (ministries of health, ministries of foreign affairs, and civil defense organizations), PAHO received clear feedback that the system should be multisectoral by design. Approached for support in the development and launch of the supply management system that became known as SUMA, the government of the Netherlands agreed with these targeted users and announced that, as a precondition for its support for a period of five years, the system must have a multisectoral reach.

The initial development of the system software was undertaken in Colombia with the participation of the Colombian Red Cross, which had an advanced logistics information system for relief operations. Design and testing were carried out in several countries so the system could benefit from the experience and advice of potential users.

In 1991, SUMA was formally launched in Latin America and the Caribbean with two main objectives: to increase the capacity of disaster officials to manage efficiently the flow of humanitarian supplies in the aftermath of a disaster and to stimulate transparency and accountability in the management of donated supplies.

In 1996, Fundesuma, a regional nonprofit, nongovernmental organization (NGO), was created under the laws of Costa Rica to support training in and the maintenance and upgrading of the SUMA methodology. Working on a contractual basis with PAHO and other sponsors, Fundesuma specialized in humanitarian logistics that served as the SUMA management entity and is charged with providing technical and operational support directly, upon request, to countries; maintaining a roster of experts for mutual assistance among countries in the aftermath of a disaster; and updating the system and adding features based on the lessons learned in each disaster and the needs expressed by users.

The PAHO annual budget for the relevant training of local agents, technical support for counterparts in 30 countries, and the regular updating of the system is under US$300,000 per year. This does not include the mobilization of technical support and volunteers in case of disaster or the PAHO contribution for the design of a new system, the LSS. It is a modest amount in absolute terms, but significant within the risk reduction budget of this specialized health organization (table 4.1).

The international partners and the Latin American countries recognized early that the availability of good software and an appropriate database structure would not, by themselves, lead to improvements in management and transparency, especially in emergencies. With the support of the donor agencies (the Netherlands and, later, Canada, Sweden, the United Kingdom, the United States, and the European Union), an estimated 80 percent of the

TABLE 4.1 Approximate Cost of SUMA in the Americas
U.S. dollars

Year	Support for Fundesuma	Other nondisaster costs	Implementation in disasters[a]
2003	142,000	25,000	30,000
2004	219,000	11,500[b]	50,000
2005	219,000	12,500	30,000
2006	280,000[c]	50,000	10,000

Source: Data from Area on Emergency Preparedness and Disaster Relief, PAHO.
a. Estimates.
b. US$330,000 for the planning and design of the LSS is not shown.
c. Includes US$50,000 for support outside the Americas (the Middle East, Turkey, and so on) and covers more than one year (into 2007).

budget for the ongoing project was dedicated to the promotion of evidence-based disaster management and human resource development. If this share seems impressive, the amounts were modest considering the number of countries covered (30 countries or territories in Latin America and the Caribbean).

Over the 16 years of the existence of the project, approximately 7,000 persons have been trained by Fundesuma, mostly in the Americas. The typical training curriculum includes one or both of two courses: software operation (three days), which covers the basic elements and functions of the system and includes practical fieldwork in normal situations or in post-disaster situations, and comprehensive logistics management (up to two days), which covers the basic principles of the logistics chain from the procurement and shipping of goods to delivery, recording, warehousing, and distribution and includes training in normal situations and in disasters.

The decision was taken at the design stage to keep the system requirements for SUMA as simple as possible. The rationale is that it should be possible to install and run SUMA on any configuration of computer equipment and operating system that may be found locally. For a considerable time, a DOS version has been maintained because the DOS operating system could still be found on many computers in the poorest countries. The Windows version relies on a user-interface that appears similar to the DOS interface; this step has been taken to standardize the training process and permit interchangeability. The trade-off has involved a sacrifice in computer tools (there is no cut and paste, for instance) and the reliance on FOXPRO that has permitted the use of software without fees. The software was distributed widely at no cost across the world.

The Development and Implementation of the LSS

SUMA, a product of the early 1990s, started to show its age and limitations, one of which was its close identification with a regional sectoral agency, PAHO. Meanwhile, the World Food Programme (WFP) and other large institutions such as the International Federation of Red Cross and Red Crescent Societies and the Office of the United Nations High Commissioner for Refugees were developing and implementing modern commodity tracking systems designed for their specific internal institutional uses. These systems were being created so that they were closely linked with the administrative procedures of the relevant organization

and could be used to track every single good. For these systems, a 100-pound bag of sugar donated by the United States Agency for International Development is recorded separately from a similar bag donated by the European Union. Donors want to know the whereabouts of each of the goods provided under each grant. In the process of improving their internal control systems, all partners gained significant insight into database issues related to logistics support.

In 2001 and 2002, the WFP assumed leadership in convening two international conferences on logistics in disasters that established the specifications for a new system based on the experience gained through SUMA in the Americas, but also increasingly across all regions of the world (see http://www.reliefweb.int/lss/). United Nations agencies (the World Health Organization, the WFP, the United Nations Office for the Coordination of Humanitarian Affairs [OCHA], the United Nations Children's Fund [UNICEF], the Office of the United Nations High Commissioner for Refugees, and PAHO) agreed to join forces to consolidate into a single LSS the experience gained at the United Nations Joint Logistics Center and through SUMA.[2]

The main steps in the development of the LSS are listed in table 4.2.

TABLE 4.2 Main Steps in the Development of the LSS

Year	Event
2001–02	six United Nations agencies and major NGOs agreed on the main principles of good humanitarian supply management
Mid-2002	approval of the terms of reference and product specifications
January 2003	contract issued with a vendor according to United Nations rules
July 2003	design document approved
September 2004	beta software completed; sample sent to the United Nations working group
End 2004	beta version tested (November-December 2004)
Mid-2005	version 1.0 (Windows and Web applications) received and field-tested by users; first training courses held

Source: Author compilation.

The programming of the LSS was contracted out to the private sector (in contrast to SUMA, which was developed by Fundesuma). Nonetheless, the LSS is constructed based on the experience of a large number of institutions, and it was designed as a complement to agency-specific commodity tracking systems that are increasingly being developed by larger humanitarian entities.

In summary, the LSS combines the strengths of these two successful initiatives (the United Nations Joint Logistics Center and SUMA), both of which have operated in different environments and have served complementary purposes. The joint instrument now available to all institutions aims to minimize duplication and improve the response to the actual needs of the affected populations, while also building on the management capacity and transparency of national institutions in disaster-prone countries.

SUMA and the LSS in Disasters

The use of SUMA has become a standard feature in almost all disasters in the Americas thanks to the high level of the promotion of the tool at the policy and technical levels. Additionally, the system has been introduced in countries outside the Western Hemisphere, and the systems have been implemented in numerous disasters (table 4.3).

The specifications for compatible equipment are more demanding in the LSS. Some of the functions require a higher level of management skills. The success of the replacement of SUMA by the LSS will depend on the level of preparedness and commitment of a country and the time available. The applications of the LSS have been fewer and more recent (table 4.4).

The most advanced countries have initiated deployments of SUMA or LSS on their own initiative and relying on their own staff. In almost all disasters, technical support is provided by Fundesuma, while PAHO and other United Nations agencies supply financial support. The lessons learned during implementation are used in designing the periodic upgrades of the software.

In Latin America, additional expertise and human resources are mobilized from neighboring countries. This represents an opportunity for governments to provide the additional personnel that are often required over and above the medical doctors and relief workers generally available directly in the disaster-affected countries. The White Helmet Initiative, in particular, has assigned high priority to the provision of experts in SUMA as part of its assistance.[3]

TABLE 4.3 The Implementation of SUMA in the Aftermath of Disasters

Year	Event
1992	tsunami on the Pacific coast, Nicaragua
1993	earthquake, Costa Rica
1994	floods and landslides, Caracas
1995	Hurricane Luis, Caribbean
1996	Hurricane Cesar, Central America
	earthquake, Nazca, Peru
1997	Hurricane Pauline, Mexico
1998	El Niño (southern oscillation), Ecuador and Peru
	earthquake, Aiquile-Totora, Bolivia
	floods, Chiapas, Mexico
	Hurricane Georges, Dominican Republic
	Hurricane Mitch, El Salvador, Honduras, and Nicaragua
1999	earthquake, Armenia, Colombia
	floods, Vargas, República Bolivariana de Venezuela
	complex disaster, Timor-Leste
2000	volcanic eruptions, Ecuador
2001	earthquakes, El Salvador
2002	earthquake, Colima, Mexico
2003	volcano eruption, Colima, Mexico
	floods, Argentina
2004	urban fire, Bolaños, Paraguay
	floods, Argentina
	Hurricane Frances, northeastern Caribbean, Bahamas, Florida
	humanitarian crisis, Haiti
	floods, Jimaní, Dominican Republic
	Hurricane Luis, Jamaica
	floods, Atlantic coast, Costa Rica
2005	floods, Costa Rica
	floods, Panama
	tsunami, Sumatra, Aceh, Indonesia
2006	floods, Santa Cruz, Bolivia

Sources: Fundesuma and PAHO data.

TABLE 4.4 The Implementation of the LSS in the Aftermath of Disasters

Year	Event
2005	Hurricane Stan, El Salvador
	Hurricane Stan, Guatemala
	earthquake, Pakistan
2006	floods, Colombia
	floods, Suriname
	conflict, Lebanon
2007	floods, Bolivia
	floods, La Mojana, Colombia
	cold wave in the south, Peru

Sources: Fundesuma and PAHO data.

A Description of the Systems

Rationale: Targeted Needs

Within a matter of days during the course of a disaster, the main logistics issue comes to revolve around obtaining information on the emergency supplies that are available and managing these supplies efficiently and properly. Acquiring and transporting goods are less of a problem. It is common for high-level officials to make public appeals for international donations of goods and equipment, while the same goods and equipment are piling up at the airport and in warehouses. The roadblock is poor information management. SUMA and LSS are particularly well suited to situations in which large amounts of unsolicited donations, ranging from the extremely valuable to the utterly useless, are received without advance notice. These situations are common during large emergencies that generate a response of solidarity within and outside a country.

Many smaller agencies and government ministries do not have computer-based inventories of available supplies even in normal times. In emergency situations, valuable goods are often released without any formal request or other documentation. Rumors about the misappropriation of the most valuable goods tend to abound, although they often cannot be substantiated. The impression that there has been serious mismanagement and corruption is particularly strong in some countries.

Transportation and storage facilities are especially scarce and costly during emergencies. The inability of transporters (military, volunteers, and so on) to differentiate between valuable goods of immediate importance and inappropriate items that should never have been donated or stocked means that air transport is often used inefficiently. Funds misused during relief efforts are thereby no longer available during early recovery.

Ideally, logistics systems are designed to operate under all conditions. They may be used in normal times to provide a tool for routine warehouse management, and they may be used during recovery and reconstruction. During all phases of a disaster, the management of information on supplies must be transparent. These systems have been used before a disaster only in a few countries and by institutions (hospitals, civil protection agencies, and local communities). In practice, the systems are most well suited to the initial phases of the relief and early recovery efforts when large amounts of supplies are provided and centralized monitoring is necessary. Reconstruction rarely calls for a unique database on all available supplies.

The Functions of SUMA and the LSS

SUMA and the LSS are both used to inventory, classify, and monitor all supplies that arrive at points of entry in the disaster area or are stored in warehouses. Inventories are maintained, regardless of ownership or consignee, on all supplies available for the affected population in an emergency. To achieve the intended coverage of all supplies in the logistics chain, whether in private or public hands, the LSS relies on digital exchanges of data among all sites on the system, as well as the reception and consolidation of data on stocks and on goods in the pipeline from non-LSS proprietary commodity tracking systems of larger agencies and NGOs. SUMA does not have this feature and requires duplicate manual entry of these data.

The systems allow users to prepare individualized reports for donors, national authorities, humanitarian agencies, and the media about the supplies received or delivered. This information is crucial in guaranteeing transparency and good governance in the management of humanitarian and recovery supplies. The reports may also be used to identify key items in short supply or in oversupply, items requiring special handling (short expiration dates or shelf lives, refrigeration requirements), and geographical areas with outstanding needs or unsatisfied requests for assistance. SUMA and the LSS thus contribute to the efficiency of the recovery effort.

An additional feature is the labeling of all containers with classification or coding stickers indicating the relevance of the content to the needs of the

beneficiaries. A typical coding system might involve the following codes: code 1, items for immediate distribution (most urgently needed); code 2, valuable or useful items not for immediate distribution (needed, but not urgently); and code 3, items to be stored long term or to be discarded (non-priority items or inappropriate or useless items).

Finally, SUMA and the LSS may serve as stand-alone or networked systems for routine stock and inventory management in warehouses of institutions that are unable to afford commercial software packages or develop their own systems. The SUMA and LSS systems provide a simple tool for the management of stocks and the maintenance of a paper trail on the movement of goods. For this reason, the systems may be configured to allow users to rely on a basic data entry model or a complete multiwarehouse inventory system.

SUMA and the LSS are designed from the ground up to support multiple languages and to permit users to customize the application menus, labels, and captions and to put them in any language and follow any data conventions by accessing the resource editor tool. The LSS versions are available out of the box in five languages: English, French, Portuguese, Spanish, and Turkish. An Arabic version is also being developed.

The LSS includes a report execution, creation, and distribution environment that is considerably more flexible than the SUMA environment. The LSS offers, namely, a custom query tool to allow easier data access for reporting agencies, advanced custom graphics capabilities, and a platform that permits the straightforward integration of a geographic information system.[4]

Intended Users

The users fall into two categories: those operating the systems and those using the data. Among the first group, SUMA and the LSS are primarily designed to be used by disaster managers who are facing a surge in the availability of donated or purchased supplies. In particular, the systems target coordinators of cross-sectoral national and provincial government relief and recovery efforts. A secondary target consists of procurement officers, logistics experts, and warehouse managers at governmental and nongovernmental institutions that do not have logistics information systems available. The systems represent little added value for larger agencies that have already implemented an institution-wide commodity tracking system. Such larger agencies benefit, however, from the overall coordination and access to information on the stocks of other agencies that the systems facilitate.

The second group, those using the data, is diverse. Any manager in a governmental agency, a donor institution, or an NGO may benefit from better information on the flow of supplies, as follows:

- Relief officials who are able to reduce duplication, avoid gaps, and use existing resources (goods, storage space, and transport) more effectively
- Governmental authorities and decision makers who are able to report to the media and the public that donations are being used efficiently and honestly
- Auditors, comptrollers, and evaluators who are scrutinizing the SUMA or LSS reports most closely
- NGOs and customs officers who use the inventories to speed the clearance and waiver of duties on bona fide donations
- Civilian and (usually) military logisticians who are better able to prioritize the use of storage and transport assets and to track the movement of supplies

The Principal Elements of System Design

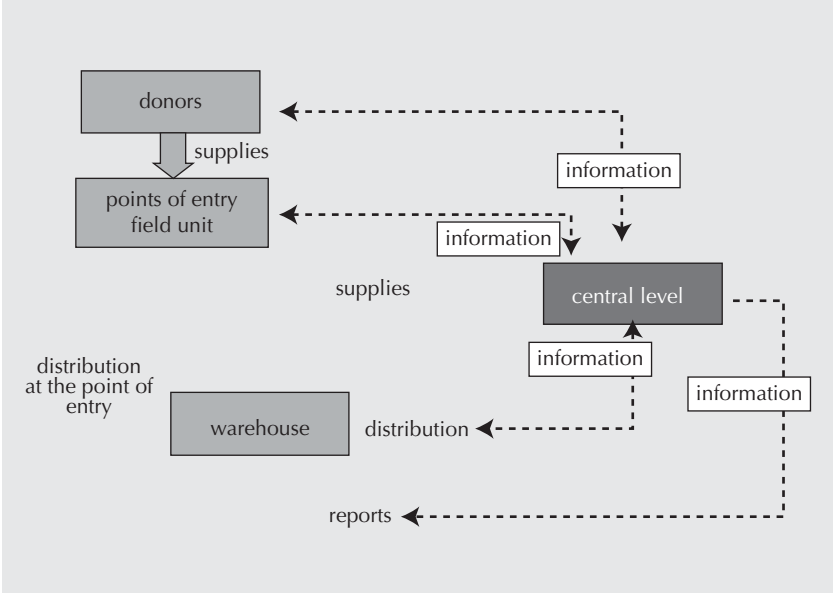
SUMA was conceived according to a hierarchical design, with a centralized unit that is located on the premises of the coordinating institution and that receives information from field units that are located at the points of entry of the assistance or supplies, such as airports, the procurement units of major organizations, and warehouses (figure 4.1). This structure, inherent in the design of the system, is rigid and has caused considerable problems in the routine use of SUMA.

The LSS is more flexible and may be implemented in the same hierarchical mode or in decentralized and autonomous, but compatible modes (figure 4.2). This improvement has responded to one of the main user concerns regarding the routine application of the systems outside emergency situations.

The SUMA and LSS systems capture information. They do not manage supplies consigned to specific recipient organizations. The national institution coordinating relief and recovery (generally a central government entity) is typically responsible for administering the system and owns the detailed information collected through the system. The distribution of this information is the responsibility of the coordinating agency.

A significant government contribution, apart from facilitating the use of human resources for system operations, is represented by the political

FIGURE 4.1 The Hierarchical Structure of SUMA



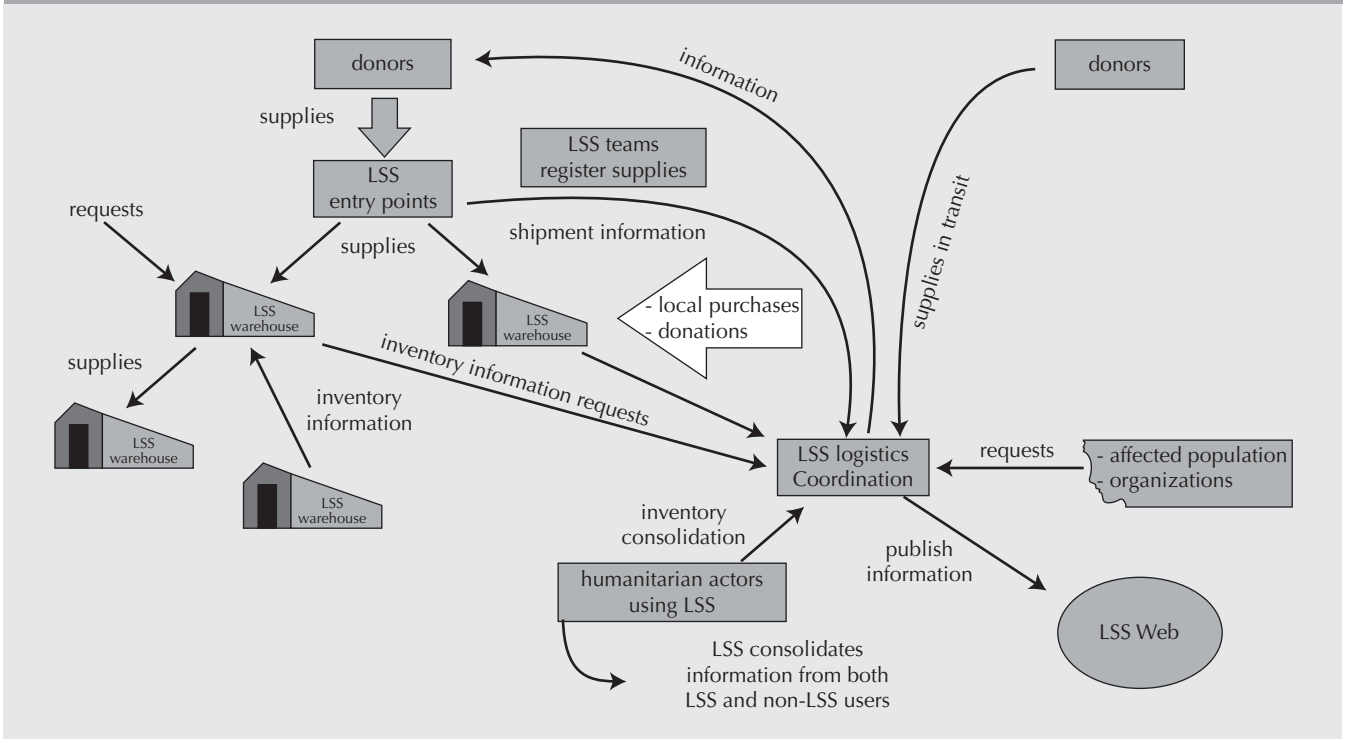
Source: Fundesuma.

commitment that obliges all relevant actors to register with the local system and share their information. This support at the highest level is usually the most critical factor determining system effectiveness.

Nonetheless, universal coverage is unrealistic because, inevitably, some local and international agencies are reluctant to share information on their activities and resources. Moreover, the extent of information sharing is influenced by the culture of the coordinating institution. Some institutions adopt an open policy toward public access; others practice military-like secrecy. (Obviously, the latter approach, if pushed to the extreme, defeats the purpose of the systems.) Logistics in countries that are easily accessible over land are particularly difficult to monitor.

The LSS offers data managers the option of compiling information only from other systems and humanitarian actors. In this case, the system serves as a master database. Its function is to facilitate the coordination and matching of information from commodity tracking systems and other systems based on straightforward Excel spreadsheets.

FIGURE 4.2 The Nonhierarchical Structure of the LSS



Source: Fundesuma.

Unlike SUMA, the LSS may also be based on the Web and provide totally transparent and open access to all information regardless of the ownership of the supplies. The full potential of this capability has not been realized because of limited broadband Internet access in many disaster-prone countries, lingering resistance to transparency within the humanitarian industry, and shortcomings in LSS security features.

System ownership by national authorities was strongly endorsed by the donors supporting the implementation of the system. This national ownership of the information may explain the lack of political support for the LSS from those who see direct coordination of external assistance as an international responsibility rather than a national one.[5] National ownership does not necessarily mean that international experts will not be taking part or exercising oversight. Indeed, national authorities usually consider the participation of international agencies essential in reassuring the public and the international community on the transparency of their management procedures for donations and recovery assistance.

Technical Design: Input

The goods and equipment required for relief and recovery operations are extremely diverse. These requirements have been the subject of much discussion among experienced system designers and lengthy negotiations among partner organizations. These requirements may be divided into 10 categories, as follows: (a) the agriculture and livestock industry; (b) food and drink; (c) health, nonpharmaceutical; (d) human resources; (e) logistics and management; (f) personal needs and education; (g) pharmaceutical; (h) shelter, housing, electrical, and construction; (i) water and sanitation; (j) other. Each category is subdivided into subcategories, which, in turn, include precoded items and user-defined items. The LSS may easily be reconfigured to work with a more limited number of categories and items. This has been done in Pakistan by the United Nations Joint Logistics Center and in the Middle East by the World Health Organization.

Systems generally have the capacity to include detailed records on individually donated or purchased goods and matériel that have been delivered, are in transit, or have been requested by end users. Data are also provided on the contact points of senders and consignees (receiving agencies), the overall weight of each consignment, and the location and identity of individuals taking delivery. This information is obtained from airway bills, inventories, and physical inspection. The data may be electronically imported from other commodity tracking systems.

The amount of detail required will vary according to the nature of the item and operational circumstances. The data on items in the pharmaceutical category (which generally accounts for the most time at data entry) include information on the subcategory, the generic name of the drug, the number of doses, the packaging, the composition and strength, the date of expiration, the need for refrigeration, and so on. All but the most essential details are considered optional, however, so as not to impede the flow of supplies. Compatibility in the formats of the data collected from non-LSS systems is automatically insured at the time of their import into LSS as a result of intense dialogue with key partners. (The SUMA data import facilities are limited, and data must often be manually reentered; see elsewhere above.) Quality control on the data is a function of the training and qualifications of system staff. Log-in identification codes are associated with data entry and inventory lists to allow repeated errors to be recorded and traced. Although the system will not permit the most obvious errors of mismanagement to occur, such as discrepancies in stocks or goods delivered, only limited electronic data oversight is possible given the emergency circumstances. Moreover, though data are nonetheless regularly updated to reflect the movement of inventories, there is no log of successive modifications. Auditors and ministries of finance have particularly stressed the need for a secure system for registering all modifications.

Technical Design: Output

The operation of the system is controlled by the owner, usually the national disaster coordinating entity. Various levels of password security are possible for database access, data entry, and access to the report function. Data are not encrypted. Access by authorized users occurs directly through the SQL software and graphics interface (SQL Enterprise Manager).

The value of the systems lies in the considerable flexibility in the design and format of the reports once data processing has been completed (the updating of stock information and so on). In addition to the standard system formats, customized reports and graphs are available on screen or for download in PDF, HTML, Excel, and XML formats.

The level of detail, the format, and the priority attached to the information are user determined. User requirements are potentially limitless. Fundesuma experts are available to assist users in adding or changing the names or formats of data fields to meet specific requirements. For instance, World Vision, an international NGO that relies on an LSS as a routine tool in some of its country operations, has requested several changes in

terminology to adapt the system to its needs. With the support of the Regional Office for the Eastern Mediterranean of the World Health Organization, an LSS system in Lebanon is being modified for use during routine inventory checks at the Karantine warehouse, the main distribution point of the Lebanese Ministry of Health.

The Case Study in Haiti

In this section, the SUMA system in Haiti is compared to SUMA systems in Angola, which have similar governance problems and a similar level of poverty, and the Dominican Republic, which shares the island of Hispaniola with Haiti. The systems in Angola are run by the Ministry of Health, while the system in the Dominican Republic is run by the Office of Civil Defense.

The Country

Haiti occupies the western third of the island of Hispaniola. It has a land area of 27,700 square kilometers. It is divided into nine departments, 41 districts, 133 municipalities, and 561 sections within the municipalities.

Haiti declared independence in 1804, thus becoming the first independent black-led republic in the world and the first independent country in Latin America. Since then, Haiti has passed through crises caused by poverty, conflict, and disasters. Of a population of 8.5 million, 80 percent are living in poverty (World Development Indicators Database 2007). Table 4.5 compares the human development index and the human poverty

TABLE 4.5 Human Development Indicators for Angola, the Dominican Republic, and Haiti

	Human development index		Human poverty index	
Country	Value	Rank[a]	Value	Rank[b]
Dominican Republic	0.751	94	11.9	27
Haiti	0.482	154	39.4	74
Angola	0.439	161	40.9	79

Sources: UNDP 2005, 2006.
a. Among 177 countries for which there is data.
b. Among 102 developing countries for which the index has been calculated.

TABLE 4.6 Good Governance Indicators for Angola, the Dominican Republic, and Haiti

	Control of corruption index		Corruption perceptions index	
Country	2004 (estimated)	Standard error	2005 (estimated)	Standard error
Dominican Republic	–0.50	0.15	3.0	0.81
Haiti	–1.49	0.22	1.8	0.48
Angola	–1.12	0.15	2.0	0.22

Sources: Kaufmann, Kraay, and Mastruzzi 2005; Transparency International 2005.
Note: The control of corruption index ranges from –2.5 to 2.5. Higher scores indicate better outcomes. The corruption perceptions index measures the degree of corruption in a country according to the perceptions of businesspeople and country analysts. It ranges between 0 (highly corrupt) and 10 (highly clean).

index for Angola, the Dominican Republic, and Haiti. The 1990s saw a worsening of poverty among the Haitian population, especially during the embargo (1992–94), when a recession became an economic depression, and the country suffered an estimated 25 percent loss in economic activity.

The SUMA system promotes transparency and good governance. The comparison between these three countries should therefore not be limited to development indicators, but should include indicators of good governance. Table 4.6 shows two broad outcome indicators—the Kaufmann-Kraay control of corruption index and the corruption perceptions index of Transparency International—for the three countries. The World Bank (2006) has noted the uneven mix of strengths and weaknesses in controlling corruption in individual countries. In terms of policies and the perception of the existence of controls over corruption, performance is broadly similar in 34 of the 66 countries eligible to receive International Development Association resources. Angola is one of these 34 countries. Haiti is relatively stronger in policies, but weak in terms of the perception that there is control on corruption.

Haiti's Vulnerability to Natural Disasters

Being a mountainous country, Haiti is a typical case of a fragile ecosystem, subject to both desertification and drought. For example, only 2 percent of

the wooded areas remain on land that was completely wooded 500 years ago (United Nations 2002).

Based on PAHO data and proposals for funding, the list below examines some of the natural risks to which Haiti may be prone.

- *Hurricanes*: Haiti is particularly exposed to tropical storms and hurricanes. The departments of the southern peninsula are the most exposed in the country (Mathieu et al. 2003). Between 1954 and 2001, the southern peninsula was hit by hurricanes 16 times. By way of comparison with other regions of the country, no other department experienced more than eight hurricanes during this same period.
- *Drought*: The irregularity of rainfall, combined with increased deforestation, has made drought an ever more serious problem throughout much of the country. The Nord-Ouest Department suffers the most frequent drought damage, experiencing drought cycles of less than five years, whereas other departments have droughts, on average, every five to seven years (Mathieu et al. 2003).
- *Flooding and landslides* are constant threats for many communities throughout Haiti. This fact was dramatically illustrated in the floods and landslides in the Sud-Est Department and in the Artibonite Department, including Mapou and the flooding in Gonaïves during 2004. An estimated 5,000 people lost their lives, and many homes were destroyed during these events (for example, see table 4.7). Several factors contributed to the vulnerability that intensified the severity of the problem. The lack of early warning systems, inaccessibility in some cases, a weakness in both governmental

TABLE 4.7 Summary of Losses Caused by Natural Disasters, in Haiti, 2003–07

Year	Deaths	Missing	Homes destroyed	Affected families
2003	87	—	—	42,000
2004	5,000	—	2,500	300,000
2005	80	32	3,776	8,341
2006	17	7	1,416	13,762
2007	135	26	7,181	36,927

Source: Data of the Directorate of Civil Protection.
Note: — = no data found in the sources.

and nongovernmental disaster response mechanisms, and the extreme poverty of much of the affected population contributed to the losses.

Landslides and riverbank erosions have become a particular threat as they frequently represent not only an immediate danger to lives and property, but also may result in the long-term loss of productive land. This occurs when hillsides or riverbanks are swept away and when fertile land in low-lying areas is covered by rock and debris from eroded slopes. In both cases, community members indicate that the loss of land has a negative impact on their productive capacity and coping mechanisms.

- *Earthquakes*: Located in one of the most seismic regions of the world, Haiti is under threat of seismic activity. Though the last major earthquake in Haiti occurred in Cap-Haïtien in 1842, the major faults that traverse the south of Haiti from the Dominican Republic through Port-au-Prince and on to Tiburon in the extreme southwest might become active at any moment (Mathieu et al. 2003).

In Haiti, as in many other countries, natural disasters have occurred before a backdrop of acute poverty and intermittent conflict, which have triggered social upheaval that has attracted significant humanitarian assistance. This was the case when, following a coup, a junta took control of the country from 1991 to 1994. Humanitarian agencies were the main source of support in the provision of essential supplies and services, including medicines, food, and fuel, during a socially damaging embargo.

An insurrection in Gonaïves in February 2004 soon turned into an armed conflict that spread to a number of cities across Haiti and eventually forced President Aristide to resign from his post and leave the country at the end of February. An interim government was established in March, and, within a few months, the United Nations Stabilization Mission in Haiti (MINUSTAH) had been created. The hurricane that struck around Gonaïves in September 2004 complicated the management of the already difficult social and economic situation, as well as the implementation of SUMA.

The Scale of Mobilization of the International Response

Haiti has been in a situation of semipermanent crisis and emergency for many years. International humanitarian assistance has therefore been directed at the humanitarian response and at capacity building in risk management. For this reason, funding for both relief and preparedness are reviewed here.

Relief Funding

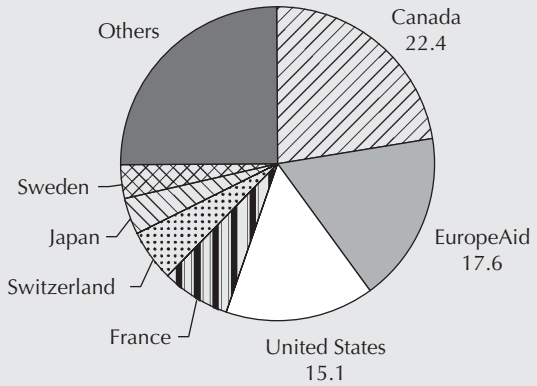
The major relief contributors were Canada (22.4 percent), the European Commission (17.6 percent), and the United States (15.1 percent) (figure 4.3 and table 4.8).

Risk Management Funding (Prevention and Preparedness)

A trio of donors—the European Union, the United Nations Development Programme (UNDP), and the World Bank—is responsible for the most substantial outside contributions in building the capacity of disaster management institutions in Haiti.

The World Bank launched a three-year US$12 million project through a grant from the International Development Association. This project, the Emergency Recovery and Disaster Management Project in Haiti, called PUGRD from the French acronym, has three components: the emergency rehabilitation of disaster-affected areas, capacity building (at the Directorate of Civil Protection [DPC] and the Permanent Secretariat of Risk and Disaster Management, as well as at other levels), and risk assessment and reduction at the community level. The project addresses critical long-term needs. It is well run and relies on an excellent and dedicated staff. Nonetheless, the rate of progress at the central level was initially slowed by the lack of significant policy commitment and by the security situation. The effectiveness and sustainability of the project may be adversely affected by

FIGURE 4.3 The Distribution of Funding by Source, in Haiti, 2004–07, *percent*



Sources: Author compilation; FTS Database 2007.

TABLE 4.8 Humanitarian Funding for Haiti, 2004–07

Year	Total (US$ millions)
2004	72.6
2005	14.9
2006	25.5
2007	36.4
Total	149.4

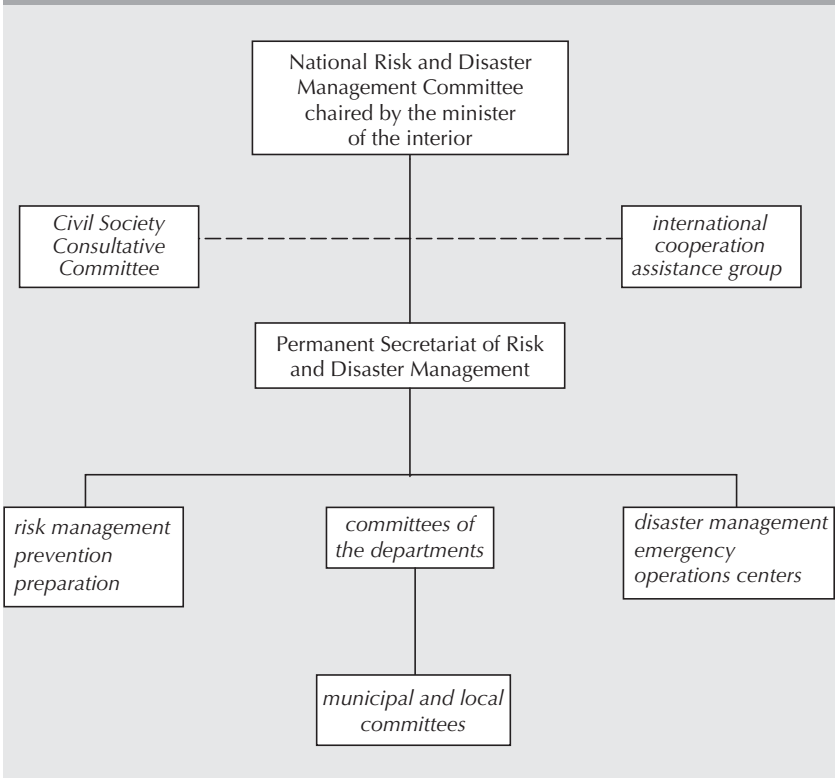
Source: FTS Database 2008.
Note: The 2004 amount includes US$25.9 million for the Haiti Floods Flash Appeal (September 2004).

the heavily centralized, formal approach. The impact at other administrative divisions—the departments and communes—is more promising. The project aims at strengthening the management capacity of the DPC. An inventory system is foreseen. As a first step, a coding system for the identification of goods has been developed. Unfortunately, the project does not rely on the system for the classification of humanitarian supplies that has been developed by the international community and integrated into the design of the LSS, the successor generation of the SUMA system. An opportunity to ensure the compatibility of institutional systems appears to have been lost. This issue must be confronted during the review of the project plan of action.

The Institutional Framework: The Disaster Management System in Haiti

With the support of the international community, especially the European Union, the UNDP, and the World Bank, the new government established the National Risk and Disaster Management System. The system is coordinated by the Permanent Secretariat of Risk and Disaster Management and the National Risk and Disaster Management Committee, which is chaired by the minister of the interior and includes the president of the National Red Cross Society, the minister of public health, and other concerned ministers (figure 4.4). Until recently, the committee had not met formally; there were no meetings in 2005–06. The participation and involvement of the line ministries were weak or nonexistent, with the exception of the

FIGURE 4.4 The National Risk and Disaster Management System



Source: Author compilation.

Ministry of Public Health, which has a disaster unit and possesses draft plans for a coordinated response.

At the operational and technical levels, the DPC coordinates routine activities. The DPC was established in 1998 and remained weak until the disasters in 2004, when the national system was ineffective at guiding and coordinating the overwhelming response of the international community (the United Nations, NGOs, and MINUSTAH), which, by the sheer weight of human and material resources, overshadowed and marginalized the DPC and local authorities.

The magnitude of the emergencies affecting Haiti and the poor performance of local and national institutions induced the main donors to include the strengthening of risk management as a priority within the Interim Cooperation Framework, 2004–06 (World Bank et al. 2004). Three

donors—the European Union, the UNDP, and the World Bank—offered coordinated assistance to strengthen the national disaster management system and expand it at the local level.

The DPC currently includes a directorate and two main coordination units responsible for risk management (prevention and preparedness) and disaster management (response). There is a strong emphasis in external projects on decentralization (deconcentration) toward the departments and communes where risk awareness is low, but the potential for improvement and action is much higher.

The lack of a delegation of authority and the excessive centralization at the cabinet level of the most minor operational decisions are depriving the DPC and its director of the possibility of exercising the authority and leadership they need in dealing with other partners. It is not necessarily a lack of political commitment from the highest authorities. The prime minister has stepped forward repeatedly at the outset of disasters to reaffirm the role of the DPC as the main coordinating body. However, in most countries with an effective civil protection system, the system is the direct responsibility of the Office of the Prime Minister or the cabinet, and the system director is granted considerable leeway in making decisions and establishing direct contacts with policy makers in other government institutions, donor agencies, and the United Nations. The more rigid approach, pushed to an extreme in Haiti, is affecting the implementation of a logistics supply management system, such as SUMA, in the country. Thus, it appears that the acceptance of in-kind assistance arriving at the airport in an emergency situation would depend on the following steps:

- Positive inspection by a team composed of representatives of the DPC, customs, and the ministries of public health, foreign affairs, and agriculture
- A formal, written recommendation through the National Emergency Operations Center to the Ministry of Foreign Affairs, which is responsible for accepting international assistance
- A positive decision taken through consultation between the Ministry of Foreign Affairs and the Ministry of the Interior and communicated to the DPC in writing

During an emergency, donations often arrive unannounced and require a quick decision. Because of its procedures, Haiti is likely to remain a dumping ground for unsolicited donations that test the capacity of airports and are costly to store, deliver, or destroy. Meanwhile, NGOs duly

registered and eligible for tax waivers on their humanitarian donations report delays of at least two months for customs clearance and tax waivers from the Ministry of Finance for their emergency supplies. The delay is experienced even during disaster response.

The Division of Labor among National and International Actors

The 2004 Haiti Floods Flash Appeal lists the main partners in the effort (table 4.9). The distribution of roles has not changed significantly since then.

Governmental Actors

Most sources report that the commitment of governmental institutions is limited. There are at least two exceptions: the Ministry of the Interior (which runs the National Risk and Disaster Management System) and the Ministry of Public Health.

At the operational level, the National Emergency Operations Center has been created at the DPC, and standard operating procedures have been established. The operating procedures define responsibilities in broad terms. They have not helped sufficiently in streamlining the heavily centralized, formal channels of decision making. This is illustrated by the problems in the approval process for donated resources.

The National Emergency Operations Center has four functional divisions: (1) data management (coordinated by the DPC); (2) operations, which is subdivided into emergency services (firefighting), infrastructure and public services (Ministry of Public Works, Transportation, and Communications), logistics and support for the population (Ministry of the Interior), and health (Ministry of Public Health); (3) international assistance (coordinated by the Ministry of Foreign Affairs, with the participation of the ministries of finance, commerce, planning and external cooperation, and agriculture, and international NGOs; OCHA and other United Nations agencies are not mentioned); and (4) public information (coordinated by the Ministry of the Interior and the DPC).

The SUMA project is particularly relevant for data management, operational logistics, and international assistance. Nonetheless, the use of this tool is not covered in the standard operating procedures.

Nongovernmental Actors

The National Red Cross Society, an auxiliary entity of the government, is influential and vocal within the country and the International Red

TABLE 4.9 The Distribution of Roles among Partners, Flash Appeal 2004

Sector	Lead agency	Government counterpart	Other agencies and NGOs
Food	WFP	National Food Security Coordination Office, Ministry of Agriculture	CARE, Action Against Hunger
Health, water, and sanitation	World Health Organization, PAHO	Ministry of Public Health	United Nations Population Fund, Joint United Nations Programme on HIV/AIDS, UNICEF, International Organization for Migration, World Vision, Association for Water and Soil Assessment in the Rural Sector
Agriculture	Food and Agriculture Organization	Ministry of Agriculture	World Vision, Agency for Technical Cooperation and Development, Action Against Hunger
Education	UNICEF	Ministry of Education, Ministry of Social Affairs	United Nations Educational, Scientific, and Cultural Organization, United Nations Office for Project Services, World Vision, Association for Water and Soil Assessment in the Rural Sector, Fondation Paul Guérin Lajoie
Early recovery, shelter, infrastructure	UNDP	Ministry of Public Works, Transportation, and Communications	International Labour Organization, International Organization for Migration, Emergency Architects, Agency for Technical Cooperation and Development
Coordination	OCHA, UNDP	DPC, Ministry of the Interior	All United Nations agencies

Source: OCHA 2004.

Cross and Red Crescent Movement. The society raises significant amounts of funding directly. The capacity of its middle-level managers is considered limited, however, and its ability or willingness to act as a team member within the national disaster management structure is questioned by some.

The timely sharing of information is seen as an issue requiring attention. The society was consistent in its interest not only in the implementation of SUMA, but also in possibly assuming responsibility for the management of all unassigned donations.[6] (An official who was trained at Fundesuma in 2003 is a senior administrator in the society.) Somewhat independently of the national society, many developed-country societies have run their own, nearly autonomous relief programs or risk management projects in Haiti. They tend to manage their own supplies.

In relative terms, the number of NGOs active in Haiti is unusually large; some say there are as many as 700. A significant proportion of the health services, water, and education projects are administered by NGOs, some of which are charitable organizations with a religious component. NGOs also play a major implementing role during situations requiring a humanitarian response.

NGOs are registered with the government and, in theory, are eligible for waivers on import duties on their supplies. The waiver process is lengthy even during emergency operations, however (see above).

Two large NGOs are a particular focus in this case study because of their connections with SUMA. One is Catholic Relief Services. In 2004, managers at Catholic Relief Services were introduced to SUMA and expressed an interest in adopting the system for the routine management of the flow of their goods. Apparently, no follow-up support was provided by PAHO or Fundesuma. Catholic Relief Services developed its own software based on the structure of SUMA (the classification of goods in categories and subcategories), thereby facilitating electronic transfers and data exchanges.

The other NGO is World Vision. World Vision has contacted Fundesuma to express its interest in progressively implementing the SUMA successor, the LSS, in all its offices. Technical support has been provided, and the software is being adapted to accommodate the specific administrative requirements of the user. However, there are several administrative and auditing obstacles. SUMA has not yet been set up in the offices of World Vision in Haiti, which is receptive to the initiative. Progress is now contingent on the software adjustments.

The private sector has not supported or collaborated closely with the DPC or SUMA in Haiti. This contrasts with Guatemala, where the private sector has played a leading role. The relationship between the private and public sectors has historically been poor in Haiti. This issue should be addressed.

The United Nations System

United Nations agencies have maintained their recognized roles during emergencies in Haiti (see table 4.9).

Haiti shares one characteristic with only a few other countries in the world: the strong presence of a United Nations peacekeeping mission, MINUSTAH in the case of Haiti. MINUSTAH was initially authorized by a United Nations Security Council resolution (United Nations 2004). At the time of Hurricane Jeanne, the total authorized strength of the mission was 6,700 military personnel, 1,622 police, 548 international civilian personnel, 154 United Nations volunteers, and 995 local civilian staff. However, these personnel had not yet been fully deployed. The floods caused by Hurricane Jeanne directly affected the contingent stationed in Gonaïves well before full operational strength had been achieved. The strength of the mission in mid-2007 was 8,810 total uniformed personnel, including 7,050 troops and 1,760 police, supported by 457 international civilian personnel, 806 local civilian staff, and 184 United Nations volunteers.

With assets deployed in Haiti, MINUSTAH is playing an increasing role in logistics following natural disasters. Because of this role, it has also helped in the coordination of actors during the response to disasters, and most of these actors depend heavily on the support of the mission.[7]

A draft disaster plan for logistics support during disasters was drawn up by MINUSTAH in September 2006. It divides operations into three stages: the valuation of damage, the response to the disaster, and the coordination of general activities. All activities are coordinated through the security operations center, which is located at MINUSTAH headquarters. An enlarged operations center involving NGOs and key United Nations partners will serve as a forum for coordination.

The experience gained in 2004 through disaster coordination meetings conducted at the offices of the United Nations was revealing. The sessions were overwhelmingly dominated by expatriates and international organizations, which marginalized the already weak structures of the government and contributed to their debilitation. Undoubtedly, the assets of MINUSTAH are important to the effort to save lives and facilitate relief and recovery.

This assistance should be provided, however, without undermining the roles of the DPC and OCHA in coordination. The relative weights of the National Emergency Operations Center and OCHA in the MINUSTAH operations center could not be determined.

MINUSTAH sees its role as primarily logistical. There is no known provision in the plan for a systematic inventory and classification of all relief supplies arriving in the country, an essential step in establishing the priorities for MINUSTAH logistics support. This is the special niche of the SUMA system implemented by the United Nations during past emergencies in Haiti and elsewhere. Without such a tool, the distribution of relief supplies by MINUSTAH may not be adequately efficient or effective.

PROMESS, a PAHO program, is acting as the central pharmacy in the country. It supports its operations through the cost-recovery sale of medical supplies and equipment. The Ministry of Public Health and registered client United Nations agencies or NGOs procure supplies directly from PROMESS warehouses. A small stock of emergency supplies, mainly kits, is maintained. The SUMA system was installed in 2003, and courses were organized at PROMESS for other agencies. Instead of SUMA, PROMESS uses INVEC 2, a software developed exclusively for large pharmaceutical warehouses by Management Sciences for Health, a private nonprofit organization funded by the United States Agency for International Development. Exchanges of information on the features and designs of the two systems have taken place between SUMA and Management Sciences for Health, resulting in some adjustments and improvements in the SUMA structure. INVEC is more robust than SUMA in linking procurement and finance systems. It is costly for the user, however, considering that SUMA is freeware.

SUMA in Haiti

Since SUMA first appeared in 1992, Haitian professionals have been included routinely in project training activities. The initial implementation of SUMA as a disaster management tool took place in 1994, at the request of the United Nations resident coordinator. Shortly after the intervention of the United States, large amounts of relief supplies arrived at the airport controlled by the United States military. Rapid postdisaster SUMA training among local specialists was organized. The trainees included personnel from customs, the Ministry of Public Health, and the United Nations. A SUMA field team was posted at the international zone of the airport.

A central unit compiling all data was located at the United Nations offices in the capital. The SUMA field team collected information before the recipient organizations, which were often present upon the arrival of the goods, were authorized to load the supplies on their trucks. The participation of customs officers during the registration process ensured that the goods registered by SUMA were speedily processed and cleared without customs duties. Indeed, SUMA stickers and printed receipts were necessary and sufficient for tax waivers and the release of goods. This benefit alone prompted most agencies to cooperate with the system during 1994.

The system served as a very useful clearinghouse for incoming assistance. However, the lack of an assertive coordination role by the United Nations, the main de facto political force, minimized the use of SUMA as a coordination tool. The United Nations made little attempt to influence and guide the donations of the many NGOs and bilateral groups providing relief and recovery assistance. There was therefore not much incentive for actors to continue collecting and providing information on the use of the goods once these were cleared by the customs administration.

From 1995 to 2003, SUMA-related activities appear to have been limited to the disaster response to Hurricane Gordon and occasional participation in regional training courses sponsored by PAHO or Fundesuma. No local institution adopted SUMA (or any other system) for the management of its own supplies and warehouses. The distribution of supplies continued to lack transparency and to raise questions regarding the integrity of procedures because of the persistent lack of a paper trail and of accountability in most agencies.

In early 2004, another political crisis obliged the United Nations to take on a major coordinating role. The departure of President Aristide left a political vacuum and considerable insecurity, which eventually led to the creation of MINUSTAH. An interim government was established.

During this period, the flow of humanitarian assistance increased once more, and, on the initiative of PAHO, the SUMA system was implemented. Table 4.10 provides the chronology of the SUMA implementation process. The events highlighted took place before Hurricane Jeanne and the subsequent floods in Gonaïves.

The timing of the cross-sectoral deployment of SUMA was considered opportune for two reasons: the declarations of the interim government regarding the need for accountability and transparency and the commitment of the international community to increase its recovery assistance through the Interim Cooperation Framework.

TABLE 4.10 The Chronology of SUMA Implementation, 2004

Date	Event
February 29, 2004	departure of Haitian President Jean-Bertrand Aristide
March 4	arrival of two experts to install SUMA at PROMESS and UNICEF (Fundesuma)
March 7	arrival of a PAHO disaster official
During March	international logistics expert begins work
During March	White Helmets Initiative provides technical support to SUMA (one week)
March 19	first training course with the DPC (around 30 participants from many governmental institutions)
April 2	letter of agreement with the Hospital of the State University of Haiti and donation of a laptop
April 6	second course (18 participants : the German Agency for Technical Cooperation, Doctors without Borders, the Adventist Development and Relief Agency, and so on)
April 8	SUMA installed at the airport
During April	briefing among United Nations agencies
May 4	DPC-PAHO agree on a joint course of action, including donations of recycled computers
June 11	the Hospital of the State University of Haiti requests technical support and computers
September 5	external evaluation

Source: Author compilation based on data of Fundesuma and PAHO.

The scope of SUMA was limited to health-related goods. This was noted in the external evaluation (carried out by the author of this chapter). According to this evaluation, the role of SUMA in covering the stock and flow of relief supplies in Haiti was limited and short-lived. The system failed to contribute to a meaningful view of the situation. Although the briefings and training exercises reached most of the actors (the government, NGOs, customs officials, career diplomats, and United Nations staff), the system tracked only nine consignments of goods channeled through PROMESS and UNICEF. Data should have been systematically captured at the entry points (the airport at least) with the support of customs officials. In contrast to 1994, this support was not forthcoming in 2004. Thus, for

example, the SUMA coordinator sought the support of the director of the customs office at the airport, but failed to realize the need to brief and seek the agreement of higher-level customs officials. Until recently, the director general of the Customs Administration and his administrative staff appeared genuinely unaware of the existence of SUMA, the LSS, and the partial implementation in 2004.

Although the system was generally ineffective in improving the flow of information during emergencies, there was an attempt to promote the adoption of computerized inventory systems for routine tracking in various organizations, including the DPC, the National Red Cross Society, the Hospital of the State University of Haiti (in Port-au-Prince at the receiving dock and in the pharmacy), and Catholic Relief Services. These institutions welcomed the concepts behind the system and participated in training courses with Fundesuma.

In May 2004, a major flood affected border areas between the Dominican Republic and Haiti. There were more than 400 deaths in the Dominican Republic (many were Haitian migrants). The Office of Civil Defense mobilized its own SUMA team and selectively monitored the flow of supplies. Accounting and tracking were significantly improved.

In September 2004, Hurricane Jeanne struck the Dominican Republic and Haiti. The number of emergency and relief partners rose. Supplies were delivered without regard to need or request and were distributed without any global oversight or monitoring. MINUSTAH was in the process of establishing itself and was recovering from losses it had experienced during the disaster.

Following the external evaluation of SUMA in September 2004, the PAHO disaster logistics expert organized training activities on SUMA for the DPC according to the schedule shown in table 4.11. Ten DPC staff have been trained over the last five years. Three have left the DPC; one is now working at the Ministry of the Interior.

These activities reported by the DPC did not, however, lead to the use of the system during small or large disasters or for routine stock control. The reasons provided by the DPC for this failure include the following: (1) Difficulties in liaison at points of entry have hampered data collection. This reflects a lack of policy commitment. It highlights that the DPC has no direct authority over other partners. (2) In 2004, the lack of computers, especially laptops, was identified as a limiting factor. The donation of recycled equipment did not fill the gap. The DPC is currently benefiting from significant financial assistance and equipment transfers (from the

TABLE 4.11 SUMA Training Activities through the DPC

Year	Activity	Participants
2004	training of trainers and courses in the country's departments	two DPC personnel; personnel at other institutions
2005	evaluation of the DPC team	four DPC personnel
2005	refresher course	eight DPC personnel
2005–06	training in data entry among support staff	three support staff

Sources: Author compilation; DPC data.

European Union, the UNDP, and the World Bank). (3) Staff were unable to demonstrate the political usefulness of SUMA in the context of the problems in logistics.

SUMA Users

The ownership of SUMA is intended to reside with the DPC. In Haiti, the government and governmental institutions have never taken on ownership of the system or provided the policy support required by the DPC to demonstrate the usefulness of the system. The system cannot operate without sufficient political support to compel all actors to make a genuine effort to record supplies and share data. The humanitarian community has a strong sense of autonomy and independence. True coordination in the sense of guiding and influencing participants in efforts to achieve a common goal is lacking. Periodic meetings at which external actors informally exchange general information and then propose their own plans do not constitute coordination.

The United Nations temporarily assumed leadership because of the complex political situation. The ownership of SUMA was never fully assumed, however, and the value of cross-sectoral inventory data in the provision of guidance for decision making among the partners was not recognized by the humanitarian coordinator. The government, United Nations agencies, and NGOs appeared to be placing greater priority on highly visible action at all cost rather than on coordination, the systematic identification of supply gaps, the reduction of duplications, and overall cost-effectiveness and transparency. The lack of true ownership and policy commitment is the major obstacle in Haiti.[8]

Thus, for example, at the receiving dock at the Hospital of the State University of Haiti, in Port-au-Prince, the delivery, location, and shipment of all supplies have been recorded since 2004. The supervisor responsible for this unit has stated that nobody has ever requested any of the data or any other information. The success in the collection of data through the system demonstrates that the system is not too complicated to use.[9] Catholic Relief Services, although it did not receive the expected technical support after 2004, used the SUMA structure to develop its own, more simplified system, which will facilitate exchanges of information with the new LSS if and when one is established by the DPC.

Is the System Relevant to User Needs?

During the response and recovery after disasters, there are as many needs as there are actors. There are the basic needs of the population, such as food, shelter, sanitation, health care, and, eventually, income, housing, and education. There are the needs of agencies in improving efficiency and avoiding waste and duplication. And there are the needs of comptrollers, auditors, and donors in documenting the use of donations and other funds by implementing partners.

In Haiti, there is a consensus that more transparency and more effective management of donations are important. There is, however, little external or internal pressure for change. The information generated through SUMA, however limited in its scope, has never actually been used. There is no internal demand by auditors or comptrollers for accounting information provided through systems. The status quo seems to be preferred or accepted. Among donors, NGOs, and, above all, governmental institutions, there is no perception of a need to impose or accept the discipline required by a collective cross-sectoral database. Indeed, representatives of potential external users, including organizations cosponsoring the development of the LSS, were not aware of the existence of SUMA. There is no institutional memory of any system application before 2004.

Institutional Arrangements and Cost Issues

Funding for the promotion and maintenance of the SUMA system was limited. Approximately US$12,000 was available per year for this type of support, plus around US$50,000 that became available for the deployment during the crisis in 2004. PAHO, a health agency, assumed most of the costs, but was supported in this by many donors (part of a larger regional project on preparedness and capacity building). No cost has been incurred by national institutions for the promotion and maintenance of the system.

The Sustainability and Institutional Integration of the System

The level of sustainability and institutionalization of the SUMA-LSS systems has not progressed in the four years since the external evaluation. Many countries in the Caribbean and in Central America have understood the benefits of a logistics system such as SUMA in ensuring transparency and as an accounting tool during the response to a disaster. In contrast, there has been no firm expression of support by the government in Haiti, nor has there been much, if any, encouragement from United Nations agencies or donors. The SUMA system has not been promoted as a policy-making tool by the sponsoring agency or the national counterpart (the DPC).[10]

The Lessons Learned in Haiti

This section addresses considerations specific to Haiti and similar countries that have experienced natural disasters within a context of poverty and weak institutions.

- SUMA implementation involves the formation of a large cadre of national experts and instructors. Throughout the Caribbean and Latin America, any emergency or routine request for English-speaking Caribbean experts or Spanish-speaking Latin American experts may be easily satisfied. Neighboring countries will respond generously if approached. SUMA has thus become a channel for meaningful mutual assistance and solidarity in the region. For cultural and linguistic reasons, Haiti is not really part of this network. Haiti is the only least-developed country and the only French-speaking developing country in the Western Hemisphere. This means it is somewhat isolated in regional efforts.
- Securing political support for the use of a new database system within a country cannot be considered an easy undertaking merely because technical counterparts appear to appreciate the tool. A concerted effort at coordination is required by the international community in countries such as Haiti, where the culture of accounting or accountability is not well developed in tracking and managing the supplies that are delivered during disaster relief and recovery efforts. In Haiti, external actors—in the opinion of seasoned observers interviewed as part of this case study—have been too concerned with the difficult challenges involved in implementing their own projects (that is, spending their own budgets as efficiently as possible).

- The efforts to establish the logistics system have mostly occurred at the technical level. The support provided to Haiti has mainly involved training personnel to use the software and enter data. Too little effort has been dedicated by supporters of SUMA to promotion at the highest level of government, among decision makers in United Nations agencies and MINUSTAH, and senior officials in donor organizations. If the humanitarian community does not support the concept of a system that facilitates coordination and transparency, why should Haiti do so?
- Capacity-building programs such those of the World Bank, the European Union, and the UNDP are essential. Their achievement in boosting the visibility and status of the DPC may be easily overturned by the inevitable chaos surrounding donations in Haiti. Capacity-building projects should focus on the LSS as a tool to improve the leadership of the DPC. The implementation of the SUMA-LSS system in other countries has been seen as an essential step in strengthening the disaster coordinating mechanism, while reducing the vulnerability of the mechanism to media allegations of corruption and mismanagement.

The DPC also needs this tool to exercise its authority and leadership over the many actors during a disaster. In recent disasters, the assets and response capabilities of the humanitarian community, particularly the United Nations system, have overwhelmed and ultimately weakened the national authorities responsible for coordinating the assistance. Many factors have combined to dwarf the Haitian counterpart: the lack of a room large enough to host the coordination meetings in the host government facility, the impressive communications and transport assets of the United Nations and MINUSTAH, the number of expatriate professional staff, and the adoption of English as the main language in the coordination effort. This was the case in Haiti in 2004 and is increasingly becoming the case even in larger countries faced with highly media-visible disasters such as the tsunami or the Pakistan earthquake.

Ultimately, these factors may be offset. Coordination authority will belong to those who are best informed rather than those with more physical assets. The SUMA-LSS system is an information tool designed to provide this leading edge to the national coordinator.

The following sequence of activities is recommended for Haiti:

- Focus efforts on the policy-making level through a short session to raise the awareness of decision makers in the national government and the

international community (at the initiative of OCHA and with technical and operational support from PAHO and Fundesuma).
- Seek formal policy commitment from the Ministry of the Interior and the prime minister. The request should be initiated by OCHA and have the explicit support of the World Bank project and other donors and agencies.
- Contingent upon a formal commitment at the policy level, include the activity in the DPC work plan.
- Once the activity has been included in the DPC work plan, seek technical support for the DPC from Fundesuma under the aegis of multisectoral partners such as OCHA, the World Bank, and other interested parties.

The Case Study in Guatemala

The Country

Guatemala is in Central America. It has shoreline on the Pacific Ocean and the Caribbean Sea. In 2005, at the time of the disaster that is a focus of this study, its population was estimated at 12.6 million, and the country's gross national income per capita was US$2,400 (World Development Indicators Database 2007). Close to half the population—43 percent in 2006—are descendants of indigenous Mayan peoples. Westernized Mayans and mestizos (of mixed European and indigenous ancestry) are known as Ladinos. Slightly more than half the population—51.9 percent in 2006—is rural, though urbanization is accelerating (U.S. Department of State 2007).

The country is highly vulnerable to disasters. In addition to periodic hurricanes, it has a long history of earthquakes. The second colonial capital, Ciudad Vieja, (Old City), was ruined by floods and an earthquake in 1541. Survivors founded Antigua, the third capital, in 1543. Antigua was destroyed by two earthquakes in 1773. The remnants of Antigua's Spanish colonial architecture have been preserved as a national monument. The fourth and current capital, Guatemala City, was founded in 1776 and was severely damaged in an earthquake in 1976.

A national disaster organization was established in 1969. It has been directed for three decades by active duty or retired military officers. After the adoption in 1996 of the law creating the Office of National Coordination for Disaster Reduction (CONRED), the national disaster system became headed by appointees with expertise or backgrounds in risk management. The executive secretariat of CONRED reports to the Office of the President.

The CONRED operating budget is modest: around Q 20 million (the equivalent of US$2.6 million).

During the response and recovery following Hurricane Stan, the leadership of CONRED in coordinating the national and international response was recognized. This is unusual in Latin America. Civil protection organizations or similar mechanisms are often sidelined by a president, first lady, or prime minister who micromanages the response. CONRED was an asset in ensuring the collaboration and support of line ministries and other actors.

The creation by the government of the Coordination Center for Humanitarian Assistance, an integral part of the CONRED system, was critically important. The center's function is to act as a clearinghouse for national and international assistance. Its areas of expertise are temporary settlements and the management of distribution centers. Its main tool in monitoring external assistance is the SUMA-LSS system.

Hurricane Stan

Stan was a small storm. On September 29, 2005, the Institute for Seismology, Volcanology, Meteorology, and Hydrology, part of the CONRED system, forecast that several departments in the country might be affected by the weather depression. On the same day, CONRED raised the alert level from yellow to orange. The yellow alert had been issued on September 27. The forecast announced on October 1 by the U.S. National Oceanic and Atmospheric Administration projected a path passing far away from Guatemala. Between October 1 and October 4, the storm moved over the Yucatan Peninsula, drenching Belize, El Salvador, Guatemala, Honduras, and Mexico with heavy rain. Though the winds never reached more than 130 kilometers (about 80 miles) per hour, the storm proved to be one of the most devastating since Hurricane Mitch struck the region in 1998. Stan barely reached hurricane status before going ashore in southern Mexico on October 4 and, in fact, never crossed the border of Guatemala. Nonetheless, the 10 days of continuous rain, adding to the soil saturation of the rainy season, caused flooding and landslides in Guatemala. Ultimately, a minor storm generated considerably more human losses than a category 5 hurricane, as shown in table 4.12.

According to preliminary figures from the United Nations Economic Commission for Latin America and the Caribbean (ECLAC), the damage and losses caused by Hurricane Stan are valued at about US$983 million, that is, 3.4 percent of the gross domestic product of Guatemala in 2004.

TABLE 4.12 Comparative Strength and Damage of Hurricanes Mitch and Stan

Specifications and impact	Hurricane Mitch (1998)	Hurricane Stan (2005)
Saffir-Simpson hurricane scale	V	I
Wind velocity, kilometers per hour	290	3,130
Deaths	268	669
Missing	121	844
Homes damaged or destroyed	60,000	38,058
Affected population	49,795	475,000
Economic loss, % gross domestic product	4.7 (US$748 million)	3.4 (US$988 million)

Sources: ECLAC 1999, 2005.

Meanwhile, the losses associated with Hurricane Katrina have been estimated at only 0.1 percent of the gross domestic product of the United States. The damage to agriculture, according to Guatemala's Ministry of Agriculture, is valued at around US$46 million. Poor peasants and rural workers who depend on terracing were particularly affected. ECLAC estimated that more than 17,000 jobs were lost as a consequence of the disaster.

According to the Humanitarian Aid Department of the European Commission, the hurricane had the greatest impact in those departments with the lowest human development indexes and low income levels. A significant portion of the populations of most of these departments is indigenous (table 4.13).

On October 5, 2005, Guatemala declared a state of national emergency and requested international support. The state of emergency was extended to November 30 so that emergency assistance might continue to be provided.

Scale of Mobilization in the International Response

Hurricane Stan did not generate as much media coverage as the tsunami in Asia or the earthquake in Pakistan. The number of international humanitarian

TABLE 4.13 Disaster Impact and Level of Development, Guatemala

Department	Affected population, %	Indigenous population, %	Impact, % of gross domestic product	Human development index, 2002
San Marcos	39.2	35.3	21.9	0.583
Escuintla	33.2	6.5	9.1	0.605
Solola	5.9	96.3	34.9	0.579
Quetzaltenango	4.1	52.3	7.3	0.655
Jutiapa	3.3	2.8	16.0	0.593
Huehuetenango	3.1	64.6	9.8	0.560
Chimaltenango	3.0	78.8	8.6	0.618
Quiche	2.1	88.4	2.0	0.508
Retalhuleu	1.9	21.0	19.9	0.632
Santa Rosa	1.9	2.4	7.7	0.604
Totonicapan	0.7	98.3	6.4	0.540
Suchitepequez	0.7	48.0	4.7	0.587
Sacatepequez	0.6	41.1	2.9	0.708
Guatemala	0.6	12.3	0.3	0.795
Jalapa	0.0	14.9	5.3	0.568
Total	100	41	3.1	0.649

Sources: Data of the Humanitarian Aid Department, European Commission.

organizations remained relatively manageable. The UNDP has reported that 27 NGOs were active during the recovery. Most of these had been previously active in the country.

The financial response was generous in Guatemala. With the support of OCHA and the United Nations Disaster Assessment and Coordination team, a Flash Appeal was issued by the United Nations, in consultation with CONRED, for US$24.7 million. A few days later, once an assessment of the food needs had been completed, the WFP added a request for US$14.1 million. A total of US$39.8 million was actually contributed (as of April 2008). As is often the case, the Flash Appeal included only the funds requested by United Nations agencies to support their own projects and their own national counterparts.

The FTS Database in 2007 reports a total of approximately US$39.8 million disbursed or committed. This exceeds the amount requested in the Flash Appeal. It includes, however, contributions by donors to the National Red Cross Society or NGOs, as well as other funds spent bilaterally.

Information on the amounts raised by NGOs is generally unavailable. For instance, the disaster prevention expert at Intervida, a Spanish NGO and the largest active in the disaster-affected departments in Guatemala, reports that the NGO has relied exclusively on the contributions of individuals, mainly in Spain. No governmental funding has been requested or received.

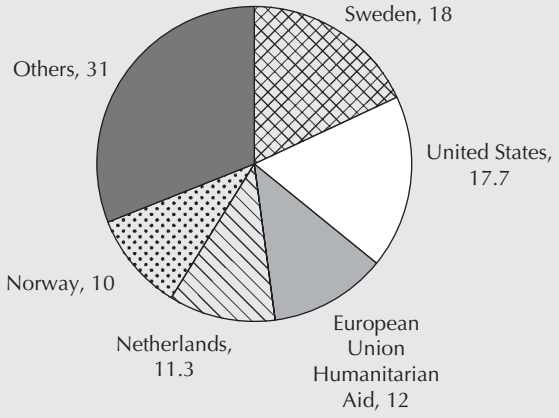
As of June 2007, five donors were providing 69 percent of the contributions (figure 4.5).

Division of Labor among National and International Actors

Governmental Actors

A positive feature of the response and early recovery in Guatemala was the support provided by other ministries and secretariats of the government in the management of the supply and logistics chain. The traditional actors in emergency management are the line or technical ministries. The relevant contributions to the effort in early recovery are divided into four groups according to the priorities of CONRED: water and sanitation; shelter, housing, and social infrastructure; food security and nutrition; and health (table 4.14).

FIGURE 4.5 Shares of Donor Funding, in Guatemala, by Donor
percent



Source: FTS Database 2007.

TABLE 4.14 National Counterparts and the United Nations' Response

Entity	Water and sanitation	Shelter and social infrastructure	Food assistance and security	Health
Ministry of Agriculture		✓	✓	
Ministry of Health	✓	✓		✓
Ministry of the Environment and Natural Resources	✓			
Ministry of Communications		✓		
Ministry of Education		✓		
National Council on Food Security and Nutrition			✓	
Welfare Secretariat of the First Lady		✓	✓	✓

Sources: Author compilation; UNDP data.

Besides the traditional actors, several other institutions also played a proactive role. The Presidential Commission for State Reform, Decentralization, and Citizen Participation was established in 1993. Two of the units of this commission were particularly relevant: the unit on advanced electronics and the unit on decentralized institutional support. Within 24 hours, the commission had assigned six information technology experts to emergency assistance and arranged for the participation of eight others from the private sector. Loans of equipment at no cost to CONRED were also negotiated by the commission through its links with the private sector. Through the commission, 15 suppliers offered technical support and material to CONRED. The commission documented the need to modernize CONRED information and communication technology infrastructure at a cost of Q 20 million. This was equivalent to the annual operating budget

of the CONRED executive secretariat that was approved by Congress in 2007. The cooperation between the commission and CONRED in the aftermath of Hurricane Stan led to an agreement between the two institutions in 2006.

The Secretariat for Planning and Programming in the Office of the President is the institution responsible for coordinating international development assistance. During a state of disaster emergency, this responsibility is transferred to CONRED for the duration of the declared emergency (60 days in the case of Hurricane Stan). Initially, the secretariat was not linked with the Coordination Center for Humanitarian Assistance. This oversight was corrected rapidly. The secretariat and the center subsequently worked together to maintain a simple descriptive database of all assistance received.

The Ministry of National Defense assumed rapidly the responsibility for logistics (mainly transport) during the relief and early recovery effort. This contribution appeared to be remarkably well integrated into the CONRED network; the executive secretariat of CONRED and the Coordination Center for Humanitarian Assistance actually determined which goods were needed and where. The military provided support in communications and transport without attempting to assume a command role, unlike the approach observed in several instances during recent disasters.

The Office of the President supported the LSS through CONRED. A reconstruction mechanism was also established by the president. Instead of establishing a new administrative structure for this purpose (as had been done in 1976), a coordinator with strong political backing was designated to stimulate and oversee the reconstruction process through existing institutions. The leadership of the reconstruction post-Stan was assumed at the beginning by the Private Secretariat of the Presidency. This role was later assumed by the Private Secretariat of the Vice Presidency, which has maintained this role.

Nongovernmental Actors

Although the International Federation of Red Cross and Red Crescent Societies provided considerable support, the national society was not able to assume its normal lead role in procuring and managing temporary settlements and shelters. This task was covered by the Welfare Secretariat of the First Lady, the Ministry of National Defense, and Executive Secretariat of the Presidency. In many countries, the national society is the coordinator and backbone of the SUMA-LSS system. This was not the case in Guatemala.

The report of the United Nations coordinator on the implementation of the Flash Appeal listed 27 NGOs that were participating in the recovery process, together with the United Nations system and the government. Most of these NGOs were already active in Guatemala. The low international profile of the disaster meant that the participation of numerous unsolicited NGOs that has been observed in more media-visible disasters did not materialize. In Aceh, Indonesia, the estimated number of NGOs active during the first three months after the tsunami ranged from 340 to 500. Most were unfamiliar with the affected areas or even with operations following large disasters in a developing country. Fortunately, the Coordination Center for Humanitarian Assistance in Guatemala did not face such a situation, for which it would have been unprepared.

The Private Sector

Traditionally, the private sector offers goods and services for disaster-affected populations. In the case of Hurricane Stan, the private sector provided information technology support, much of which was directed at the rapid implementation of the LSS. The main challenge has been the upgrading of the obsolete equipment of CONRED at the central level, but also the establishment of a computing facility and Internet access in the most affected districts.[11]

GBM in Guatemala, an IBM alliance company offered its assistance through the Welfare Secretariat of the First Lady. After its initial offer to procure vaccines, GBM was finally asked to supply equipment and logistics support for SUMA. Training courses were organized by Fundesuma on GBM premises and equipment. GBM experts found the LSS software simple and practical. Up to 60 Internet-linked personal computers were donated. The equipment installed among municipalities was collected by the Presidential Commission for State Reform, Decentralization, and Citizen Participation approximately five months after the beginning of the emergency.

Cervecería Centro Americana, the main beer and soft drink producer in Guatemala, has considerable experience in logistics because it delivers its products to all corners of the country. Following a request from the Office of the President, it provided its technical expertise to help strengthen CONRED logistics capacity to dispatch relief supplies according to needs. Five system engineers assisted CONRED in monitoring incoming donations at the international airport and in using the LSS system. Additional technical cooperation in the use of geographic information systems was eventually added to match needs and supply in a visual format. The most

valuable support was essentially technical in nature, although the public relations department of Cervecería Centro Americana also focused more on donations of bottled water and soft drinks.

The insights of private sector leaders on the strengths and weaknesses of CONRED as a business proposition have been useful to this case study and should be sought by the government.

The United Nations' System

The responsibilities of the United Nations' system in Guatemala are summarized in table 4.15. The cluster approach whereby one agency is formally assigned responsibility for a specific sector (for instance, health) or a class of activities (such as logistics) has not been implemented in Guatemala.

This disaster, relatively unnoticed at the international level, generated a surge of solidarity from all agencies and the private sector. The most

TABLE 4.15 Contributions of the United Nations' System

Entity	Water and sanitation	Shelters and social infrastructure	Food assistance and security	Health
UNDP		✓	✓	
Food and Agriculture Organization		✓	✓	
WFP		✓	✓	
UNICEF	✓	✓	✓	✓
United Nations Population Fund	✓			✓
International Labour Organization		✓		
PAHO, World Health Organization	✓		✓	✓
United Nations Educational, Scientific, and Cultural Organization		✓		
International Organization for Migration		✓		

Sources: Author compilation; OCHA 2005a; UNDP data.

interesting feature of the response and early recovery was the ability to channel this assistance into areas where the partners were most able to contribute, namely, in expertise and management skills rather than through donations of goods.

CONRED fulfilled its role as coordinator of the national response rather than as an agency directly assuming operational responsibility. Undoubtedly, there were many shortcomings, especially given the unrealistic expectations of the private sector and NGOs regarding the capabilities of government agencies. There is, nevertheless, a general consensus that the CONRED approach stimulated participation and solidarity within the country. The interviewees consulted for this case study concurred in presenting a picture of a governmental system responding collectively to a situation for which it had not been prepared. Coordination and leadership were weaker in the departments in which CONRED did not have a sustained presence, generally because of its modest resources.[12]

The LSS in Guatemala

The Owners and Users of the LSS

There was a high level of awareness in Guatemala of SUMA and the LSS prior to Hurricane Stan. This awareness was the result of several factors, including the high profile of the system in CONRED counterpart agencies in most Latin American countries and the use of such systems in many disasters in the Americas, including in Guatemala after Hurricane Mitch.[13]

Following Hurricane Mitch, relevant professionals in Guatemala did not participate much in the training courses periodically organized on the LSS in interested countries. At the beginning, CONRED was headed by the military, which, at the time, was unwilling to share information. Later, the civilian head of CONRED thought the SUMA-LSS system duplicated, if not competed with emergency management software that was being developed under a trade license. In 2005, a new CONRED coordinator had to address the failure of the system to deliver the expected services and pay significant royalty fees (for a license) to fix a software system that CONRED had helped develop. The new coordinator of CONRED and his assistant had participated in SUMA courses in 1992. As a result, a visit from Fundesuma was organized in July 2005 to brief CONRED on the new system, the LSS, that had been developed recently.

Within 48 hours of the unexpectedly severe onslaught of Hurricane Stan, CONRED formally requested the international support of PAHO and Fundesuma in activating the system in Guatemala. On October 8, a Fundesuma technical support team was on site. The understandable reluctance of the staff who had invested time in the unsuccessful design of a tailored system was rapidly overcome because of the comprehensiveness and quality of the data provided through the LSS.

The chronological sequence of these initial events helps place the implementation of the LSS in context (table 4.16). The process was marked by improvisation because SUMA had never been installed within the institutional network, and few personnel were familiar with the details of logistics management and the LSS taught by Fundesuma in other countries.

In mid-October, the success of the LSS at the central level prompted the authorities and the United Nations coordinator to implement the system in selected departments and municipalities. Accelerated half-day training was provided to central staff, local personnel, and United Nations

TABLE 4.16 Chronology of Events, Hurricane Stan, and Humanitarian Assistance

Date	Event
October 2	the Institute for Seismology, Volcanology, Meteorology, and Hydrology reports the formation of a storm north of the Yucatan, in Mexico
October 3	first reports of flood damage in some departments of Guatemala
October 5	declaration of a state of emergency by the president
October 6	blanket appeal for international assistance
October 7	creation of the Coordination Center for Humanitarian Assistance
October 8	arrival of a Fundesuma expert team
October 29	departure of the team
December 12	closing of the emergency operations center (end of relief)
February-March	end of LSS operations in the departments and then at the central level

Source: Author compilation.

volunteers organized through the UNDP. The main user and the entity responsible for the system was CONRED, which installed the system and trained the appropriate staff during the days immediately following the arrival of the experts.

One of the positives of the implementation of the LSS in Guatemala was the active encouragement and participation of most relevant institutions. The Welfare Secretariat of the First Lady, the Executive Secretariat of the Presidency, the Ministry of National Defense, and the community development councils assumed responsibility for the distribution centers and the management of shelters. The Ministry of Health loaned staff at the request of CONRED. The Presidential Commission for State Reform, Decentralization, and Citizen Participation rapidly diagnosed the need for drastic improvement in the database management capacity of CONRED. The military, in contrast to its response during the aftermath of Hurricane Mitch, accepted a support role. United Nations agencies, particularly the UNDP, joined PAHO in providing technical and material support among the country's departments during the implementation of the system. NGOs were encouraged to participate because, by formally channeling goods through CONRED, which, in turn, commissioned the recipient agency to administer the goods, they received an exemption from customs duties. The formality of the transaction was imposed to meet the requirements of customs authorities at the borders.

In brief, the implementation of the LSS system represented a positive example of the collective participation of numerous partners. This outcome may be credited to the policy commitment and the participative approach adopted by CONRED and its partners.

Among the departments and municipalities, there was little CONRED presence before the disaster and, consequently, still less awareness of the existence and functions of the SUMA-LSS system. The hasty training of two or three officials, including the United Nations volunteers, was not accompanied by motivational encouragement among local authorities. Policy promotion and ownership clearly cannot be improvised in an emergency situation. Many of the people interviewed for this study felt that the ownership of the LSS had remained in the capital city. Poor communications (both physical and social) also contributed to the lack of commitment by municipal authorities, who were often uncomfortable with the discipline required to ensure transparency and good governance. The interviewees said that, at the local level, commitment and ownership were limited.

Relevance of the System to User Needs

As mentioned in the case study in Haiti, above, four types of needs arise after disasters: (1) basic needs of the population, such as food, shelter, sanitation, health care, and, so on; (2) needs of agencies in improving efficiency and avoiding waste and duplication; (3) needs of comptrollers, auditors, and donors in documenting the use of donations and other funds by implementing partners; and (4) needs of local level and central level policy leaders seeking to be accountable before their constituencies.

According to the interviewees, the LSS assisted users, especially at the central level, in meeting the first three types of needs. The fourth type of need was viewed informally as a major impediment in rationalizing and improving the response and recovery effort. National disaster managers considered the LSS a tool that encourages the distribution of assistance on the basis of needs. This was facilitated because of the strong pressure exerted by the humanitarian community in favor of transparency and oversight.

The Access to and Use of the Data

The SUMA-LSS system held a large array of macrolevel data on consignments from individual donors, individual shipments and their contents, and deliveries to individual sites. No complaints about a lack of data access were voiced during the interviews. Similarly, the quality of the data was considered highly satisfactory (probably exceeding the expectations and use capacity of many actors). The need for a more robust, tailored security system was noted.

Data were utilized most intensively at the macrolevel, as follows:

- The most important use reported by the interviewees was to reassure donors, political authorities, the media, and the public that humanitarian assistance was all accounted for. This might seem a trivial task of little benefit to the affected population. Disaster relief and recovery coordinators must dedicate an inordinate amount of time to meeting the need of these groups for information. The ability of the system to operate efficiently depends on satisfying those holding the resources or oversight authority. Ultimately, the LSS, by helping demonstrate that the process was properly managed, made it possible for the logistics team to focus its attention and resources on getting assistance to those needing it.
- A corollary is the protection that the LSS provided to disaster managers from the pressure exerted by influential individuals to provide

supplies for parallel distribution to their constituencies. The distribution from central distribution points and in the departments was based on the assessment of needs, however imperfect this was, rather than according to election results or political or personal position.

- Maps generated through the technical support of Cervecería Centro Americana permitted managers to determine the locations requiring assistance. Such information is essential for efficient distribution. However, the mapping was not matched by a comprehensive, accurate, and rapid geographical assessment of actual needs. The data received on needs took the form of requests (often wants rather than needs). Logistical constraints and the lack of resources at CONRED and with the United Nations Disaster Assessment and Coordination team prevented these institutions from collecting quantified information on basic needs as efficiently as the collection of information through the LSS on incoming resources.
- Considerable attention is usually given to geographic information systems. However, the geographical mapping for the assistance provided in Guatemala was based on a more practical community-based system adapted from the business needs of a beverage distributor aiming to reach the most remote distribution points.[14] In such a business context, community is understood as a significant cluster of potential customers. Similarly, it might be said that there is a market for humanitarian assistance.
- The classification of goods according to their usefulness in an emergency response or recovery contributed to the more effective use of scarce air and road transportation resources. The extent to which the assignment of priority codes to goods was based on sound operational judgment is unknown. Reports from those involved in transportation suggest that this classification helped prevent the massive dispatch to the field of items considered to have no value.[15]

In operations, the potential of the LSS was underused by decision makers. Data were collected but not used to improve the management of the effort. The agencies did not base their decisions on all the facts and data potentially available. In the humanitarian context, the speed of an action is valued more than effectiveness and efficiency. Lists of goods by type, use-by date, or need for special handling (such as cold storage) were rarely requested. The interviewees point to the lack of adequate training provided in the four workshops organized by Fundesuma during the first three weeks of implementation. In fact, the training provided by Fundesuma is

predominantly directed to the technical management of the LSS and not to the promotion of evidence-based decision making. The latter requires different skills and a sort of policy support that only the United Nations sponsors or the World Bank is able to provide.

In the departments and municipalities, the lack of ownership and the limitations imposed because of improvisation in a policy context unaccustomed to external or foreign oversight narrowed the impact of the LSS. This experience should be seen as a first step in the effort to expose local authorities to the more rigorous and transparent management of the resources entrusted to them in emergencies.

At the cross-sectoral and macrolevel, the LSS supplied a comprehensive picture of the content and destination of the material assistance that had been received. It serves a critical function in ensuring transparency and accountability. However, individual institutions and NGOs did not take advantage of the wealth of technical and operational information compiled through the LSS. At the local level, the lack of LSS awareness and of a CONRED presence limited the short-term benefits.

Institutional Arrangements and Cost Issues

The management and oversight of the LSS implementation process were highly appropriate. CONRED was the recognized owner of the system. Its authority (attached to the Office of the President) greatly facilitated its leadership role and the participation of other institutions. The lack of institutional integration of the LSS within CONRED and this agency's weakness in the departments delayed LSS implementation and the effectiveness of the system outside the capital.

The wasteful duplication of data during data entry was minimal. Inevitably, a centralized system will require double entry if arrangements (programming routines) have not been undertaken prior to the disaster for the import and transfer of data to LSS databases from the proprietary commodity tracking systems of larger agencies. However, no complaint by such agencies was received.

The main problem in implementation was the inexperience of the staff at CONRED and other agencies who had not participated in training courses for at least the previous three years. The introductory technical visit in July (three months before the storm) was opportune, but did not provide training. The whole operation suffered from lack of preparedness and institutional integration prior to the emergency.

The issue of cost-effectiveness is rarely taken seriously during disasters. The interviewees felt that the services offered by the LSS amply justified the cost. Because of the mobilization of the private sector, the cost of LSS implementation during the emergency was apparently not the problem. The main problem was the obsolete state of the technological infrastructure of CONRED. Improvements were overdue regardless of the use of the LSS. The cost of technical support was covered systematically by outside experts and was modest (an estimated US$30,000, which was covered by PAHO). Donated equipment that relied on cellular-based Internet access could not be used in many disaster-affected municipalities, placing in doubt the feasibility of Web-based operations in many cases. The overall predisaster expenditure by the supporting agency (PAHO) was lower in Guatemala than in other countries because of the lack of interest of the previous management of CONRED. One may only speculate about how much more might have been achieved with more substantial funding by Fundesuma or other partners. Maintaining a group of trained instructors and system analysts in each country would ensure ongoing technical support. The current funding structure does not accomplish this.

Sustainability and Institutional Integration

The sustainability and institutional integration of the SUMA-LSS system are the greatest challenge for disaster-prone countries, but especially Guatemala. Although the LSS is suitable for long-term use (including reconstruction), the mandate of its national owner is limited to the emergency phase (declaration of a state of emergency). The material donated by GBM was put to other uses approximately five months after the disaster, ending the role of the LSS as a routine tool.[16]

The fact that Fundesuma is able to respond rapidly and provide emergency assistance may not encourage countries to keep the system active between emergencies.

In Guatemala, CONRED and the Welfare Secretariat of the First Lady are both planning to design their own systems to link the management of supplies and their administrative and financial systems. CONRED's unsuccessful attempt over the last five years to develop locally a full emergency management system is not encouraging. The local planning and implementation of a complex tailored system have proven more expensive than expected. Moreover, the time this requires may exceed the normal staff

turnover time among institutional managers. Both the proposed systems, if they are ever completed, may be incompatible unless both institutions begin collaborating closely on implementation.

There has been no follow-up on the excellent technical support provided by the private sector. The interviewees at GBM and Cervecería Centro Americana have remained willing to support CONRED in improving the system, but have not been approached since the emergency. Relative to CONRED, both partners have more experience in designing systems and have been favorable to the work of the LSS designers. The Welfare Secretariat of the First Lady, CONRED, and other government entities engaged in this matter should invite private sector actors and Fundesuma to participate and take on an advisory role in a task force overseeing the development of these planned systems.

Several alternatives appear to make economic sense, including using the codes of the LSS (free software) and adapting them, adding new modules and features if needed, or adopting the LSS item classification and data structure in the design of a new system to ensure cross compatibility.

Guatemala is not the only country in this situation. The entity responsible for civil defense in Brazil is similarly considering the adaptation of an LSS to its own administrative and financial system. Fundesuma has been unable to participate in this undertaking to the extent desired because of its limited resources (funding and permanent staff) and the reluctance of its sponsoring agency to deviate from its mandate in health.

Meanwhile, the LSS should be considered for use in the routine management of warehouses and distribution centers.

Maintaining overall preparedness and the accuracy of the LSS should be considered essential components of disaster risk reduction, capacity building, and good governance in Guatemala.

Lessons Learned in Guatemala

The SUMA and LSS systems were initially conceived as a technical management tool to improve the effectiveness of the relief and recovery process. Facilitating accounting and transparency and preventing abuses in the distribution of internal and external donations are important, but secondary, benefits.

In Guatemala, as in many other countries, the objective was primarily to reassure the media and the authorities that supplies had been accounted for and shipped to disaster-affected municipalities. Transparency and good

governance at the central level and in the departments more than justified the LSS implementation.

LSS implementation involved the collection of an enormous amount of information. This approach was recommended during consultations with emergency managers and users. This is particularly the case in the delivery of medicines and medical supplies because every pharmaceutical product must be differentiated on the basis of active ingredient (generic name and brand names), packaging, dosage, and language, among other specifications. Application requirements (expiration date and the need for refrigeration) are also recorded for each item. This information is collected and entered in the system on the assumption that it will be useful in improving the distribution of resources and the reduction of waste. There is little evidence that the decision makers in CONRED or at the sectoral level exploited this wealth of detail. The potential of the LSS for improving the management of resources was never realized.

Although LSS training is regularly provided in interested countries, some level of improvisation must be anticipated. A last-minute request for external technical assistance such as in the case of Guatemala is common.

Disaster coordination agencies in disaster-prone countries should maintain their skills by using the LSS module for the routine maintenance of stocks. Disaster preparedness funding and projects should include the maintenance and updating of these skills.

The desire of agencies in Guatemala to have their own tailored, comprehensive management system that seamlessly links technical, administrative, and financial functions is understandable. However, this plan may not be cost-effective considering the limited resources of these institutions. This solution calls for a more careful appraisal of the expected costs (always grossly underestimated).

The disaster coordinating agency should ask its partners to use a common goods classification system relying on categories and subcategories to permit the exchange of data and consolidated national overviews in times of disaster. The goods classification system used in the LSS, the result of long negotiations with many national and international partners, should form the basis of a national humanitarian supply classification system.[17]

The experience in Guatemala has contributed to refinements in the supporting software. It has also demonstrated the practical value of the LSS's ability to use overlay distribution information on existing maps. It has

confirmed that good maps may be developed without necessarily using the coordinates of the global positioning system.

Users also pointed to some areas in need of improvement in the first version of the LSS. Among these is the need to maintain a log of changes and modifications as they occur. This feature has been specifically requested by users in Guatemala and other countries, but has not been included.

In principle, the LSS is a joint interagency undertaking. The fact that a single sectoral agency with a health mandate is seen as the promoter and caretaker of a tool for cross-sectoral transparency and coordination is not in the best interest of all. While PAHO should be credited for the success of the LSS, it is reconsidering its role and the relevance of its commitment to the LSS in light of its health mandate. It succeeded in carrying out a project with modest resources that were sufficient to sustain the life of the project, but definitely not to give it the impetus that the users expected. The updating of the first version of the LSS is a case in point. The new system is more sophisticated and more effective, but it is also more costly to maintain (upgrading, training, customizing, and so on). The rising demand for support from countries outside the Americas is encouraging, but is also a cause for concern.

Cross-sectoral agencies with the lead mandate in relief coordination, recovery, and the fight for good governance should assume primary responsibility for promoting and supporting the LSS.

The most revealing lesson from the successful application of the LSS in Guatemala is the importance of political commitment at the highest level. A system for monitoring all supplies regardless of their ownership (the government, the United Nations, or NGOs) requires strong backing from country leaders.

In Guatemala, the LSS was effective at the central level because the awareness of and interest in the system were substantial prior to the disaster. At the local level, there was no preparatory policy effort and no gentle persuasion. This could not be improvised after the onset of the disaster, and the shortcoming contributed to a lack of local ownership and commitment.

It is essential that the policy advocacy for such a tool that promotes transparency and good management be carried out at all levels as part of preparedness activities. Preparedness plans and standard operating procedures should include the use of the LSS and be explicitly supported by the highest authorities.

The donor community, international financial institutions, and United Nations agencies should speak in one voice to ensure this support and commitment at the local and national levels.

General Conclusions and Recommendations

- SUMA and the LSS are generic information systems possessing features that facilitate their use under emergency conditions. The systems have been developed and introduced in countries prior to the onset of disasters. They have been promoted at the policy level and are adopted to foster better management and greater transparency. The LSS is a joint preparedness venture of six United Nations agencies: OCHA, the office of the United Nations High Commissioner for Refugees, PAHO, UNICEF, WFP, and the World Health Organization. This gives the system credibility. User feedback and the experience with disasters are incorporated regularly in the software. A dedicated nonprofit group (Fundesuma) provides personalized technical support to coordinating organizations (CONRED in Guatemala), but is not delayed because of the significant administrative requirements characteristic of some larger agencies.
- SUMA and the LSS are not merely software. They are management and good governance tools. External actors may donate the equipment required for the system, teach the techniques, or install the software. Local ownership remains essential. In the absence of the political will necessary to reach the objectives, including coordination, better resource management, transparency, and accountability, such technical support may be wasted.
- Policy promotion and the promotion of awareness of this tool should be conducted by agencies with cross-sectoral coordination responsibilities (such as OCHA in relief and the World Bank in recovery). The area of expertise of Fundesuma revolves around technical support, information technology support, and training, not the policy promotion of transparency. An agency with a regional and sectoral mandate (PAHO) cannot (and perhaps should not try to) promote and service the LSS with the appropriate credibility and weight. This health agency has made a commendable effort by launching the SUMA system, but it is poorly equipped to lead or even sustain the rapid global growth of the LSS.
- In terms of human resource development, the focus of the training has been predominantly on data entry and the management of the system

itself, not the use of information for the more effective management of the response and recovery. A specific training course for decision makers on the proper use of LSS data and reports to improve their decisions should be envisaged jointly by the sponsors of the LSS.

- At the technical level, the Web-based LSS version has greater flexibility and more features. The security features of the Web version should permit the administrator to be selective about access to most of the key functions (by assigning or restricting access): the entry of data on a given disaster; the selective access to information on needs; the access to general or detailed data regarding donations from all or specific donors; specific data on receiving agencies, emergencies, or reports; and so on.
- The installation of the Web version should provide an easy link to the home page of each institution, thereby providing users with selective access to information. The installation should not require a high level of sophistication in an information technology department.
- Improvements are needed to the custom graphics interface.

Notes

1. The author would like to express appreciation to the people who gave their time for interviews and offered advice during the research. The interviewees and contacts in Haiti included the following: Marie Alta Jean-Baptiste (Directorate of Civil Protection [DPC]); Michaele Amedée-Gédéon and Guetson Lamour (National Red Cross Society); Mariama Bah, Henriette Chamouillet, Philippe Doo-Kingue, Sandra Guerrier, and Elisabeth Verluyten (Pan American Health Organization [PAHO]); Rony Bayard and Christian Skoog (United Nations Children's Fund [UNICEF]); Jean Closter Julien, Senghor Etienne, Flore Marie Laurent, and Paul Thomas (World Vision International); Reynald Eugène, Ludovic Labonté, and Jean-Jacques Valentin (Customs Haiti); Ross Gartley, Catherine Tovey, Yolene Surena, and Roberts Waddle (World Bank); Jean-Pierre Givel (International Federation of Red Cross and Red Crescent Societies); Manuela Gonzalez and Narciso Rosa-Berlanga (United Nations Office for the Coordination of Humanitarian Affairs [OCHA]); Gabriel Jean-Leger (Pan American Development Foundation); Henriot Nader (Programme d'Alimentation pour le Développement); Paulo Oliveira Martins and Alexey Tsarenko (United Nations Stabilization Mission in Haiti [MINUSTAH]); Rob Padberg (Bureau de Nutrition et Développement); Valérie Tremblay (United Nations Development Programme [UNDP]); and Willem Van Roey (World Food Programme [WFP]).

   The interviewees and contacts in Guatemala included the following: Eduardo Aguirre (Office of the President); Edgar Alveño and Eluvia Morales (Presidential Commission for State Reform, Decentralization, and Citizen Participation); Jose Luis Barrientos Paau, Alvaro Dubón, and Walter Sanchez (Ministry of National

Defense); Rosario Castro (PAHO); Waleska Garcia Corzo, Fernando Paredes, and Neeta Sirur (World Bank); Jorge David Gomez, Angel Manzano, Felix Mencos, and Julio Cesar Valdes Diaz (Ministry of Health); Luis Hernandez, Daniel Lopez Castillo, and Jéssica Solano Divas (Office of National Coordination for Disaster Reduction [CONRED]); Rolando Herrera (Welfare Secretariat of the First Lady); Jose Luis Loarca (OCHA); Gloria Luz de Muralles (Japan International Cooperation System); Teresa Maroquin (National Red Cross Society); Roberto Alfaro Migoya (Intervida); Manuel Pinelo Sisniega (WFP); Ruben Rios (GBM); Eugenia de Rodriguez (Secretariat for Planning and Programming, Office of the President); and Mariza Sobrani and Walter Wintzer (Coordination Center for Natural Disaster Prevention in Central America).

2. The United Nations Joint Logistics Center has been established by the Inter-Agency Standing Committee to provide an overview of the provision of specific humanitarian supplies worldwide. The system is now recognized by United Nations agencies, but also by the Red Cross system and the principal international humanitarian NGOs. The logistics center has been able to gather data from a wide variety of agencies that previously had not shared this type of information so openly. The Internet-based system has been successfully used in a number of countries, particularly in the context of the ongoing humanitarian crisis in Afghanistan and Iraq, as well as in natural disasters (the Indian Ocean tsunami and the earthquake in India and Pakistan). The WFP is the custodian of the center, contributes staff and resources, and houses the center's core unit.
3. The United Nations General Assembly, in resolutions 49/139 B of December 20, 1994, and 50/19 of November 28, 1995, called on the United Nations Volunteers, a program administered by the UNDP, and on OCHA, together with the entire United Nations system, to encourage the use of the expertise available through the White Helmets Initiative. The initiative, established by the government of Argentina, designates trained standby teams of volunteers from various national volunteer corps to be placed at the disposal of the secretary-general of the United Nations in support of immediate relief, rehabilitation, reconstruction, and development activities.
4. The advanced graphics in the first version of the LSS are not yet satisfactory.
5. Confusion is frequent about the proper role of international agencies in complex emergencies and in natural disasters. In complex emergencies, national authorities are often a party to a conflict or represent a failed state that has lost control over the country. During natural disasters, governments generally attempt to assume their responsibility for victims, despite many limitations.
6. The support of the Ministry of the Interior and the Ministry of Foreign Affairs would be required for such a significant change in the roles in the standard operating procedures of the National Emergency Operations Center. This is not likely to occur in the immediate future.
7. MINUSTAH is financed by assessments on a special account. The approved budget of the mission, from July 1, 2004, to June 30, 2005, was around US$379 million. From July 1, 2006, to June 30, 2007, the budget was approximately US$510 million.
8. In Timor-Leste, a SUMA team unsuccessfully attempted to raise the interest and capacity of United Nations agencies and other actors. Several months of effort led to

well-organized warehousing, but the initiative collapsed following the departure of the Fundesuma technical experts who had been funded by the World Health Organization.

9. A SUMA system is reportedly still being used by the Ministry of Health in Angola, including in the province of Huambo, which was devastated by the civil war. The conditions are worse than those in Haiti.
10. In other countries, directors of civil defense and civil protection have typically advocated for the system among legislators and high-level government officials. They usually secure a strong mandate and authority for the implementation of SUMA. This is clearly not the case in Haiti, where the DPC has little political capital to spare in its lonely fight against mismanagement and lack of accountability.
11. Several districts were operating under Windows 98, which is no longer supported by the LSS.
12. The reconstruction program includes the modernization of the main airports in the departments and the provision of a warehouse and office facility for CONRED.
13. The use of SUMA in the aftermath of Hurricane Mitch (1998) was partial and not particularly effective. At the time, CONRED was part of the Ministry of Defense and was headed by military officers. Inventories of the supplies stored, managed, or transported by CONRED were not permitted. The system was able to rely only on a number of the warehouses belonging to the Ministry of Health.
14. In the geographical distribution networks of brewers and soft drink producers, the accuracy of a geographic information system is often unnecessary. The producers are able to reach any potential customer efficiently.
15. Useless items may represent 20–50 percent of pharmaceutical supplies. Outside the health sector, used clothing and household food items account for the most wasteful application of logistics assets. The LSS is designed to eliminate such items from the system.
16. The LSS inventory module was added to facilitate the institutional integration of the LSS.
17. This approach is universally accepted in the health field. The International Classification of Diseases of the World Health Organization determines the structure of information systems used in ministries of health.

References

ECLAC (United Nations Economic Commission for Latin America and the Caribbean). 1999. "Guatemala: Assessment of the Damage Caused by Hurricane Mitch, 1998; Implications for Economic and Social Development and for the Environment." Report LC/MEX/L.370 (April 23), ECLAC, Mexico City.

———. 2005. "Efectos en Guatemala de las lluvias torrenciales y la tormenta tropical Stan, octubre del 2005." Report LC/MEX/R.895 (November 24), ECLAC, Mexico City.

FTS Database (Financial Tracking Services Database). United Nations Office for the Coordination of Humanitarian Affairs. http://ocha.unog.ch/fts2/ (accessed June 28, 2007, and February 28, 2008).

Human Development Report Database. United Nations Development Programme. http://hdr.undp.org/en/statistics/ (accessed April 2007).

Kaufmann, Daniel, Aart Kraay, and Massimo Mastruzzi. 2005. "Governance Matters IV: Governance Indicators for 1996–2004." Policy Research Working Paper 3630, World Bank, Washington, DC.

Mathieu, Philippe, Jean-Arsene Constant, Josue Noel, and Bobby Piard. 2003. "Carte et étude de risques, de la vulnérabilité et des capacités de réponse en Haïti." Oxfam International, Port-au-Prince, Haiti.

OCHA (United Nations Office for the Coordination of Humanitarian Affairs). 2004. "Haiti: 2004 Flash Appeal." Flash Appeal, Consolidated Appeals Process, OCHA, Geneva.

———. 2005a. "Guatemala, Floods and Mudslides: 2005 Flash Appeal." Flash Appeal, Consolidated Appeals Process, OCHA, Geneva.

———. 2005b. "Floods and Mudslides: Guatemala, 21 October 2005." OCHA Situation Report 5, OCHA, Geneva.

Transparency International. 2005. *Corruption Perceptions Index 2005*. Berlin: Transparency International. http://www.transparency.org/policy_research/surveys_indices/cpi/2005.

UNDP (United Nations Development Programme). 2005. *Human Development Report 2005, International Cooperation at a Crossroads: Aid, Trade and Security in an Unequal World*. New York: UNDP.

———. 2006. *Human Development Report 2006, Beyond Scarcity: Power, Poverty and the Global Water Crisis*. New York: UNDP; New York: Palgrave Macmillan.

United Nations. 2002. "Johannesburg Summit 2002: Haiti Country Profile." Country Profile Series, Commission on Sustainable Development, Division for Sustainable Development, Department of Economic and Social Affairs, United Nations, New York.

———. 2004. "Resolution 1542 (2004), Adopted by the Security Council at Its 4961st Meeting, on 30 April 2004." Security Council Resolution S/RES/1542 (2004), United Nations, New York.

U.S. Department of State. 2007. "Background Note: Guatemala." February. Bureau of Western Hemisphere Affairs, U.S. Department of State, Washington, DC. http://www.state.gov/r/pa/ei/bgn/2045.htm.

World Bank. 2006. *Global Monitoring Report 2006, Millennium Development Goals: Strengthening Mutual Accountability, Aid, Trade, and Governance*. Washington, DC: World Bank.

World Bank, UN (United Nations), IDB (Inter-American Development Bank), EC (European Commission), and Haitian Transition Government. 2004. "Republic of Haiti, Interim Cooperation Framework, 2004–2006: Summary Report." Document presented at the Haiti Donor Conference, Washington, DC, July 19–20.

World Development Indicators Database. World Bank, Washington, DC. http://go.worldbank.org/ B53SONGPA0 (accessed April 2007).

5

World Bank: Tracking Reconstruction Funds in Indonesia after the 2004 Earthquake and Tsunami

Jock McKeon

This chapter describes the methodology used by the World Bank to track the allocations of funds and expenditures by key actors during the reconstruction of Aceh and Nias following the earthquake and resulting tsunami that struck Indonesia and elsewhere in the Indian Ocean in 2004.[1] The purpose of the chapter is to derive lessons about good practices in financial tracking and to suggest changes in the financial tracking system used in Indonesia.

Background

The Disasters

On December 26, 2004, there was an earthquake off the coast of Sumatra, Indonesia. It originated at a shallow point around 30 kilometers below the Indian Ocean. The epicenter was approximately 150 kilometers south of Meulaboh, a city in Aceh Province (*Nanggroe Aceh Darussalam*), on the northwestern tip of Sumatra, and about 250 kilometers from Banda Aceh, the capital of the province.

Measuring 9.0 on the Richter scale, the earthquake was the most powerful anywhere in the world in a generation. In terms of energy

released, it was the worst natural event in Indonesia since the eruption of the Krakatoa volcano in 1883.

The quake generated a large tsunami that traveled rapidly throughout the Indian Ocean, striking beachfront areas at high speeds with catastrophic results in Bangladesh, India, Indonesia, Sri Lanka, Thailand, and other Asian countries, as well as East Africa. The tsunami killed more than 150,000 people.

The tsunami hit the coastline of Aceh Province 45 minutes after the earthquake. It carried water five kilometers inland, and, within minutes, it had swept bare an 800-kilometer-long strip of the Aceh coast that is equivalent to the coastline from San Diego to San Francisco. The tsunami caused unimaginable devastation. Over 130,000 people were killed in Indonesia. Over 700,000 people were displaced from their homes, which had been washed away or left in ruins. The scale of the damage to the local economy, infrastructure, and administration was unprecedented. In an instant, the livelihoods and security of hundreds of thousands of people were in jeopardy.

In March 2005, there was another major earthquake, this time on the island of Nias, near Aceh. This earthquake caused additional heavy damage.

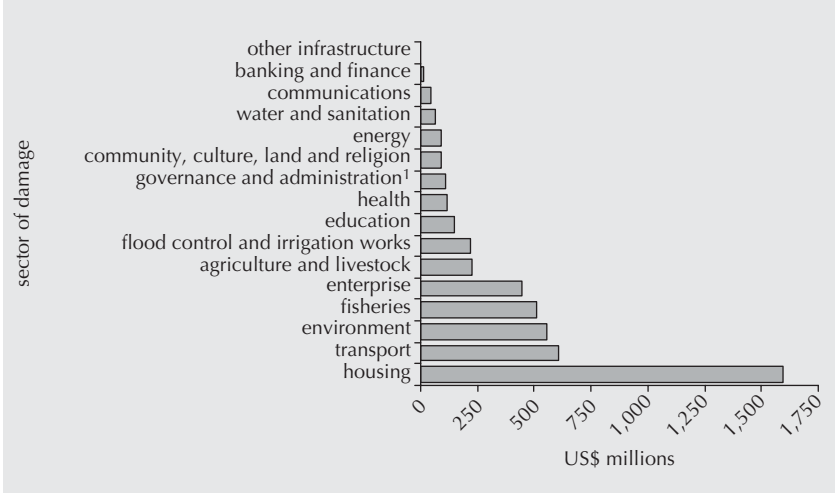
The magnitude of these events triggered an amazing outpouring of compassion and generosity from around the world. Private citizens provided huge amounts of support, and donors pledged generously to help survivors.

Damage and Loss

These disastrous events of 2004 caused immense social, economic, and environmental devastation to areas that were already poor, while sparking unprecedented emergency support. Before the tsunami, more than 28 percent of the population of Aceh and Nias had been living in poverty, and swift recovery was complicated because of the backdrop of a decades-long conflict in Aceh (World Bank 2006a).

The destruction and loss caused by the catastrophe have been valued in Indonesia at Rp 41.4 trillion or US$4.5 billion (CGI 2005). Of this total, 66 percent represents property damage and damage to infrastructure, while 34 percent represents income flows lost to the economy. These damage estimates provide an idea of the destruction of assets in the country and offer a baseline for any reconstruction program. Private sector assets and activities that relate directly to the personal livelihoods of urban and rural communities—housing, commerce, agriculture and fisheries, transport vehicles, and services—accounted for US$2.8 billion or 63 percent of the US$4.5 billion total (figure 5.1). Public sector assets, especially infrastructure, the

FIGURE 5.1 Damage and Loss Assessment



Sources: World Bank 2006a, 2007a.
[1] Including land.

social sectors, and government administration, accounted for US$1.1 billion or 25 percent of the total. There was also significant environmental damage to coral reefs and mangrove swamps, as well as the destruction of many hectares of arable land.

The total amount of damage and loss was equivalent to 2.2 percent of the gross domestic product of Indonesia. However, the measure is entirely different if one examines the effects on the economy of Aceh Province, where the ratio of the total damage and loss to the provincial gross domestic product was around 100 percent. This highlighted the need for substantial national and international support for the province; the internal resources available to Aceh Province would not have been sufficient to complete the recovery.

Response of the Government and the International Community

Recognizing the extent of the devastation, the government of Indonesia declared the tsunami in Aceh a national disaster. It appointed the National Coordinating Board for Disaster Management to implement the emergency response.

The international response came from all corners of the world. Over 130 nations provided assistance through this humanitarian effort. During the emergency response, military troops from a range of countries were deployed in a significant non-battle-related emergency military mission.

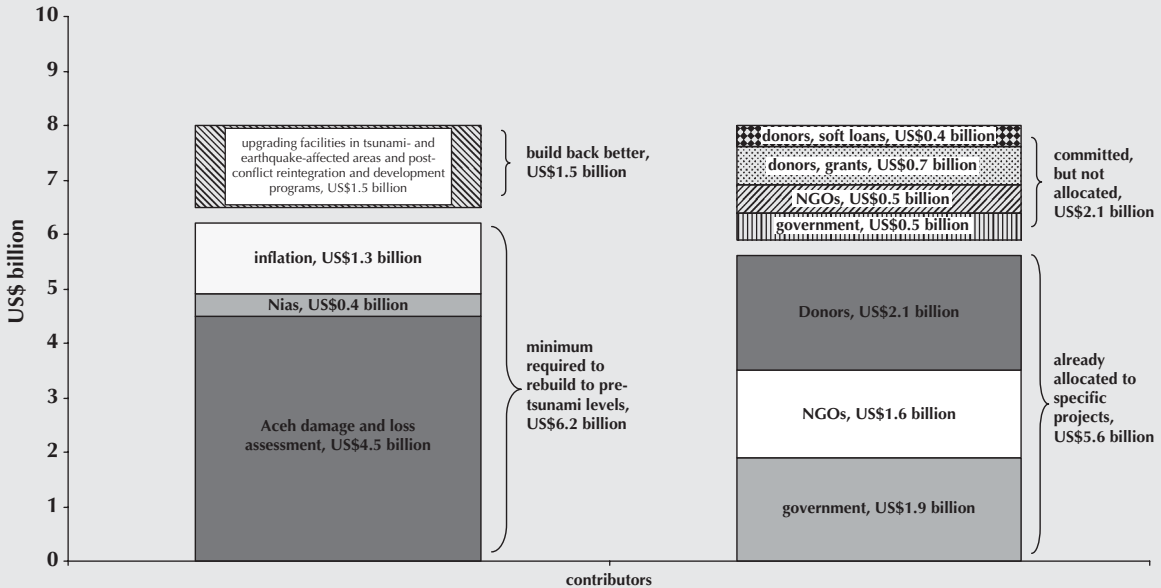
After the emergency response phase had been completed, the government assigned the National Development Planning Agency with the responsibility for coordinating the drafting of a rehabilitation and reconstruction plan for Aceh and Nias. Several institutions participated in the process of developing a master plan (*rencana induk*), in cooperation with international bodies (Bappenas 2005). The master plan reviewed the requirements for the redevelopment of the areas affected by the disaster. It also highlighted the need to establish an entity responsible for the coordination and implementation of the plan. The government therefore created the Agency for the Rehabilitation and Reconstruction of Aceh and Nias (*Badan Rehabilitasi dan Rekonstructsi*) (BRR). The governing bodies of the BRR consisted of an advisory board, a supervisory board, and an executing agency. A presidential decree stipulated that each of the governing bodies had a complementary role and responsibility within BRR.

The advisory board was responsible for ensuring that the aspirations of all parties represented by the agency were addressed within the rehabilitation and reconstruction program. The supervisory board took on a functional role; it was responsible for ensuring that the program operated efficiently and effectively and in accordance with the needs of the community in the regions affected by the disaster. The executing agency was responsible for managing and coordinating the program in the disaster-affected regions.

Along with the government's assistance program, an unprecedented amount of assistance was provided by the international community; the pledges of assistance for reconstruction and development totaled US$8 billion. By the end of 2006, projects and programs budgeted at US$5.6 billion had been initiated by over 300 organizations, and 50 percent of the budget total had already been disbursed to the projects. The international community and local nongovernmental organizations (NGOs) have implemented over 1,600 projects to date. The BRR itself has implemented an additional 12,000 projects during its more than four years of operation.

The total allocations for reconstruction were split fairly equally among the government, donors, and NGOs, as shown in figure 5.2. The Multi Donor Fund for Aceh and Nias, consisting of 15 donors, contributed

FIGURE 5.2 Funding Allocations by Contributor Type



Sources: World Bank 2006a, 2007a.

30 percent of the total donor allocations. The fund was established as one of the mechanisms to ensure the efficient and coordinated delivery of financial support; it now contains over US$650 million.

A New Political Era

The greatest hope for lasting, effective recovery has sprung from the signing of a peace accord in Helsinki between the government and the Free Aceh Movement (*Gerakan Aceh Merdeka*) on August 15, 2005, ending a 30-year conflict, during which almost 15,000 people had died. Under the terms of the accord, both sides agreed to cease all hostilities. The Free Aceh Movement agreed to disarm, while the government pledged to withdraw all nonlocal military and police by the end of 2005. A presidential decree granted amnesty to about 500 former members of the Free Aceh Movement who were in exile in other countries and unconditionally released about 1,400 members who had been jailed by the government.

Also as part of the accord, the government agreed to facilitate the establishment of Aceh-based political parties, and, in December 2006, Aceh held its first democratic elections. Irwandi Yusuf, a former member of the Free Aceh Movement and a peace negotiator, was elected as governor; he was inaugurated in February 2007.

The reconstruction process was therefore set within the context of a newly elected democratic provincial government, which had to consider the needs in reconstruction and development in community infrastructure and facilities after 30 years of conflict and neglect. In addition to the many challenges imposed by such an immense reconstruction program, the national government and international agencies also had to determine how to maintain and transfer newly available assets to the provincial government and local agencies.

Development of the Financial Tracking System

Because of the huge influx of support from a vast number of actors, it became evident soon after the tsunami that a centralized system for collecting and reporting on funding was required to enable all actors to allocate appropriate funds without duplicating efforts, while providing support wherever it was needed. The combination of large amounts of funding and the demand for timely action created an environment in which reliable information and analysis about the progress of reconstruction were crucial.

Within weeks of the meeting of the Consultative Group on Indonesia in January 2005, donors had made substantial pledges of nearly US$8 billion for the reconstruction of Aceh.[2] Because it had only limited resources available internally, the BRR asked the World Bank to provide a high-level overview of the ways these pledges were being committed and allocated and how the money was being spent on post-tsunami reconstruction. Meanwhile, the international donors were seeking information to assist them in allocating their funds appropriately.

Following the request of the government, the World Bank set about designing a simple financial tracking system that would, at regular intervals, provide a snapshot of the amount of funds available for the reconstruction effort. The system structure was not adapted from any known system, but was largely conceived based on a stocktaking of the information available at the time.

The first report was produced six months after the tsunami had struck (see World Bank 2005); updates were issued quarterly thereafter. Figure 5.3 shows the timeline of key events and publications in the months and years following the tsunami.

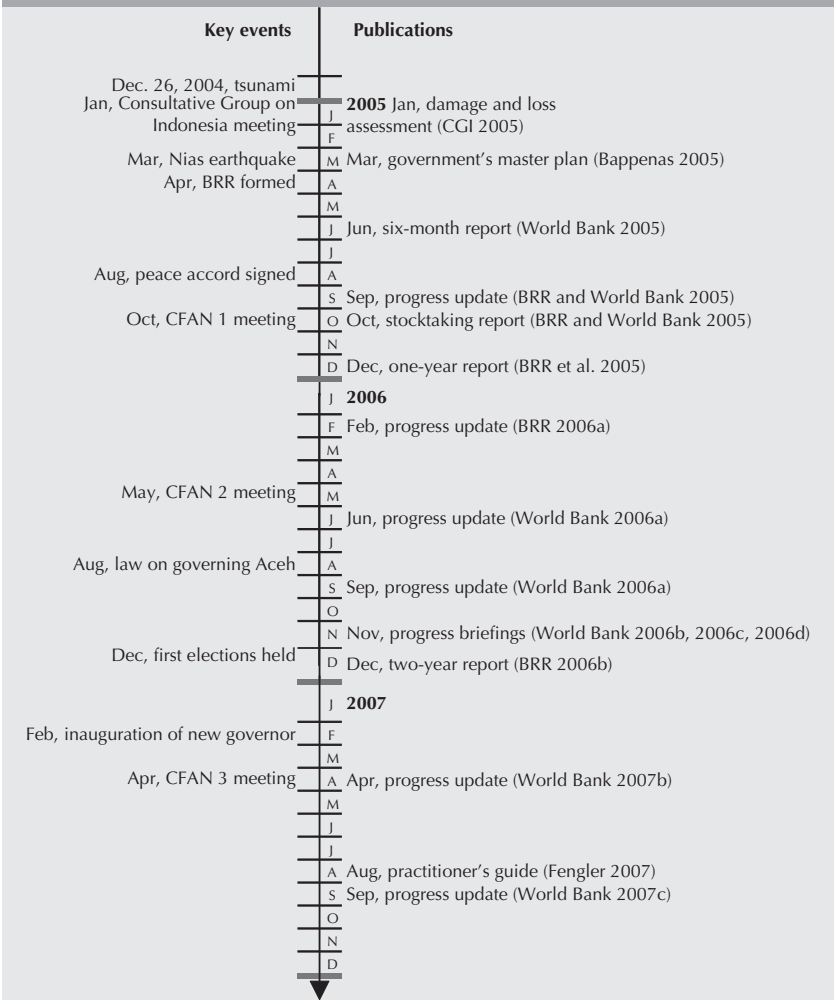
Description of the Tracking System

Principal Design Elements

The financial tracking system was established because the need for comprehensive data on the financial inflows during the reconstruction phase of the recovery program had become apparent. The mandate of the BRR was centered squarely on the reconstruction phase rather than the coordination of the emergency response, and data were required about who was doing what and where. The BRR and the donors first needed to understand where funds were being allocated and then to identify any gaps in allocations to apportion incoming funds suitably. The system was therefore focused entirely on the postemergency and relief phases of the recovery effort, and the primary goal was to obtain a holistic view of reconstruction funding. The focus was also on tracking financial data rather than data on physical progress. Thus, the system had a clearly defined and manageable scope.

The intended users of the system were broadly defined and included the National Development Planning Agency, the BRR, multilateral and bilateral donors, and local and international NGOs. However, the system welcomed only a manageable number of actors and therefore targeted key

FIGURE 5.3 Timeline: Post-Tsunami Events and the Output of the Financial Tracking System



Source: Author compilation.
Note: CFAN = Coordination Forum Aceh and Nias.

bilateral and multilateral donors and the 20 most important NGOs. Because the BRR had been established by presidential decree, agencies were required by law to meet any data requests put to them by the BRR. In fact, the data collection process was facilitated because the BRR issued a formal request to targeted agencies requiring them to submit data to the World Bank for analysis. The budget of the BRR was also a key input into the analysis.

Institutional Arrangements

The World Bank has financed and maintained the management and oversight of the system since the beginning. The system is staffed by three or four analysts who must collect data and produce periodic reports. The lead time for the production of output has been up to two months, which has proved easy for some and problematic for others. The majority of donors and NGOs have been able to supply required data within a short time (as little as one week). However, the majority of the United Nations agencies have had to confirm their data with global headquarters, and, in some instances, up to three months have elapsed between the request and the submission of valid and authorized data.

Technical Design

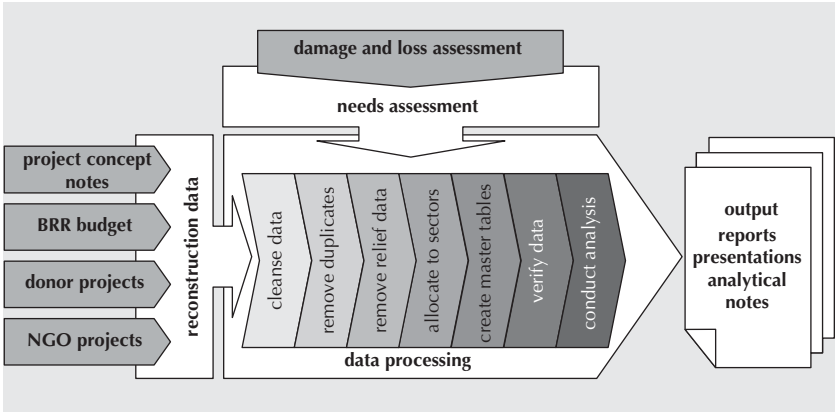
Figure 5.4 illustrates the key elements of the system, from data input to output. Each element is described in greater detail below.

Input

The principal data sources required by the system provide mainly needs assessments and data on reconstruction.

The crafting of a needs assessment occurred following the detailed damage and loss assessment that was made in the weeks immediately after the tsunami and that was adjusted to include the needs arising because of the earthquake in Nias in March 2005 (see CGI 2005). The damage and loss assessment represented a quick look at the extent of the damage in the disaster area. It was published by the National Development Planning Agency, with World Bank support and the involvement of specialists from line ministries. The assessment was based on a methodology of the United Nations Economic Commission for Latin America and the Caribbean (ECLAC).[3]

FIGURE 5.4 Overview of the Financial Tracking System



Source: Author compilation.

Adjustments were made to the damage and loss assessment primarily to identify needs that would call for financial support from the government or the international community. Losses in future income and private sector damage covered by insurance were therefore excluded from the needs assessment. The sectors used in the needs assessment were the same as those used in the damage and loss assessment so that constructive comparisons could be made (see Bappenas 2005).

Shortly after the establishment of the BRR in 2005, the BRR introduced the requirement that implementing agencies must provide detailed concept notes that describe the plans for reconstruction projects. These documents offer a wealth of reconstruction data in the following areas:

- project details and synopses
- budgets, costs, and funding details
- sector and subsectors
- locations
- detailed project descriptions, including outputs
- impact assessments
- details of local community support
- monitoring processes
- milestones for project deliverables

The notes were examined internally to ensure completeness and accuracy. They were then presented to a fortnightly concept note approvals

meeting. These meetings assessed the projects to determine if existing needs were filled by the projects and to avoid duplication with projects already approved. (For a sample concept note, go to http://www.multidonorfund.org/documents/pcn_krrpp.doc.)

Before each approval meeting, the details of all concept notes to be assessed at the meeting were entered into a batch file. This file was used as input in the World Bank's tracking system. While the batch files contained full project details, including the proposed budgets and the target sectors, the files did not contain information on planned future projects, nor on actual expenditures and disbursements. However, the files could be used as a basis for determining current project allocations across sectors and locations, and relevant information from the batch files was sent to individual agencies for verification prior to the production of system outputs.

While the BRR was established by the government to oversee the coordination of the reconstruction effort, it also evolved into an implementation agency with a total budget in excess of US$2 billion over its four-year mandate (2005–09). The budget consists of financing for a debt moratorium (provided through the Consultative Group on Indonesia), as well as loans and grants. The BRR is required to submit a proposed annual budget for approval by the government each year, along with details on expenditures (disbursements) on previous budgets. The annual budget is detailed at the sector level and contains financial information on planned projects.

This budget information (in Microsoft Excel format) is used in the World Bank tracking system to identify and monitor the *government*'s commitments, allocations, and disbursements by sector.

During the initial data collection exercise, the data on *donor* projects was lifted from the concept note batch file. Projects were itemized by donor, and donors were asked to verify the accuracy of the information on their projects and include details on future projects for which the donors had allocated funds. During subsequent data collection exercises, the donors were presented with their previous data submissions and were asked to update them.

The process had significant benefits. Many donors and NGOs witnessed high staff turnover after the tsunami, and institutional knowledge was lost whenever staff moved on. Because the previous data submissions were regularly presented to the donors for updating, the donors were more likely to understand the situation and respond in a consistent and timely manner.

The donors that have contributed to the data collection exercises are listed in table 5.1. Many of them have also contributed to the Multi Donor Fund for Aceh and Nias. The amounts of the contributions of

TABLE 5.1 Bilateral and Multilateral Donors in the Reconstruction Effort

Type	Donor
Bilateral	Australia, Canada, France, Germany, Italy, Japan, Republic of Korea, the Netherlands, New Zealand, Singapore, Switzerland, United Kingdom, United States
Multilateral	Asian Development Bank, European Union, United Nations, World Bank

Source: Author compilation.

these donors to the fund have been separated away from their stand-alone contributions to the reconstruction effort. This step has been taken to avoid double counting.

The data on all *United Nations agencies* were taken from the statements of accountability issued quarterly by the United Nations Office for the Coordination of Humanitarian Affairs. The process was conducted in this way at the request of the Office of the United Nations Recovery Coordinator for Aceh and Nias. The statements collated information on the financial commitments and expenditures of this group of donors. Because the United Nations agencies used these data procedures, it was unnecessary to ask them to undertake separate reporting processes.

As with donor data, the initial data collection exercise on *NGOs* began with an analysis of the concept note batch file. NGO data were extracted. The data detailed financial allocations, sectors, and project locations. As in the case of the donor data collection process, NGOs were presented with their previous data submissions and were asked to update the disbursement data, include additional commitment information, and check for accuracy. Because of the large number of NGOs active in Aceh and Nias, only the largest 20 were targeted as part of the data collection process.

Data submission among donors and NGOs is a manual process undertaken at the request of the BRR. Formally, the BRR wrote to each organization and required it to submit data to the World Bank for analysis. Bank analysts then contacted the agencies directly to follow up and ensure timely delivery of the data. Because the process continued and the organizations saw the results, the organizations became accustomed to providing the Bank with the data, and the need for the formal request by the BRR subsided.

The *International Red Cross and Red Crescent Movement*, which has been formed by the International Federation of Red Cross and Red Crescent Societies and participating national societies, has been by far the largest NGO involved in the reconstruction effort and a substantial donor in its own right. To ease its own operations, the movement entered into a memorandum of understanding with the government on its tsunami response. Then, two months after the tsunami, it established an internal coordination mechanism whereby concept notes were presented, reviewed, and approved collectively by the movement's partners. Approved concept notes were consolidated each month, entered into a movement database, and forwarded to the World Bank and the BRR for inclusion in their reporting processes. Individual movement partners were responsible for entering and updating their own projects in the BRR project database, the Recovery Aceh Nias Database (RAN), described elsewhere below.

Data Definitions

The sectors used in the damage and loss assessment were based on the standard ECLAC definitions. The four broad categories—social sectors, infrastructure and housing, productive sectors, and cross-sectoral sectors—are detailed in the case of Aceh and Nias in table 5.2.

These same sectors were used in the needs assessment and were maintained throughout subsequent analysis and reporting to ensure consistency. However, the ECLAC methodology suggests that sector definitions should correspond with the sector identifiers used in a nation's national accounts. This facilitates macroeconomic analysis and helps in tracking funding from line ministries.

Thus, while the use of these sectors made for consistent and easy data analysis, the sectors did not match those used internally by the BRR. This meant that additional manipulations were required to enable the BRR to make appropriate comparisons between its budget allocations and the needs assessment.

Funding Definitions

The funding flow definitions were as follows:

- The tables in the reports include both *on-budget* and *off-budget spending*. Donor funds that are channeled through the government budget are on-budget funds. If funds are channeled directly to projects, they are off-budget funds.

TABLE 5.2 Sector Definitions

Sector	Definition	Examples of projects
Social sectors		
Education	Revitalization of education delivery services and management systems; design, rehabilitation, renovation, and reconstruction of school and other educational buildings; education material and equipment; teacher training, advocacy, research, and support in education.	Australia: education rehabilitation assistance. Save the Children: revitalization of community and district educational systems
Health	Revitalization of health services and the health management system; design, rehabilitation, renovation, and reconstruction of health facilities; medical and health equipment; training, advocacy, research, and support in health.	United Nations Children's Fund: provision of primary health care services and supplies. Mentor Initiative: rebuild the capacity of communicable disease control in provincial and district health offices throughout Aceh and Nias
Community, culture, and religion	Community regeneration program; training and capacity building to facilitate income-generating activities; children and youth activities; design, rehabilitation, renovation, and reconstruction of community centers and religious buildings; cultural lessons, workshops, and events.	Multi Donor Fund for Aceh and Nias: community recovery through the Kecamatan Development Project. Catholic Relief Services: community-based recovery and development in Aceh, Accord

Infrastructure and housing		
Housing	Temporary and permanent housing and shelter design, rehabilitation, and reconstruction.	United Nations Development Programme: Aceh Housing Rehabilitation Project (implementing partnership with UN-HABITAT). World Vision International: permanent housing in Meulaboh
Transport	Revitalization of transport infrastructure such as roads, bridges, ports, airports, and bus stations.	United States Agency for International Development: reconstruction of Banda Aceh–Meulaboh road. International Aid and Cooperation Organization: reconstruction of Batee bridge, Pasir Gentang, Pidie
Communications	Establishment of an early warning communications system; distribution of publications and information on the progress in tsunami-affected areas; radio broadcasts to support social sector activities; other revitalization activities for communications infrastructure.	Japan: support for radio-television broadcasting activities. International Federation of Red Cross and Red Crescent Societies: early warning communications system
Energy	Rehabilitation, renovation, and reconstruction of the energy system and infrastructure such as the electricity grid; provision of temporary alternative supplies of electricity; research, studies, and workshops on energy issues.	Asian Development Bank: power sector project. Soluziana S.A.: feasibility study for the development of wind energy in Nias Regency, Nias Island, North Sumatra

(continued)

TABLE 5.2 (*Continued*)

Sector	Definition	Examples of projects
Water and sanitation	Rehabilitation of water and sanitation facilities and systems, including the water supply network, piped water systems, wells, and springs; improvement in the access to safe drinking water and proper hygiene; study, research, and training in water systems, water infrastructure, and environmental sanitation.	United Nations Children's Fund: provision of clean water supply and basic sanitation facilities. German Federal Agency for Technical Relief: rehabilitation of springs and water intakes for the tsunami and earthquake victims of Simeulue Island, Aceh Province
Flood control and irrigation works	Cleaning, rehabilitation, and reconstruction of river, drainage, and irrigation systems; study and research on aquaculture projects and systems.	Japan: selected emergency repair work of floodway dyke in Aceh. Muslim Aid Indonesia: Banda Aceh flood relief flow valves and pump stations
Other infrastructure	Rehabilitation, renovation, and reconstruction of other infrastructure and facilities, such as a warehouse and repair shops.	United Nations Development Programme: restoration of minor infrastructure. International Federation of Red Cross and Red Crescent Societies: regional warehouse preparedness Jakarta, Surabaya, Medan, Banda Aceh
Productive sectors		
Agriculture and livestock	Cleaning, rehabilitation, and recovery of the agricultural sector; agricultural equipment, tools, and inputs such as seeds, fertilizers, crops, plant protection; workshops, training, and technical assistance in agricultural planning, mapping, and production management systems for sustainable livelihoods.	Asian Development Bank: restore support services and farming; community empowerment. Solidarités: rehabilitation of agriculture in tsunami-affected areas

Fisheries	Recovery and reactivation of fishery sectors through the provision of credit and loans to purchase fishery equipment; rehabilitation and reconstruction of piers, fish markets, cold storage facilities, and ponds; reconstruction and provision of boats, nets, and other fishing materials and tools; workshops, training, and technical assistance in fishing techniques, navigation, systems, and distribution management.	World Bank: support for fisheries sector, post-tsunami rehabilitation. Winrock International: Aceh Fisheries Rehabilitation and Development Project
Enterprise	Recovery of trade, industries, small and medium enterprises, and cooperatives; manpower issues; community regeneration through small industry development and financial access and loans for microenterprises; reconstruction and rehabilitation of markets, factories, and other business activities; workshops and training in economic capacity building, skill training, production management, and entrepreneur skills.	Canada: Private Enterprise Participation Implementation Project. Save the Children: economic recovery assistance and microenterprise development
Cross-sectoral		
Environment	Rehabilitation of degraded areas and regeneration of forests through enriched planting and raising environmental awareness in communities; redevelopment and environmental protection	Multi Donor Fund for Aceh and Nias: Aceh Forest and Environment Project. Leuser International Foundation: integrating environment and forest protection in the recovery and future development of Aceh

(continued)

TABLE 5.2 (*Continued*)

Sector	Definition	Examples of projects
	of coastal areas and coastal ecosystems by planting mangroves; providing grants for activities to rehabilitate the environment; workshops, training, and technical assistance in environmental planning, public education on the environment, and assisting in developing laws, policies, and regulations on natural hazards.	
Governance and administration, including land	Rehabilitation, renovation, and reconstruction of government buildings; government administration activities such as the population census, registration of births, registration of beneficiaries for relief aid; land use rehabilitation program, including land clearing, mapping, administration, land records; capacity building, including workshops and training in support of local governments.	Australia: restoring local governance and communities in Aceh. United States: Local Governance Support Program
Banking and finance	Rehabilitation and reconstruction of banking and other financial buildings; monitoring, evaluating, and appraising the portfolio of microloans and small loans; capacity training and workshops on issues in banking and finance.	Savings Bank Foundation for International Cooperation: Savings Bank Reconstruction Fund for South Asia

Source: Author compilation.

- *Donor disbursement data* are directly gathered from each major donor. A financial allocation made by a donor is classified as a disbursement if the funds were spent on a project. Funds transferred to government or NGO accounts, but not available for project expenditure, would not be defined as a disbursement.
- *NGO disbursement* refers to funds spent by NGOs on projects directly or transferred by NGOs directly to implementing agencies. NGO disbursement data are obtained mainly from the BRR and the NGOs directly. Additional information may be obtained from NGO Web sites and financial reports.
- *Central government disbursements* are covered in two categories: the BRR budget and deconcentrated (line ministry) expenditures. Disbursement refers to actual spending against project activities, that is, based on disbursement orders issued by treasury service offices to central treasury accounts. Data were provided by the Directorate General of Treasury in the Ministry of Finance.
- The financing numbers are expressed in U.S. dollars. Data in non-U.S. dollar donor currencies were converted to U.S. dollars using the exchange rate at the moment the project was entered into the BRR concept note database. The exchange rate between the Indonesian rupiah and the U.S. dollar was initially US$1.00 = Rp 10,000, but has fluctuated as the U.S. dollar has weakened on global markets.

Processing

In the month following the tsunami, a damage and loss assessment was rapidly undertaken by sector (CGI 2005). This assessment formed the basis of the needs assessment that was used as an input into the system to establish gaps in the allocation of funds (Bappenas 2005). The damage and loss assessment included estimates of the total physical damage, future losses, and any additional expenses related to the cleanup. Adjustments were made in this assessment to remove any damage or loss that might be covered by private funding (for example, insurance) to focus on determining the amount of money required from either the government or international actors. This resulted in an estimate of the core minimum needs that broadly defined the amount of funding required to replace the physical assets damaged or destroyed by the tsunami.

Nonetheless, the estimates of the value of the damage and loss may be supplemented by adding estimates of the broader financial needs of the reconstruction program based on the criteria of the reconstruction strategy.

In February 2005, the United Nations announced the appointment of former United States President Bill Clinton as the Secretary-General's Special Envoy for Tsunami Recovery. Part of the special envoy's intention was to champion a new kind of recovery, one that not only restores what existed previously, but goes beyond, seizing the moral, political, managerial, and financial opportunities the crisis has offered governments to set these communities on a better and safer development path. The core minimum needs may be adjusted to give an estimation of the cost to build back better (see elsewhere below).

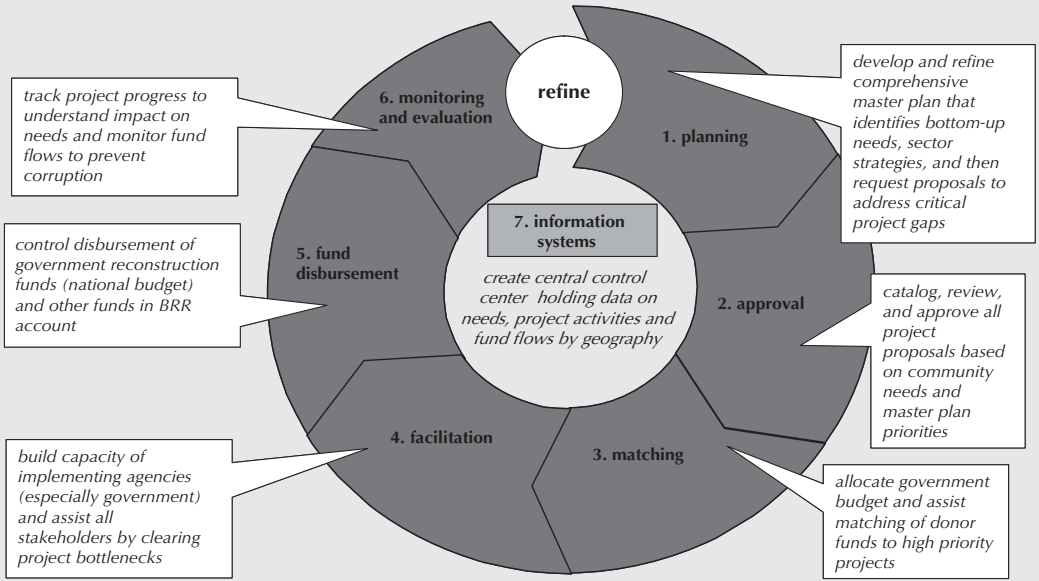
The collection of data from the BRR on the contents of the concept notes was critical to the success of the first data collection exercise. Figure 5.5 depicts the BRR project planning and approval cycle. At stage 2 of the cycle (approval), all executing agencies were required to submit project proposals, or concepts, which were then assessed and approved if they matched identified needs. The concept notes required detailed information on the project, including financials, geographical distribution, beneficiaries, and outputs.

During its review of concept notes, the BRR recorded all project information into a Microsoft Excel spreadsheet. This spreadsheet (known locally as the approvals batch file) was updated fortnightly for each round of concept note approvals. It contained the required data on sources of funding, thereby enabling the identification and removal of projects that may have caused double counting. The data also permitted the segregation of funds according to sectors and geographical areas.

Figure 5.6 highlights the financing complexities experienced in Aceh because of the multitude of donors and other actors. There was an outpouring of financial support from communities around the globe. Many international NGOs received these funds and, among these, many added significant funds of their own. Many of the NGOs had never before managed so much spending. Moreover, the funding flows among traditional donors, international NGOs, United Nations agencies, local NGOs, and the government were complex. Funds would be transferred across multiple levels across agencies before reaching executing or implementing agencies for final disbursement.

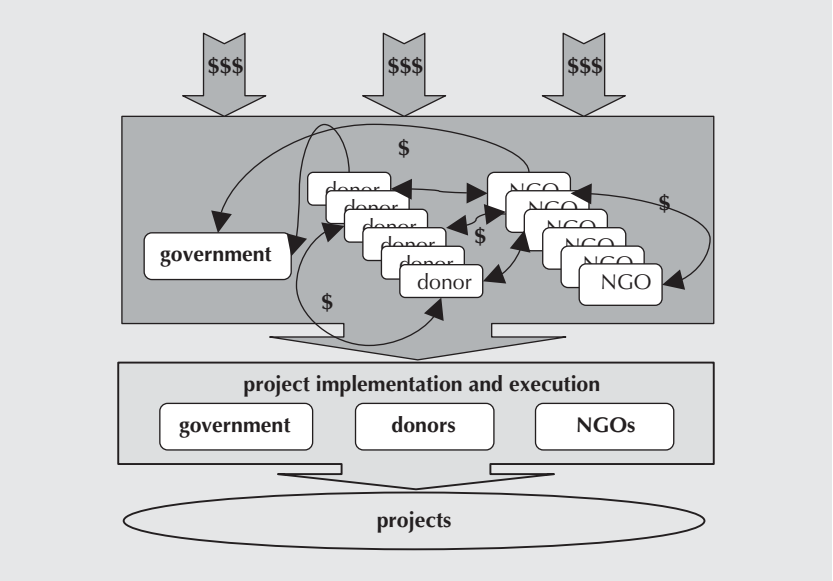
These complex arrangements created a risk that funds could be double (or triple) counted during data entry. It was therefore important to determine whether funds were reported at the original donor level and also at the executing agency level so that any duplication of funds would be removed from the analysis. While donors presented valid arguments for reporting at the donor level to ensure transparency, the complexities of this would

FIGURE 5.5 BRR Project Planning, Approval, and Implementation Processes



Source: BRR et al. 2005.

FIGURE 5.6 Funding Flows across Actors in Reconstruction



Sources: Author compilation.

prevent meaningful detailed analysis at the sectoral (and geographical) levels. Therefore, data were reported by the executing agencies as long as it was possible to identify the sources of the funds and remove these from the amounts in the donor reports.

The following formulation was used in reporting to provide clarity on the issue. Occasionally, financing figures may be susceptible to *double counting*, since an institution may provide financial resources through other institutions. For example, a donor country provides project funds, but the project is implemented by another donor country or an NGO. Both institutions report the same project concept note to the BRR. To avoid double counting, a distinction between execution and contribution is made. The financing numbers are calculated on an execution basis and take into account the institutions' implementing projects rather than the institutions' provision of or contribution to funds.

The effect of this approach was to understate the donor contributions and overstate the contributions from NGOs and United Nations agencies.

However, in compensation, there was some certainty that double counting had been minimized and that the data were therefore more reliable.

Fengler (2007) explains that emergency spending is often significant, but that the activities involved in emergency spending as opposed to reconstruction tend to be of relatively short duration and provide relief only during the initial, difficult stage of recovery. Reconstruction finance tracking should *exclude emergency and relief spending* and focus on the funding required for investments to replace assets that have been damaged or lost.

By comparing the data in the concept note batch files with the data provided directly by executing and implementing agencies, analysts were able to identify the projects focused on the emergency response and relief efforts immediately after the disaster (such as the provision of medicine, temporary shelters, food, and cash for rapid cleanup work) and the projects focused on the ongoing reconstruction and rehabilitation phase of recovery. Projects not focusing on the ongoing reconstruction effort were excluded from further analysis.

Defining sectors without ambiguity in the definition was problematic. To resolve this problem, the World Bank's analytical team requested a detailed description of each project from the data providers. Based on the project descriptions, projects (or parts thereof) were then allocated to appropriate sectors (see table 5.2). This task was performed during each data collection, and records on allocations were maintained for reference. This ensured consistency across data reporting periods and consistency in the assignment according to sectors across agencies.

Once these data had been collected and organized, *master funding tables* were produced (table 5.3). These tables are the core element in the tracking analysis. The tables summarize the allocations and, separately, the disbursements of the overall reconstruction program for each sector and for each type of agency. The sectors used matched the categories defined in the damage and loss assessment and in the needs assessment. The tables for allocations and disbursements provided the basis for analysis and enabled data comparisons (see the subsection on output below).

The initial processing of NGO data during the first round of data collection was wholly based on the concept notes. In subsequent reporting periods, after cleansing the project data by removing duplicate and nonreconstruction data and apportioning funds by sectors, the analytical team sent the data to the original data providers for *verification and confirmation of the project allocations*.

TABLE 5.3 Summary of Aceh and Nias Reconstruction Funding Allocations
US$ millions

	BRR	Donors	NGOs	Total
Social sector	**313**	**750**	**484**	**1,547**
Education	105	301	149	556
Health	96	236	255	586
Community, culture, and religion	113	213	79	405
Infrastructure	**1,051**	**1,004**	**814**	**2,869**
Housing	545	234	622	1,401
Transport	244	516	30	790
Communications	56	11	3	70
Energy	30	10	5	45
Water and sanitation	48	98	136	283
Flood control and irrigation works	129	78	2	209
Other infrastructure	0	57	16	72
Productive sectors	**187**	**189**	**269**	**645**
Agriculture and livestock	40	32	79	150
Fisheries	52	46	56	154
Enterprise	94	112	135	341
Cross-sectoral	**396**	**160**	**74**	**630**
Environment	12	48	34	94
Governance and administration including, land	384	112	25	521
Banking and finance	0	0	15	15
Total	**1,948**	**2,103**	**1,641**	**5,691**

Source: World Bank 2007a.

Output

A range of outputs was produced to meet the needs of stakeholders. In addition to formal publications, updates were published containing key tables and graphs in Microsoft Word and PowerPoint formats. The publications generally contained a broad picture of the status of the reconstruction process and included detailed analyses of the updated financing situation.

The PowerPoint presentations were particularly useful among donors, which were able to cut and paste key information into their own reports for briefings and presentations to head offices, ministries, and relevant ministers. This ease of use of the output provided donors with an additional incentive to supply reliable information.

The four charts in figure 5.7 are examples of key pieces of information that have been produced in the publications and used widely by stakeholders. These graphs and the associated data have been reproduced in reports, briefing notes, and other presentations since 2005. See the references section at the end of the chapter. Links are also available at http://go.worldbank.org/HQMC6331P0, http://go.worldbank.org/K64795H580, and http://go.worldbank.org/TTAEQW4DR0.

Because the system was manual, output was pushed out by the World Bank to data providers via e-mail. Stakeholders who did not provide data would usually access the data through the publications, especially those distributed by the BRR.

Evaluation of the System

Ease of Use and Users

The use of the system output varied depending on the type of organization and the time period. The government and donors appear to have found the system more useful than NGOs and United Nations agencies, primarily because the latter tend to be more focused on or restricted to specialist areas.

In general, data providers have given broad support to the data collection and reporting processes and have understood the limitations in the output. Some agencies suggested that because the BRR was under such immense pressure and had such limited capacity, it was appropriate that the system was managed outside the government and within the World Bank.

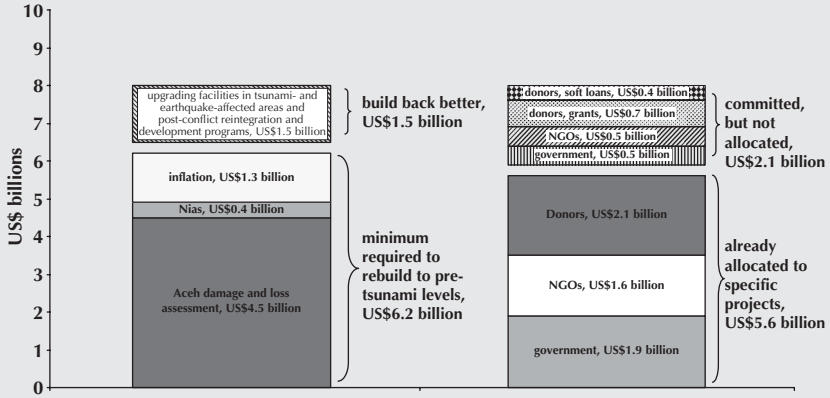
Because the process is manual, involves low overhead for information technology, and relies on a small team, the system has been cost effective. However, the system is labor intensive during processing periods.

Government

Mainly through the BRR, the government used the output in ways that influenced budget allocations, policy making, and communications with

FIGURE 5.7 Examples of Key Outputs

Needs versus allocations: This key chart illustrates the comparison between the core minimum needs and the total allocation of funds to projects. It highlights the amount of money going into building back better, as well as the extent to which some funds have yet to be allocated to specific projects.



Sectoral gaps: This chart shows the gap between funding allocations and the amount of money needed to meet core minimum needs. The light gray bars show that sectors have sufficient funds to rebuild to pre-tsunami levels, while the dark gray bars show a deficit in funding.

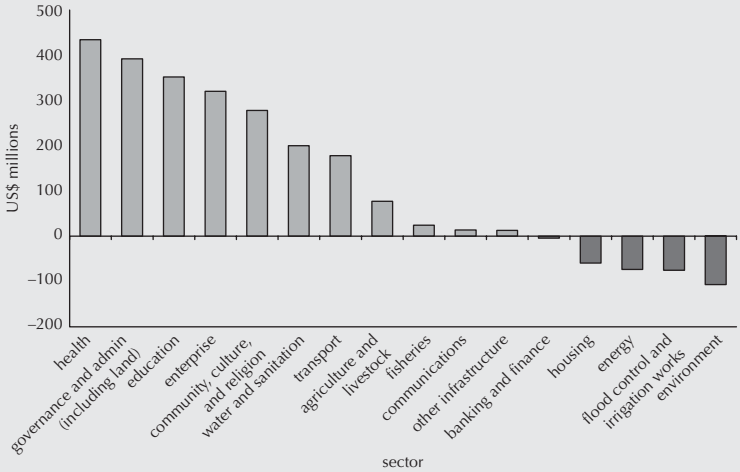
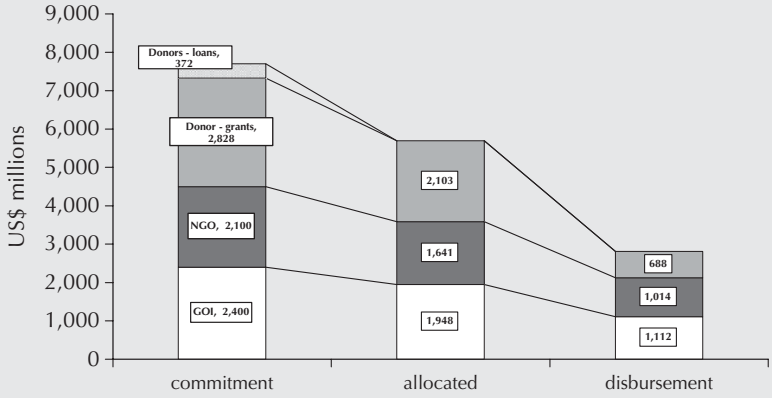
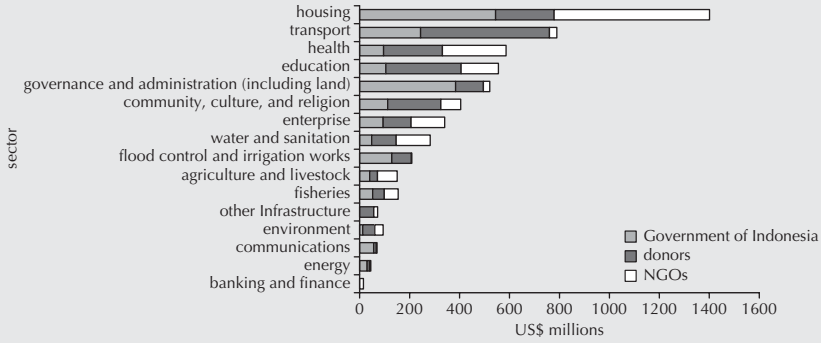


FIGURE 5.7 Examples of Key Outputs *(continued)*

Funding flows: Indicated in this chart are the funding flows from contributor commitments to project allocations and disbursed funds. The chart reveals that approximately 50 percent of the allocated funds have been disbursed.



Allocations by sector: Highlighted in this chart is the difference in allocation choices made between contributor types across sectors. For example, the second and fifth bars from the top show that NGOs allocate fewer funds than governments and donors to transport and governance.



Source: World Bank 2007a.

external organizations. The data produced through the system accomplished the following:

- Provided the big picture for funding activities
- Were inputs in the planning and budget process
- Identified funding gaps, particularly by showing where sectoral executing agencies were directing their efforts; the analysis according to sector and type of agency (such as bilateral donor versus NGO) enabled the government to direct funds toward underfunded sectors and sectors in which the funding for physical reconstruction was inadequate
- Provided an input in the BRR accountability statement to the government
- Facilitated communication among stakeholders more broadly; the provision of credible data in presentation format allowed the BRR to use the output to communicate with external stakeholders, to supply regular updates on progress, and to garner support for directing unallocated funds toward underfunded sectors
- Were used by the National Coordinating Board for Disaster Management in monitoring and evaluation.

Donors

The early output of the system was influential among donors, primarily because it offered guidance in decisions about the targets of financial allocations. It also supplied background information and information about progress that was useful in reporting. For donors, the output of the system accomplished the following:

- It compared donors, NGOs, and the government in terms of performance.
- Used in conjunction with internal data, the data on sectoral gaps helped in decision making about fund allocations; this was the case primarily during the first year when the majority of funds were allocated.
- It made an immediate difference in reconstruction financing for the Multi Donor Fund for Aceh and Nias. The analysis was used especially in the early days of the fund to identify sectoral and geographical gaps in the reconstruction process. The driving principle behind the fund then quickly became the need to fill these gaps according to identified priorities.
- By providing donors with credible information in presentation format, it facilitated report writing to parliaments, ministries, and ministers.
- The needs assessment influenced the targets set out in project proposals.
- It provided comparisons among donors; this was useful in reporting and in assessing the performance of donor disbursements.

NGOs and Specialized Agencies

Specialized agencies, such as many United Nations agencies, often have a clear mandate within a given sector and work with ministry counterparts. For example, the focus of the United Nations Children's Fund on education and health among children, guides its funding allocation decisions. The value of a broader picture is limited. NGOs have been more restrained in their use of the data than the government or the donors; they have a clear mandate to focus their efforts on specific sectors.

The specialized agencies tended to find the gap analysis, along with the reporting on disbursements by sector, more useful. The majority of these agencies still appreciate the value of a broader picture of the available funding in any case.

Adapting the System

The system was not expected to be permanent. It was expected to supply a picture of the progress in financing during the reconstruction phase of the recovery. There was thus no strategy to transfer the system to local authorities or to incorporate it into national systems.

However, it is feasible for such a methodology to be employed by local authorities to monitor donor and NGO activities. A short practitioner's guide has been produced by the World Bank's Indonesia country office (Fengler 2007). The guide details the steps involved in creating the master funding tables and should facilitate the application of the system in other postdisaster environments with relative ease.

The Recovery Aceh Nias Database

The monitoring and evaluation of reconstruction spending received considerable attention. In early 2005, Jan Egeland, United Nations under-secretary general for humanitarian affairs and emergency relief coordinator (Geneva), announced that the international community would establish a system that would "show that we are up to the task, not only getting relief to the needy parties, but also in keeping track of every penny" (OCHA 2005, 1). Following the successful introduction of the Development Assistance Database in Afghanistan in 2003, the United Nations Development Programme then rolled out the system in four of the worst tsunami-affected countries. The Indonesian government agreed to implement the system, and, after modification, the system was implemented in Aceh and Nias, where it was renamed the Recovery Aceh Nias Database.

The RAN was not launched until November 2005 because, before that, it was being tested and developed in the field. This transformed the RAN, giving it extra functionality and purpose that was not experienced in other countries using the Development Assistance Database. The new key element was the ability to enter project information in relation to planned and actual outputs (thereby creating key performance indicators). This provided the BRR with the conceptual capacity to monitor the physical progress of reconstruction, in addition to establishing transparency in funding flows.

The extra functionality led to practical problems, mainly because of the complex funding arrangements among the large number of actors involved in the reconstruction and recovery. On the one hand, the system represented an attempt to track funding flows from the original fund providers to downstream agencies. On the other, the implementing agencies were required to supply specific project details. In practice, there was often a disconnect between these two goals, leading to duplications in funding data and project data and other data inconsistencies.

Moreover, it took many months for participating agencies to gather and transmit the data. While the BRR required each agency to supply project details in the RAN and to keep the project details updated, agencies found this challenging. Agustina (2007) describes some of the challenges faced in Aceh and Nias, including the following:

- The system design was complex and highly detail oriented, requiring significant time commitment by individuals entering project information.
- There was a lack of clear methodology, and user manuals, standardized definitions, and descriptions of terminology were not widely available to assist users.
- The tool was developed as a proprietary system and proved inflexible whenever the BRR sought program modifications.
- The tool suffered from poor speed performance compared with alternative tracking systems.

A dedicated BRR team assisted agencies in updating project information on the RAN. However, much of the team's time was spent addressing the four challenges described above. As a result, two years after the tsunami, the RAN was still unable to provide the BRR with the required overview of financial commitments, allocations, and expenditures from donors and NGOs. Moreover, there was a regular demand on the World Bank analysts

to provide a big picture overview to stakeholders. This meant that data providers were being asked to supply data regularly to both the World Bank and the RAN.

Potential System Enhancements

The system draws on many stakeholders for data. The information needs of this diverse group of stakeholders vary, and these needs have not always been met fully by the system. We now present a summary of suggestions and requests received from stakeholders concerned about improving the system and adding more value to the data.

Parallel Reporting at the Donor Level

Rather than trying to track all of the large number of organizations involved in the recovery, the system processing and system outputs were focused on the executing agencies. The donors and the government were keen, as well, to obtain detailed analyses of the contributions of high-level donors, including countries. The system was able also to provide brief, but useful analyses of the total commitments and allocations by donors (particularly bilateral and multilateral actors).

However, as discussed elsewhere above, there was a real risk of double counting. To reduce this risk, a distinction was made between data on project execution and data on financial contributions. If a reconstruction program is managed by a small number of players and if the number of NGOs is limited, then a system focus on funding agencies and donors is considered the better option. This was the approach in the data reporting on the 2006 Yogyakarta earthquake in Indonesia for instance (JRF 2007).

Data on Physical Progress

The system was not designed to report on the physical progress of the reconstruction effort. However, the reconstruction community in Aceh and Nias still lacked meaningful physical progress data two years after the disaster struck. Because of the system's effective data collection processes, consideration might be given to expanding the mandate of the system so as to report on the physical progress in reconstruction.

Measuring Impact

There is little information available on the actual impacts once projects have been implemented. While the aim of the system was not to monitor or

assess such impacts, there remains a need for evaluation so as to gauge the effectiveness of the reconstruction effort.

Sector Analysis by Contributor Type

The assessment of sectors of reconstruction by contributor type (government, donor, or NGO) gave the government insight into the sorts of projects funded by other entities and thus allowed the government to identify areas in which funding for infrastructure and physical assets was low. While physical reconstruction was foremost in the reconstruction effort, there were many projects aimed at intangible outputs, such as capacity development. An example is offered in the health sector, where NGOs played a pivotal role in enhancing the skills of existing health sector staff and training new staff. By understanding this focus of NGOs, the BRR was able to investigate the amount of funding allocated toward the rebuilding of physical assets such as hospitals and health centers, an area in which the funding was insufficient. (See elsewhere below for a discussion of the issues involved in matching funding allocations to a needs assessment.)

Geographical Breakdowns

The use of the concept note batch file permitted breakdowns of NGO funds by project location. However, similar data were often not available from donors. There is a clear need in the case of natural disasters to be able to rely on transparent, accessible geographical information and systems that offer links to or provide geographical mapping capabilities (geographic information systems). These systems can be effective in absorbing and distributing historical and real-time information in such areas as the gaps in financing and funding allocations across regions. Using these systems, actors are able to assemble large amounts of information about communities and analyze and use the information in an efficient, intelligent manner.

One particular need in Aceh and Nias was to ensure that districts received adequate funding for reconstruction. Donors often provide funds to implementing agencies based on sector allocations, rather than geographical requirements. The donors then are often unaware of which districts are receiving the funds. If adequate geographical data had been available from all data providers, analysis might have been produced that showed needs compared with allocations and commitments, thereby highlighting any districts that were not receiving adequate funds.

Reach Out to all Stakeholders

The system proactively gathered data, and output was then shared with all those who contributed information: the government, bilateral and multilateral donors, and the 20 most important contributing NGOs. But, because over 300 agencies were active in the reconstruction effort, the system output was not supplied to agencies outside the data submission group. These agencies relied on BRR publications to gain access to the output. Two years after the tsunami, the output became available on the World Bank Web site, but a number of smaller NGOs did not know how to access the information. It was therefore suggested that the analysis should be distributed through an electronic mailing list containing all actors who expressed an interest in receiving the data. It was also suggested that the availability of the output on the Bank's Web site should be more widely publicized.

Broader Needs Analysis

The tsunami reconstruction effort in Aceh took place among communities recovering from decades of internal conflict. Much of the province's infrastructure had suffered from neglect, and there was a clear demand for investment in communities that had been affected by this conflict. Indeed, it was often difficult for actors to distinguish between communities affected by the tsunami and communities affected by the conflict. Consideration should be given to the broader needs of a community so as to determine an effective recovery plan.

Lessons Learned

Data Collection Process

A proactive data gathering approach involving strict quality control is important in ensuring the integrity and consistency of data. For the system in Aceh and Nias, the BRR required the data submissions, while the data were collected and processed by World Bank analysts. This allowed the analysts to ensure that timely and accurate information was collected from the data providers. Because it was compulsory, the data submission process also ensured a high level of compliance. Data quality was maintained because the data were entered into the system by the World Bank analysts. This contrasts with the RAN system, where data are entered into the system directly by the data providers, creating data quality challenges for the RAN management.

Involve Local Government

The system was conceived as a joint collaboration between government agencies and the World Bank. More value might have been added by involving local governments at an earlier stage in the design process to ensure that local needs would also be met by the system and that local governments understood and had confidence in the system.

Well-Defined Terminology

It is important to be absolutely clear about terminology and to ensure that definitions are communicated to all stakeholders.

Sectors

The system's sector definitions were based on the standard sectors used by ECLAC. It is important to be consistent in the use of sector definitions, particularly during a sectoral gaps analysis aimed at identifying shortfalls in sectoral funding. However, the ECLAC methodology suggests that the sectors used in the damage and loss assessment should be aligned with the definitions used in the country's national accounts. These sectors should then be used consistently by all actors, including the reconstruction agency.

Financial Definitions

Many terms were being used with special meanings by the multitude of actors. The following were specialist terms used in internal accounting and reporting systems, but sometimes with different meanings: allocated (unallocated), allotment, available, commitment, contributed, disbursed, earmarked, expenditure, obligated, planned, pledged, received, requirement, and spent.

Allocated might mean that funds had been budgeted by donors for tsunami reconstruction (that is, a donor's internal budget allocation). It might also mean that funds had been specifically tied to certain projects. These two definitions are quite different, and, yet, the term is used freely without clear distinction by many actors.

Similarly, defining disbursements in relation to projects may be problematic because the money often flowed through multiple channels before being disbursed to a beneficiary. Measuring disbursements through the final implementing or executing agency ensures consistency.

From Emergency Relief to Reconstruction

The system was designed to capture reconstruction and rehabilitation projects only and exclude from analysis any projects that focused on the emergency and relief phases, such as the provision of medicines, temporary shelters, food, and cash for cleanup. Because of the sheer scale of the disasters in Aceh and Nias, the emergency phase extended well beyond a normal duration. Significant efforts were also spent on the transitional and early recovery phases of the reconstruction effort. The boundaries between these phases are ambiguous, but it is important to be able to identify in which phase a project is active and to have clear definitions for all special terms in discussions about reconstruction projects. Thus, in the case of Aceh and Nias, reconstruction and development programs were defined as programs that sought to build back or upgrade physical, economic, and social assets.

Carefully Assess Damage and Loss

The first focus immediately after a disaster has struck is often emergency aid to help survivors. However, a valuable contribution may be made in the early weeks by conducting an assessment of damage and loss. Such assessments often guide the initial funding decisions by donors and influence the reconstruction process for years to come. Indonesia benefited because it applied the standard methodology developed by ECLAC, a standard accounting tool to estimate the replacement cost of destroyed assets and the resulting losses or forgone earnings. Damage and loss numbers are the benchmark for the reconstruction period and are at the core of many funding decisions.

Revise the Needs Analysis

Two key lessons in relation to the needs assessment have arisen through this review. The first lesson is that a needs assessment that is undertaken following a damage and loss assessment should apply the methodology described by ECLAC, namely, that the value of damages must be supplemented to define the financial needs of the reconstruction program by introducing criteria set through a reconstruction strategy and adjusted for inflation. Figure 5.8 illustrates the ECLAC process for transforming a damage and loss assessment into a comprehensive needs analysis.

FIGURE 5.8 Creating Damage and Loss Assessments for Reconstruction Planning

Value of Damages	Reconstruction Needs	Reconstruction Program	Financing Formula
	= Damages + technological improvement + relocation costs + mitigation costs + losses relating to capacity development + inflation estimate	Consider: • Financing needs • Priorities for reconstruction ○ sectoral ○ geographical	Consider: • Government funds • Private sector funds • Insurance reimbursements • International grants • International loans (diversion existing loans, fresh loans)

Source: Author adaptation based on information provided by Roberto Jovel, ECLAC.

The needs analysis should also include losses in capacity and losses in capacity development, both of which may occur during a disaster (the case of the tsunami). Specifically, quality improvements, technological innovation, the introduction of mitigation methods, relocation to safe areas, the costs of skills development and training, and overall multiyear inflation caused by the combination of speculation and scarcity must be considered and assessed.

The second key lesson in relation to the needs assessment is that the needs should be revaluated at appropriate times. The value of the sectoral gaps analysis diminished over time as stakeholders came to feel that the needs as originally defined did not correspond in every way to current needs.

In Aceh, core minimum needs were established to calculate the minimum funding required to build back to pre-tsunami levels (see the subsection on defining core minimum needs). *Core minimum needs* are also a first-step financial benchmark for governments and donor-funded reconstruction programs.

Here, core minimum needs are defined as (a) the full replacement of all public sector damage (according to the damage and loss assessment); (b) the financing of private sector needs, such as housing, agriculture, and fishing, up to the limit set in the master plan; (c) the partial financing of environmental damage that may only be addressed to a limited degree by external interventions; and (d) an adjustment for inflation according to recent price

trends. Our assessment assumes that a portion of the damage and loss experienced by households and the private sector would be covered by households and the private sector, possibly through insurance or savings.

Matching Project Allocations to Appropriate Needs

The needs assessment used in Aceh was predominantly an estimate of the cost to replace damaged or lost physical assets within selected sectors. However, the funding allocations from contributors included a much wider spectrum of projects, including endeavors involving intangibles, such as training and capacity building. Therefore, it is likely that the gaps analysis underreports the amount of funding required for the replacement of physical assets within sectors. A clear example in Aceh is the health sector, which appeared to receive adequate funding in aggregate and actually received substantial allocations of funds from NGOs; however, much of the NGO disbursement in health was not directed at physical reconstruction projects, but at intangibles (for instance, staff training), whereas the health needs assessment primarily assessed the costs to repair health infrastructure, especially hospitals and health centers. It is important therefore to ensure that the funding allocations and needs assessment are aligned.

Communicating the Methodology

The participation of numerous organizations at multiple levels created the risk of double counting. A concerted effort was made to identify and remove incidents of double counting. The methodology that was used to eliminate duplicate data had been published and broadly explained (see the discussion on the subject elsewhere above). Nonetheless, several users were unconvinced either that there was any such effort or that the process was effective. These users continued to doubt the accuracy of the information supplied through the system.

Defining Appropriate Sectors

Consistent and meaningful analysis is made easier if the sectors receiving allocations and expenditures are comparable with the categories in the damage and loss assessment. In our case, the sectoral definitions used in the damage and loss assessment were those used in the standard ECLAC methodology. Project funding may be recorded in more than one sector if the project is cross-sectoral. The ECLAC methodology also allows

adjustments in the standard sectors at the local level to align them more closely with the categories in a country's national accounts. This enhances the analytical potential of the data because it permits alignment between the data on needs and the data categories used in ministries.

Verifying Data

The World Bank's analytical team worked through peak periods and was well trained in data analysis. The team acted closely with the data providers, who were permitted to follow up, update, and verify data and clarify any issues and problems relating to the data. This verification process also helped ensure consistency across reporting periods.

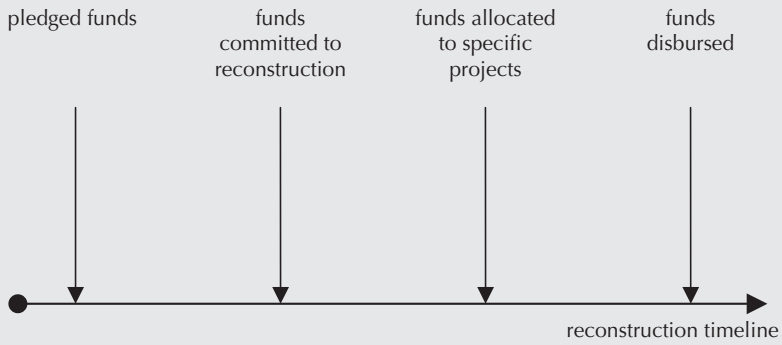
Capturing Changes in Assumptions

A lesson learned by the World Bank's analytical team was the value of documenting all changes in assumptions between reporting periods, such as changes in exchange rates.

Capturing the Funding Flows

While the definitions of funding are numerous, there are four key points at which the funding flows should be captured and analyzed most carefully. These are shown in figure 5.9.

FIGURE 5.9 Funding Flows Required for Data Analysis



Source: Author compilation.

Conclusion

The system produces an overview of the funding available for the reconstruction effort, along with details on the amounts of this funding allocated across sectors and on the disbursements of these funds. Users are able to identify gaps in funding allocations and therefore adjust their own allocations to meet the unsatisfied needs of affected communities.

The system has been informative, and it has aided in decision making, particularly in the early days after the tsunami. The ease of use has also helped agencies needing data to report to their constituents.

Although the system is based on the manual collection of data and may therefore be labor intensive and time consuming, it has been effective in providing a broad overview of reconstruction financing at regular intervals. The manual nature of the system has revealed that a simple process, with a clear scope and methodology and based on a small dedicated team of analysts for data collection and analysis, is able to produce highly useful output at a low cost and within a postdisaster environment. The building of relationships with key players that occurred during the development of the system created an environment in which proactive data management was possible. This contrasts sharply with the experience with advanced information technology systems.

The system was not planned or designed to be permanent. It was expected to provide only a clear picture of financing flows during the reconstruction phase of the recovery in Aceh and Nias. Nonetheless, the methodology may be employed with relative ease by local authorities to monitor donor and NGO activities in postdisaster environments.

Notes

1. The author would like to express his appreciation to the people who gave their time for interviews and offered advice during his research. Their contributions were invaluable in gaining insight and detailed information on the functionality, use, and effectiveness of the methodology and system described in the chapter. Specifically, he thanks the following: Magda Adriani, Cut Dian Agustina, Enrique Blanco Armas, Zaki Fahmi, Wolfgang Fengler, Joel Hellman, Ahya Ihsan, and Harry Masyrafah (all of the World Bank); Suprayoga Hadi (MSP Multistakeholder Partnership, National Development Planning Agency); Teuku Ismail (Save the Children); Melissa Janis (United States Agency for International Development); Ji-Hoon Kim (Korea International Cooperation Agency); Hagar Ligtvoet (Embassy of the Kingdom of the Netherlands, Indonesia); Catherine Marie Martin (International Federation of Red Cross and Red Crescent Societies); Satoko Nakawa (United Nations Office for the

Coordination of Humanitarian Affairs); Eddy Purwanto, Roy Rahendra, and Puteri Watson (Agency for the Rehabilitation and Reconstruction of Aceh and Nias); Kerry Ross (Oxfam International); Ayako Shimizu (Embassy of Japan, Indonesia); Kazuhiro Shirase (Japan International Cooperation System); Gi-Soon Song (United Nations Development Programme); David Taylor (World Vision International); Bernadette Whitelum (Australia-Indonesia Partnership for Reconstruction and Development); and Diane Zhang (Multi Donor Fund for Aceh and Nias).

2. The Inter-Governmental Group on Indonesia, an international group of lenders, was established by the Netherlands in 1967 to coordinate multilateral aid to Indonesia. It became the Consultative Group on Indonesia in 1992. This organization was disbanded in 2006. Members included the Asian Development Bank, the International Monetary Fund, the United Nations Development Programme, the World Bank, and governmental aid organizations in Australia, Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, New Zealand, Switzerland, the United Kingdom, and the United States.
3. ECLAC has been developing expertise in the evaluation of the damage caused by natural disasters in Latin America since the 1970s. The methodology is now well documented and tested, including through a handbook published by ECLAC (2003).

References

Agustina, Cut Dian. 2007. "Tracking the Money: International Experience with Financial Information Systems and Databases for Reconstruction." Paper presented at the World Bank conference, "Responding Effectively to Crises and Emergencies," Washington, May 2–3.

Bappenas (National Development Planning Agency). 2005. *Master Plan for the Rehabilitation and Reconstruction of the Regions and Communities of the Province of Nanggroe Aceh Darussalam and the Islands of Nias, Province of North Sumatra*. Jakarta: Bappenas.

BRR (Agency for the Rehabilitation and Reconstruction of Aceh and Nias). 2006a. "BRR Strategy Paper for the Remaining Resources of the Multi Donor Fund for Aceh and Nias." Strategy paper, World Bank, Jakarta.

———. 2006b. *Aceh and Nias Two Years after the Tsunami: 2006 Progress Report*. Jakarta: BRR.

BRR (Agency for the Rehabilitation and Reconstruction of Aceh and Nias) and World Bank. 2005. *Rebuilding a Better Aceh and Nias: Stocktaking of the Reconstruction Effort; Brief for the Coordination Forum Aceh and Nias*. Report 34201. Jakarta: World Bank.

BRR (Agency for the Rehabilitation and Reconstruction of Aceh and Nias), World Bank, ADB (Asian Development Bank), IFRC (International Federation of Red Cross and Red Crescent Societies), and UNDP (United Nations Development Programme). 2005. *Aceh and Nias One Year after the Tsunami: The Recovery Effort and Way Forward*. Report 35507. Jakarta: World Bank.

CGI (Consultative Group on Indonesia). 2005. "Indonesia: Preliminary Damage and Loss Assessment; The December 26, 2004 Natural Disaster." Jakarta: National Development Planning Agency.

ECLAC (United Nations Economic Commission for Latin America and the Caribbean). 2003. *Handbook for Estimating the Socio-economic and Environmental Effects of Disasters*. Mexico City: ECLAC and World Bank.

Fengler, Wolfgang. 2007. "Tracking Financial Flows after Disasters: Reconstruction Expenditure Tracking Analysis Methodology (RETAM)." PREM Notes 114, World Bank, Washington, DC.

FIAS (Foreign Investment Advisory Service). 2005. "Indonesia, Aceh/Nias: Mini-Diagnostic Analysis of the Investment Climate." Report 38793, International Finance Corporation and World Bank, Jakarta.

JRF (Java Reconstruction Fund). 2007. "One Year after the Java Earthquake and Tsunami: Reconstruction Achievements and the Results of the Java Reconstruction Fund." Progress Report 2007, JRF, Jakarta.

MDF (Multi Donor Fund for Aceh and Nias). 2006a. *Quarterly Financial Management Report* 5 (June), Multi Donor Fund Secretariat, Jakarta.

———. 2006b. *Quarterly Financial Management Report* 6 (September), Multi Donor Fund Secretariat, Jakarta.

———. 2006c. "Implementing Projects, Achieving Results: 18 months of the Multi Donor Fund for Aceh and Nias." Progress Report III, Multi Donor Fund Secretariat, Jakarta.

OCHA (United Nations Office for the Coordination of Humanitarian Affairs). 2005. "Press Briefing by Emergency Relief Coordinator." Press Briefing 050314, March 14. http://www.un.org/News/briefings/docs/2005/Egeland_Briefing_050314.doc.htm.

USAID (United States Agency for International Development), IOM (International Organization for Migration), and Indonesia, Ministry of Justice and Human Rights. 2005. *Settlement and Livelihood Needs and Aspirations Assessment of Disaster-Affected and Host Communities in Nanggroe Aceh Darussalam, 2005*. Banda Aceh, Indonesia: USAID.

World Bank. 2005. *Rebuilding a Better Aceh and Nias: Preliminary Stocktaking of the Reconstruction Effort Six Months after the Earthquake and Tsunami*. Report 32893. Jakarta: World Bank.

———. 2006a. *Aceh Public Expenditure Analysis: Spending for Reconstruction and Poverty Reduction*. Jakarta: World Bank.

———. 2006b. "Reconstruction Financing Brief." Progress briefing note, World Bank, Jakarta.

———. 2006c. "Reconstruction Progress: Disbursements and Physical Outputs." Progress briefing note, World Bank, Jakarta.

———. 2006d. "Housing: Financing and Progress Report." Progress briefing note, World Bank, Jakarta.

———. 2007a. *Managing Resources to Build Back and Create a Better Future for Nias: Nias Public Expenditure Analysis 2007*. Jakarta: World Bank.

———. 2007b. "Reconstruction Progress Update, April 2007." Progress presentation to donors, World Bank, Jakarta.

———. 2007c. "Reconstruction Progress Update, September 2007." Progress presentation to donors, World Bank, Jakarta.

6

The Flow of Information during Disaster Response: The Case of the Mozambique Floods, 2007

Marcin Sasin

Introduction

This chapter presents a case study that provides background for the cross-country analysis of the use of information systems in disaster management. Ideally, if a disaster strikes, such systems should help identify needs; monitor and coordinate the inflows and distribution of response, relief, and reconstruction aid from governments, international organizations, and non-governmental organizations (NGOs); and facilitate the supervision of aid efforts by providing transparency and accountability. The focus of the study is a country, Mozambique, in which there have been numerous sudden onset disasters; the need for a well-functioning disaster information system is particularly acute in this situation.

The response of the government of Mozambique and its partners to the flooding along the Zambezi River in 2007 is widely perceived as an enormous improvement over the responses during previous severe flooding incidents in the country. The improvement has, in large part, been attributed to advances across all stages in disaster risk management but, particularly, in the strong role of the government in coordination.

Although good coordination usually depends on good information, the information available to decision makers in Mozambique during disasters

has been somewhat patchy because there is no integrated system to support decisions in emergencies. Nonetheless, a positive innovation has been the establishment of the National Emergency Operations Center (Centro Nacional Operativo de Emergência) (CENOE). CENOE and its branches are designed to act as information nodes for coordination and decision making during disasters. CENOE was put to the test and proved instrumental during the disaster response in 2007.

This report describes the key components of the information infrastructure available to decision makers in Mozambique in the context of floods and cyclones. Specifically, it maps the flow of information during the response to the floods along the Zambezi and to Cyclone Favio. Particular attention is paid to the operation of the new disaster response coordination structure, CENOE.

The report has two purposes: to derive lessons about good practices in the creation of disaster management information and coordination systems and to provide input for the ongoing effort to support disaster management preparedness and response. This effort in Mozambique currently includes initiatives to upgrade information management capabilities.

The research behind this chapter has relied on a series of semistructured interviews with key stakeholders in Mozambique on June 7–28, 2007, and consultations with many experts.[1] It also draws on reports and other relevant documents on the subject (see the References section).

Mozambique and Disasters

After gaining independence in 1975, Mozambique underwent 15 years of devastating civil war between the ruling Front for the Liberation of Mozambique and the rebel Mozambican National Resistance. The end of the Cold War and dissolution of the apartheid regime in neighboring South Africa removed much of the pressure behind the hostilities, and a peace agreement was eventually signed, in 1992. The two factions converted into more conventional political parties, and a period of political stability followed. Democratic elections were won repeatedly with a comfortable majority by the Front for the Liberation of Mozambique, most recently in 2004. In parallel with political stability, the economy has been growing at a healthy rate of about 8 percent, on average, since the early 1990s.

Achievements notwithstanding, Mozambique remains one of the poorest countries in the world. Income per capita is about US$350 a year, and the country ranked 172nd out of 177 countries on the United Nations

Development Programme's human development index (UNDP 2007). About 60 percent of the population lives below the poverty line. Illiteracy rates are 40 percent for men and 70 percent for women. Life expectancy is around 40 years and, because of HIV/AIDS, is not improving. Infrastructure is in disarray; for example, only 5 percent of households have electricity. Three-quarters of the population depend on agriculture, including fisheries. This means that livelihoods are highly vulnerable to weather shocks and other vagaries of nature.

Mozambique is prone to natural disasters, including droughts, floods, cyclones, and earthquakes. Sometimes, these calamities occur simultaneously. Poverty and the economic necessity of living and working along riverbanks, on the coast, or in arid areas add to the vulnerability of many people to these disasters.

Droughts are the most frequent and deadly natural disaster, occurring every three or four years and causing acute food shortages. Between 1980 and 2000, droughts and the associated food shortages were responsible for about 4,000 deaths. Moreover, in arid and semiarid parts of Mozambique, even the normal level of precipitation is not sufficient for food security. In general, the weather is particularly variable and unpredictable, with average annual rainfall of 1,000 millimeters in the north and 400 millimeters in the south.

Floods occur almost every year in some part of the country. Water upstream from a large part of southern Africa drains through the plains of Mozambique toward the Indian Ocean. Most rivers become torrential during short periods in the rainy season, but have relatively little water during the remainder of the year. The floods in 2000 were the worst on record. The death toll reached over 700. More than a half million people were displaced. Losses and damage were estimated at US$600 million, and there was a drop in the annual growth rate in gross domestic product from 10 to 2 percent that year.

The country lies in the path of tropical cyclones that form in the Indian Ocean, usually between October and April, and often wander into the Mozambique Channel, where they affect coastal areas. Although few cyclones make landfall in Mozambique, three or four are usually close enough or sufficiently strong to produce heavy rains, flash flooding, devastating winds, and several deaths each year.

Large earthquakes occur infrequently in the two seismic areas, namely, the East African Rift and the Mozambique Channel. The most recent major earthquake was in February 2006. It measured 7.0 on the Richter scale, the highest magnitude earthquake on record in the region. There have

been no recorded tsunamis, but a tsunami striking in this part of the Indian Ocean would not seem surprising.

The most characteristic feature of natural disasters in Mozambique is their recurrence. It is not a matter of whether, but of when and where the next disaster—flood, drought, or cyclone—is going to occur. Because disasters are a fact of everyday life, one might expect that Mozambique would have already become resilient in the face of disaster. This is not so.

Disaster Management

Disaster Management Policies

The key document guiding the government's development effort is the Action Plan for the Reduction of Absolute Poverty (Programa de Acção para a Redução da Pobreza Absoluta), which is the country's Poverty Reduction Strategy Paper. Although it has not been an issue of the highest priority, disaster management has acquired growing importance in development planning over the years. The most recent action plan explicitly recognizes the need to reduce the vulnerability of the country's population and infrastructure through the integration of disaster management into long-term development planning.

The legal basis for disaster management activities is provided by the 1999 National Policy on Disaster Management (Política National de Gestão de Calamidades). This law established the procedures and the legal framework for mechanisms for coordination and resource mobilization as part of disaster prevention and response. It focuses on preparedness by, for example, stressing contingency planning and early warning systems. Today, the law is considered somewhat inadequate. There is room to strengthen the proactive features of the legislation, define more carefully the roles and responsibilities of various government departments and agencies, clarify procedures and rules of engagement, strengthen disaster management institutions, and integrate disaster prevention and mitigation into local and national social development planning. Accordingly, a new law, which addresses some of these issues, has been drafted, but has been awaiting approval by the parliament and the government for some time now.

The government approved, in March 2006, the 10-year Master Plan for the Prevention and Mitigation of Natural Disasters (*Plano Director de Prevenção e Mitigação das Calamidades Naturais*). The master plan is an ambitious, comprehensive, multisectoral program of action aimed at reducing the vulnerability of the population to natural disasters. It envisages new

water reservoirs, reforestation, expansions in irrigation, the introduction of drought-tolerant crops, the promotion of nonagricultural employment, microcredit schemes, agricultural insurance, the fine-scale mapping of disaster areas at risk, the promotion of community land use planning, an increase in the number of weather tracking stations and river monitoring stations, and enhancement of early warning systems and disaster management information systems.

The master plan emphasizes communications, information management, and coordination in the response to disasters. Specifically, it recognizes that vast areas of the country are not covered by reliable and efficient communications networks, that no coherent disaster information management system exists, and that coordination among actors during disaster response should be improved. Accordingly, the master plan calls for priority for disaster-prone areas during the expansion of communications networks. It envisages detailed mapping of flood areas and cyclone zones, disaster-conscious urban planning, and more systematic use of scientific data and computers in weather forecasting, the modeling of rivers, and the strengthening of early warning systems. The plan recommends a finer definition of the various levels of emergencies, the establishment of clear procedures among the agencies involved, the creation of rules and incentives for private sector participation in emergency response, the preparation of inventories of the resources and infrastructure available during disasters, and the design of mechanisms for information sharing. Among these last are resource and multiuse centers, which are community centers where local inhabitants may participate in gathering and processing scientific data, monitoring statistics and other disaster-related information, and exchange disaster experiences and ideas about disaster management practices.

Most of these initiatives have not yet been undertaken and may be expected to be slow in materializing because of resource constraints. However, the government has moved decisively in one direction; it has established CENOE, in Maputo, and a CENOE branch in Vilanculos. A CENOE branch is also under construction in Caia, and a branch in Angoche or Nacala is planned.

Actors in Disaster Management

There are many stakeholders involved in disaster management in Mozambique at the local, national, regional, and international levels. The roles and responsibilities of the various agencies involved in disaster management are

not precisely defined in legal terms, and the current institutional framework has emerged and evolved more or less as a practical solution.

At the national level, the highest authority is the Coordination Council for Disaster Management (Conselho Coordinador de Gestão de Calamidades), which is chaired by the prime minister and includes several ministers. During quiet periods, the council meets infrequently to discuss disaster management issues, review the situation, and make policy decisions. During disasters, the council meets more regularly to take any decisions of a political or policy nature—such as whether to issue an international appeal or to consider the form of the assistance needed by the population—and resolve high-level coordination problems arising in the course of the disaster response.

The National Institute for Disaster Management (Instituto Nacional de Gestão de Calamidades, or INGC), part of the Ministry of State Administration, is responsible for coordinating all governmental and nongovernmental activities in disaster prevention, mitigation, and emergency response.[2]

The typical day-to-day activities of the INGC include supporting local authorities in drafting contingency plans and consolidating them into a national contingency plan, preparing the contingency budget for disasters, organizing simulations, implementing various measures and policies required in the master plan (such as the creation of the resource and multiuse centers and the CENOE branches and the design of disaster information management systems), coordinating disaster-related activities among stakeholders, promoting and participating in early warning systems, training community risk management committees, organizing seminars and learning events, and rallying political support and funding for disaster prevention and mitigation.

During disasters, the INGC provides personnel to various coordinating agencies (such as CENOE), supplies logistics support, facilitates information flows, gathers input from stakeholders, and drafts multisectoral response and reconstruction plans.

The INGC has undergone significant restructuring. There have been numerous capacity-building exercises, particularly after the 2000 and 2001 floods, including, for example, intercountry exchanges with Guatemala and Honduras (organized by the German Agency for Technical Cooperation) and multiyear staff training programs. The INGC is also decentralizing. Of the approximately 800 staff, 90 percent are located in the provinces and districts, particularly in disaster-prone districts. There are also three regional directorates (south, center, and north). In 2006, a new management team, led by Paulo Zucula, the national director, became a driving force behind

the recent reform in disaster management and helped elevate disaster management in the public eye.

During normal times, coordination is the responsibility of the Technical Council for Disaster Management (Conselho Técnico de Gestão de Calamidades), an interministerial body that includes representatives, usually at the director level, of ministries participating on the coordination council, as well as of important stakeholders, such as the World Food Programme (WFP), the United Nations Children's Fund (UNICEF), the Mozambique Red Cross Society, and the German Agency for Technical Cooperation. Other stakeholders, such as NGOs and the private sector, are occasionally invited to meetings, depending on the agenda. The technical council is chaired by the INGC national director and meets regularly to discuss contingency planning and other disaster management issues, analyze disaster-related information, draft recommendations for the INGC, and write submissions to the coordination council.

During national emergencies, coordination is performed by the national coordinator within the structure of CENOE. The national coordinator is named by the coordination council and, depending on the nature of the emergency, might be, for example, the INGC national director, a minister, or the prime minister.

The INGC loans out personnel to assist during the disaster response. Most of the groundwork is actually performed by the ministries. For example, during a disaster, the Ministry of Health would be responsible for monitoring the health situation, assessing the damage to health infrastructure, mobilizing doctors, procuring medicines, and coordinating the creation of emergency health facilities. The Ministry of Public Works and Housing would take charge of restoring infrastructure, setting up temporary shelters, helping people to rebuild their homes, and mobilizing transport capacity.

Despite the unquestioned importance of central coordination, most of the coordination effort occurs at the local level. Local authorities, usually local INGC representatives, district administrators, and local ministry staff are the first to respond in an emergency. They know where key people are and understand what resources are available. They reach out to the population immediately with information and are responsible for implementing the contingency plans in the disaster areas and helping in organizing the use of emergency stocks.

The same disaster management structures and administrative procedures are replicated at the central and local levels. Thus, there are provincial emergency operations centers, district risk management committees, district

technical councils, and district emergency operations rooms. At the grassroots, community risk management committees are being created throughout the country after a successful pilot project in the Buzi River basin that was supported by the German Agency for Technical Cooperation. The committees are composed of volunteers, usually respected individuals such as teachers and traditional leaders. Their role is to create awareness of disaster-related issues, promote preparedness, identify places of safety, design contingency plans, transmit information to and from the population, link up with local authorities, and so on.

The National Institute of Meteorology monitors the weather, collects and analyzes meteorological data, and prepares forecasts. It also manages the cyclone early warning system. Four regional water administrations run the country's hydrological networks. They monitor water levels on major rivers and issue appropriate flood warnings to local authorities. The National Directorate of Water, the country's water authority and water policy-making body, participates in flood early warning and engages in national and international cooperation on water issues.

The water authorities in the region cooperate on a regular basis. Bilateral and regional cooperation with neighboring countries within the framework of the Southern African Development Community is critical, particularly in flood management. As much as half of the water flowing through Mozambique originates outside the country's borders, and hydrological and weather conditions elsewhere generally determine the water issues faced by the country. The Southern African Regional Climate Outlook Forum fosters interaction among weather and disaster management specialists in the Southern African Development Community. Each September, the forum produces a rainy season weather outlook that is used in contingency planning in Mozambique. In addition, Mozambique is party to several formal and informal agreements with neighboring countries that involve discussions and exchanges of data about the relevant issues.

At the nongovernmental and international levels, the key players are the donors, United Nations agencies, and NGOs. Mozambique is a poor country and relies on official development assistance. External donor aid represents about 17 percent of the gross domestic product and accounts for around half of government expenditure. The International Development Association of the World Bank Group is the largest single donor. A large part of this assistance involves direct budget support paid into government accounts. The rest goes toward specific projects. Donors occasionally finance government initiatives in disaster management. For example, the

German Agency for Technical Cooperation, the U.K. Department for International Development, and the United States Agency for International Development are financing capacity building and other risk reduction activities at the INGC. One of the goals of the World Bank country strategy is an enhanced capacity to respond to disasters. This is supported by a US$1 million grant from the Global Facility for Disaster Reduction and Recovery. Donors also directly fund various actors involved in humanitarian assistance during disaster relief.

In general, donors rely on United Nations agencies to take the lead in disaster management issues. The United Nations Development Programme has an active program of institutional support at the INGC and other entities in capacity building and in mainstreaming disaster management into development planning. The WFP and UNICEF are the two largest INGC partners in disaster response. The recurrence of natural disasters in the country and the chronic vulnerability of the population mean that disaster preparedness and relief have become a regular focus of the programs of these two partners even during normal times through, for example, support for food vulnerability analyses. The Regional Office for Southern Africa of the United Nations Office for the Coordination of Humanitarian Affairs, in Johannesburg, organizes regular training for individuals involved in disaster management in the region, including those with the INGC.

The disaster-related coordination of United Nations agencies is ensured through the UN Disaster Management Team, which includes representatives of the Food and Agriculture Organization of the United Nations; the United Nations Development Programme; the United Nations Educational, Scientific, and Cultural Organization; the United Nations Population Fund; the Office of the United Nations High Commissioner for Refugees; UNICEF; United Nations Volunteers, the WFP, and the World Health Organization. The team is headed by the United Nations resident coordinator. The team normally operates through the UN Disaster Management Technical Working Group, chaired in 2007 by the representative of the WFP and open also to other agencies. The group meets regularly to discuss and coordinate interagency activities related to disaster management. The main role of the team and the working group is to conduct and coordinate disaster preparedness activities within the United Nations community, review and maintain adequate response capacity among members, and support the government in preparedness, prevention, and mitigation efforts. Since the floods in 2000–01, the team has been periodically updating a UN interagency emergency preparedness and response

plan for Mozambique. Based on consultations with the government, the plan outlines key activities to be implemented by the United Nations to achieve preparedness, as well as the steps to be taken during an emergency, including the identification of the agencies responsible for disaster management. The plan involves efforts to make an inventory of the resources available to the United Nations system and its partners in cases of emergency, including useful contacts in the country.

During normal times, many local and international NGOs active in Mozambique, such as Save the Children, Concern Worldwide, and Oxfam, operate various projects in health care, education, awareness building, child protection, HIV prevention, agricultural development, nutrition, hygiene, and so on. These projects are usually relatively small and focused on specific localities. Through this field presence, many such organizations have developed strong links with local governments and gained the sort of knowledge about local circumstances that becomes valuable also during a disaster response. Thus, the Mozambique Red Cross Society maintains an extensive network of volunteers, trained in first aid, in all provinces, most districts, and many communities and owns warehouses around the country. It also supports local risk management committees, and society volunteers participate in disaster early warning systems.

The United Nations has been pushing for a reform to fix some of the long-standing global problems in humanitarian response, such as fragmentation, patchy coordination, lingering disputes, lack of information sharing, and lack of inclusiveness. In the spirit of reform, a more inclusive humanitarian country team was created in Mozambique in 2007 under the oversight of the United Nations resident coordinator. It is composed of the usual members of the UN Disaster Management Team, plus other stakeholders, especially NGOs.

The private sector, academia, and, particularly, the media also participate in disaster prevention and response. Radio is a primary tool in keeping the population informed about potential or impending disasters. The government has also been creating incentives for the private sector to become more effectively involved in disaster reduction efforts.

The Realities of Disaster Management

Some of the challenges in disaster management in Mozambique are common in all humanitarian emergencies; some are particular to Mozambique.

The people most affected by disasters are usually poor subsistence farmers, and the property they most often lose during emergencies is their

homes and their crops. Many of these people find shelter during disasters in accommodation camps and require food assistance. Hence, the distribution of food and nonfood items and the provision of basic services in accommodation camps are principal tasks during disaster relief in Mozambique.

The INGC takes the unquestioned lead in coordination during the response, though most of the work is done by local authorities, their partners, and volunteers.

The national budget for emergency response in 2007 was about US$4.5 million, while international partners were able to mobilize over US$35 million (FTS Database 2007). The WFP received almost 40 percent of this amount, while the Red Cross and UNICEF received about 20 percent each. The Central Emergency Response Fund of the United Nations provided US$11 million; the European Commission and the United States, about US$6 million each; and Germany and the United Kingdom over US$2 million each.

The WFP and UNICEF perform the main roles in sectoral coordination but, within the current framework for humanitarian response, do not provide relief directly in disaster areas except as providers of last resort. Emergency supplies and other goods are distributed through contracts with implementing partners already knowledgeable about the disaster areas and equipped with a local distribution capacity. These partners are usually NGOs (some specializing as executing agents), the Red Cross, local community organizations, or district authorities. The contracting agencies monitor the distribution of goods. The larger NGOs and the Red Cross also distribute emergency supplies from their own stockpiles.

Such arrangements seem to suit the government, which prefers to deal with fewer partners and has requested that international partners stand as one during disaster response. The INGC appears to welcome the role of the United Nations, the WFP, and UNICEF in coordinating the international component of the response. However, the customary contracting arrangements influence the relationship between the United Nations and NGOs and do not always promote effective partnerships. Nonetheless, some agencies seem more readily able to guarantee inclusiveness and handle grievances.

Personal contacts are important. Most of the people involved in the flood response in 2007 had maintained working relationships with each other long before the disaster, and this turned out to be a great asset during the emergency. Also, the government emergency response seems to have been driven by a few key individuals rather than a well-defined institutional structure.

Humanitarian assistance has grown in complexity, and this makes emergencies more challenging in new ways. The aspiration nowadays is not only to save lives, but to deliver on the perceived rights of the population in accommodation camps to certain standards. Thus, besides the distribution of food and water, there should be provision of education, health services, entertainment for children, policing (including specially trained women police officers), latrines, HIV prevention, agricultural inputs and tools, and other items to help restore the livelihoods of people. These conveniences may exceed the living standards prevailing in communities and may sometimes produce perceptions of unfairness among unaffected populations and thus lead to tensions.

The population is aid-savvy and often opportunistic. For years, people have been witnessing and drawing benefit from international assistance during disasters. Thus, the aid distribution after the devastating floods of 2000–01 was particularly generous; indeed, it was called a relief bonanza. Some people have developed ways to maximize aid, for example by double-dipping or misrepresenting their needs. Every time disaster strikes, unaffected people flow into the accommodation camps in expectation of receiving free relief goods. After the food has been distributed, many people return home. There is some consolation in such situations that all the people are poor even if they have not been affected directly by the disaster. In fact, the needs expressed by locals during the disaster relief operations were the needs of a population that had been generally poor and impoverished before the disaster.

The aid-dependency and the passivity of some of the affected population are sometimes stunning. For example, one of the biggest problems in relief activities, such as setting up and maintaining latrines or education facilities, is lack of community participation.

The situation is made more difficult by the moral hazard exhibited by river valley farmers.[3] Because the Zambezi floodplain is fertile compared with the water-scarce higher land, farmers face few opportunities outside agriculture and are tempted to farm the floodplain, although they realize an entire harvest could be washed away. However, the probability of receiving relief in such a case is also significant.

Some of the incentives available to actors may seem perverse. For example, during planning for disaster response, governmental and nongovernmental agencies, in anticipation of more substantial financial inflows during the allocation of budgets or a relief appeal, may be tempted to forecast that large numbers of people will (potentially) be affected by a disaster.

Likewise, during an emergency situation, information often becomes an asset and a bargaining chip; so, many participants may fail to be fully transparent. The media, particularly the foreign media, sometimes seem to gravitate toward the sensational. Misinformation may lead to unnecessary panic. In 2007, the local authorities reportedly had to appeal for calm partly because of such confusion. Indeed, communities have been facing the risk of flooding for centuries and have developed coping mechanisms; these strategies should be acknowledged.

Politics do not always help. Disasters seem to represent an occasion for politicians to appear on television. Mozambique has, for years, been governed by a single strong party. Since the north and the Zambezi valley have traditionally been areas showing higher support for the opposition, it is easy to assign any flaw in the disaster response to political motive. Similarly, it may take time for disaster response agencies to build trust with partners and show their commitment to people in general rather than only party supporters. Finally, the politics of food aid in Mozambique and in southern Africa is said to be well summarized by an equation: food equals votes.

A country that once relied on a highly centralized planned economy, Mozambique is undergoing decentralization. Traditionally, most of the power has been concentrated in sectoral ministries; now, district or provincial administrations are legally responsible for most subnational matters, including disaster mitigation and response. There have been problems in the transition. For instance, local branches of ministries are now accountable to local administrators and to central ministries, which complicates coordination.

Capacity problems are widespread. Mozambique did not have a local civil service at independence. The years of civil war that followed devastated infrastructure and destroyed most social capital. Almost half the population is illiterate, and a significant number of people do not understand disaster warning messages. Years of considerable investment have not been sufficient to build adequate capacity in government agencies.

The Information Infrastructure for Disaster Management

Contingency Planning

The preparation of the annual national contingency plan is central to emergency preparedness in Mozambique. The contingency planning process

was first undertaken in 1996. The plan is comprehensive and involves many stakeholders. It is multihazard in that it identifies the potentially affected population, the resources required, and the steps envisaged for each prevalent type of disaster, namely, floods, cyclones, and droughts. The plan is prepared at all administrative levels, from the grassroots to the capital.

The annual contingency planning exercise begins ahead of the rainy season. The first evidence for the plan is the seasonal forecast for southern Africa developed by experts under the umbrella of the Southern African Regional Climate Outlook Forum. The forecast represents the expert opinion on the likelihood that areas in the region will experience above normal, normal, or below normal precipitation. In Mozambique, it forms the foundation for the preparation of various disaster scenarios.

Disaster-prone districts are also supposed to draft contingency plans and submit them to the provincial authorities, who must tie district plans into a provincial contingency plan. The INGC likewise consolidates provincial contingency plans into a national contingency plan. The Technical Council for Disaster Management reviews the draft and submits it to the Coordination Council for Disaster Management. Ultimately, the national contingency plan goes to the government for approval.

While the national plan is important for planning purposes, the district and provincial plans are the most important during response operations. These plans include (a) a detailed list of all localities prone to disaster, including the number of the potentially affected population estimated on the basis of seasonal weather predictions and according to the severity of the disaster (minimum, medium, and maximum [the worst]); (b) the resources available for response, such as cars, boats, fuel, and food, by quantities; (c) the expected requirements for food and nonfood aid, by quantities; (d) evacuation routes and places of safety in each locality, means of access, lists of airfields; (e) lists of the steps to be taken before, during, and after a disaster, as well as the agencies responsible for each step; and (f) estimated emergency budget requirements, by sector.

The contingency budget is allocated among provinces and sectors according to the contingency plans. The INGC plays an important role in the allocation process, and this authority confirms the INGC's function as disaster management coordinator. Some of the budgeted funds go toward moving essential relief items into prepared storage points in disaster-prone areas (prepositioning). The funds allocated to local authorities are reportedly insufficient, and the districts remain without adequate resources.

United Nations agencies and other partners periodically issue updated contingency plans (for example, see UNDMT 2005). Other major organizations also draft contingency plans.

The highlight of the contingency planning process is the annual simulation exercise organized by the INGC. The simulations are carried out in Maputo and in selected districts. (In October 2006, they were held in Buzi and Caia.) Desk simulations are run over several days. Agency staff members who have been made focal points for disaster management meet to draft a response plan. Communications channels are tested. Field simulations are carried out, including demonstrations of search and rescue operations on rivers. The simulation exercise is universally prized because key players test their preparedness, contact lists are refreshed, closer links are established with counterparts who may become key contacts during an emergency, and potential problems are identified and addressed.

According to observers, the contingency plans were instrumental during the emergency response in 2007. Thus, for example, the INGC, the Red Cross, Concern, and other partners had already stocked essential goods in Tambara, and local residents knew the evacuation routes and the locations of the shelters that had been prepared in or around schools on higher ground.

Early Warning Systems

Early warning systems exist for three major types of disasters in the country: droughts, floods, and cyclones. The systems each possess forecasting, detection, and other relevant components.

The *food security early warning system*, a drought alert system, is coordinated by the Technical Secretariat for Food Security and Nutrition, an interagency coordinating body led by the Ministry of Agriculture and including the participation of other organizations such as the WFP, the Famine Early Warning Systems Network of the United States Agency for International Development, and NGOs. The centerpiece of the system is the Vulnerability Assessment Committee. The committee conducts crop and household surveys, analyzes weather and other secondary data, and monitors markets to assess the food security outlook. (Food insecurity and drought are typically slow onset disasters; they are not a focus of this chapter.)

The *cyclone early warning system* is operated by the National Institute of Meteorology. Cyclone forecasting is not straightforward. It requires sophisticated models that must be calibrated according to long historical series

of meteorological and oceanic data. Unfortunately, such data are not available for the southwest Indian Ocean over long periods, so the accuracy of the seasonal forecasts of tropical cyclone activity in the region is limited. Nonetheless, cyclones may normally be detected sufficiently early for tracking. The National Institute of Meteorology relies on information from various meteorological services, including the services of France (the station on the Indian Ocean island of Reunión), the United Kingdom, and the United States, and its own onshore radar station in Xai-Xai (capital of Gaza Province) to forecast the location and severity of disaster impacts and issue warnings to provincial authorities and the INGC.

Public cyclone warning messages rely on several elements. The numbers from 1 to 5 indicate the severity of the cyclone, from moderate to very intense, based on factors such as wind speed and the type of destruction anticipated for homes and crops. Color alerts in blue, yellow, and red indicate that a cyclone is expected to reach a potentially affected area in, respectively, two days, one day, and six hours. Cyclone warnings are communicated through a system of colored flags hung out by volunteers and through radio messages, drum beats, whistles, and megaphones. Although many people know of the new system, the public still needs to become educated about the meaning of the colors and numbers.

The *flood early warning system* is the most complicated. The main actors are the four regional water authorities (the south, the center, the Zambezi, and the north), the National Directorate of Water, the National Institute of Meteorology, and the INGC. The National Institute of Meteorology prepares daily, five-day, and seasonal forecasts, including precipitation estimates. These are published on a Web site and in bulletins. The regional water authorities operate river and dam monitoring stations and exchange water flow data with water authorities in neighboring countries. If water levels reach alert thresholds, the regional water authorities warn provincial and district authorities, the National Directorate of Water, the INGC, and the media.

Flood forecasting presents challenges in Mozambique. The infrastructure for hydrological and meteorological measurement is inadequate. The National Institute of Meteorology has only 15 comprehensive weather stations, which cover only 25 percent of the country (compared with 115 stations in Mozambique in 1975 and 68 stations now in neighboring Malawi, a much smaller country). Similarly, the water authorities have only five gauging stations on the Zambezi, the biggest river in southern Africa. Measurements are performed manually and communicated over the closest available telephone or radio transmitter, which may be several kilometers

away. The infrastructure and technical capacity are insufficient for precise, real-time, or short-term flood forecasting. Often, the most one may say is that a flood will probably occur in one of the usual places along the usual rivers sometime during the flood season. To predict the location, dates, and extent of flooding more accurately for each incident, one must first create a proper computer-based hydrological model supported by a network of monitoring stations capable of real-time water flow measurements; a long, solid series of historical baseline data; a digital elevation model; soil and vegetation information; and state-of-the-art rainfall forecasts. In Mozambique, a proper hydrological model exists only for parts of the Limpopo River, in the south; the creation of another, for the Save River, is being considered. Even flood zoning—a rather basic requirement in flood management—has not become much more detailed than the general identification of areas prone to flooding.

Flood warning information is transmitted to key individuals through a more traditional method of communication. It is communicated by provincial authorities to district authorities, who inform community leaders directly or through NGOs, volunteers, or local risk management committees.

Public warning messages are broadcast by radio. The public does not necessarily act on warnings, however. A message stating that the Zambezi is going to flood is not equivalent to a message stating that your house is going to be flooded. The decision to abandon possessions, dwellings, and fields is not an easy one, and people tend not to leave until they are convinced the flood will occur, which, often, is only after the water has reached the door. A precise forecast is therefore critical. Each inaccurate prediction damages the credibility of warnings in general.

For this reason, the INGC is promoting community involvement in the flood warning system. Such a people-oriented warning system has been successfully piloted along the Buzi River. Local people measure the river themselves, combine the measurements with the results of their traditional, centuries-old ways of sensing an imminent flood, and warn their fellow citizens downstream. This sort of warning system is now being implemented throughout the country.

CENOE

CENOE was developed in 2005–06 in response to the recognition by the new INGC management that there were serious information and coordination gaps in the readiness for disaster. The inspiration for CENOE arose

in Latin America, where INGC is involved in an active program to exchange experiences. For example, in Guatemala, there is a similar entity, the Office of National Coordination for Disaster Reduction. The need for such a national emergency operations center was written into the master plan of 2006. The initial financing was provided through the funds remaining in the 2005–06 contingency account. Construction of the center started later in 2006.

Two features are critical aspects in the concept of CENOE. One is the existence of a physical structure, the building housing the center, where all lines of information are supposed to intersect and where all major players meet. The other is the institutional and operational arrangements.

The CENOE building contains a conference room. Sectoral working groups, including representatives of various partner agencies, have their own rooms, computers, and (if the system is functioning properly), communication links to relevant ministries. In the information room, INGC officers gather and compile routine information produced by various services. Space has been made available for communications equipment. There is also a room for back-office support services, including refreshments.

The central CENOE headquarters building is located at the Mavalane Air Base, in Maputo. An exact copy of this edifice has also been built in Vilanculos (Inhambane Province). Another is under construction in Caia (Sofala Province), and one is planned for Angoche or Nacala (Nampula Province). The newer centers will serve as regional branches and operational bases covering the south, the center, and the north of the country, respectively. Although not yet fully operational, the branch in Caia was used to coordinate the response during the floods along the Zambezi in 2007, and the Vilanculos branch was used to coordinate the response to tropical cyclone Favio.

During normal times, CENOE operates 24 hours a day. Several INGC information officers work in shifts, gathering information from weather, water, and other services; monitoring the situation; producing daily bulletins and announcements; and conducting more general disaster research. CENOE staff are able to transmit information to key authorities and recommend to the INGC national director that a change be initiated in the alert level. During emergencies, the INGC regional director or the national emergency coordinator runs CENOE operations, and the number of information and monitoring officers is strengthened significantly.

The centerpiece of CENOE during emergencies is the groups of focal points (*pontos focais*), that is, the operations officers recruited from ministries and other agencies involved in disaster response at the local and central

levels. The focal points remain at CENOE during an emergency. They act as liaisons and are responsible for managing information flows, including supplying CENOE information and conveying CENOE requests for information to relevant partner agencies. The focal points must meet specific critical requirements, including the ability to obtain accurate, detailed information about current needs in disaster-affected areas; the ability to retain a thorough awareness of the resources available for emergency response; the ability and the authority to make quick decisions and to deal directly with ministers; team spirit; the ability to function under pressure; and the ability to accomplish tasks. Focal points may be appointed from the technical council.

CENOE activities are subdivided into four broad sectoral areas or working groups: (a) information and planning, (b) communications, (c) infrastructure, and (d) social services. The information and planning group, led by the Ministry of Planning and Development, is responsible for acquiring and analyzing information, mobilizing adequate resources, and planning and advising on appropriate responses. The communications group, led by the Information Office and the INGC, is the voice of CENOE. It maintains external communications and ensures that all have the same information. The infrastructure group, led by the Ministry of Public Works and Housing, is responsible for logistics and transport, ensuring access to emergency areas, guaranteeing adequate telecommunications, and rebuilding of critical infrastructure. The social services group, led by the Ministry of Health, provides assistance to disaster victims. It coordinates the establishment of accommodation camps, registration of affected populations, distribution of food and nonfood aid, provision of public health, and coordination among volunteers. CENOE also includes a civil protection unit, which is responsible for search and rescue operations.

The Cluster Approach

The United Nations system, participating NGOs, and other external partners have developed an integrated coordination structure known as the cluster approach. In larger emergencies requiring a multisectoral response, United Nations agencies and NGOs are supposed to organize themselves around clusters. Clusters are groups centered around a theme, a sector, or a task. They may be composed of United Nations agencies, NGOs, and governmental and donor representatives. The entities represented possess a mandate or a comparative advantage in the particular theme or sector. By clarifying

the division of labor, narrowly defining roles and responsibilities, and facilitating information sharing and coordination, the cluster approach strengthens partnerships and ensures more predictable, accountable, and integrated international responses to emergencies.

The United Nations, the Red Cross, and NGO focal points may also use the CENOE facilities. The majority of the operations of these agencies fall within the CENOE social service pillar. The logistics cluster naturally provides a counterpart with CENOE's infrastructure sector.

Switching to Emergency Mode

The government has established an alert system to assist agencies in understanding the scope of an emergency. The four levels of alert—green, yellow, orange, and red—indicate four levels of required response, ranging from the status quo, through local emergencies of varying intensities, to a nationwide emergency. Alerts may be announced for a province or nationwide.

Acting upon information submitted to the INGC or CENOE by various agencies, such as water authorities, meteorological services, local risk management committees, or local INGC representatives, the INGC director may convene a meeting of the technical council to elevate the alert. Yellow and orange alerts are usually declared by the INGC director or the technical council. The nationwide red alert is, in principle, declared by the coordination council upon the recommendation of the technical council.

District authorities are expected to deal with local emergencies on their own and in accordance with district contingency plans. The provinces are expected to intervene to support districts reaching the limits of their capacities. In this case, a provincial alert is declared, and provincial emergency operations centers begin to respond. The national contingency plan allows the INGC to shift resources toward affected provinces. If an emergency affects four or more provinces or if the resources available through the global contingency plan do not match the needs of the disaster, the national red alert is declared.

Specific responses are required depending on the alert level. The yellow alert indicates that there is sufficient likelihood of a natural disaster to warrant a review of the resources available and transfers to nearby warehouses, preparation of emergency centers, a check of all communications and transportation equipment, changes in contingency plans, updates in lists of key contacts, and consultations with local and community disaster management committees.

The orange alert indicates that a disaster is imminent. CENOE and other agencies are expected to initiate the repositioning of stocks and the notification of potentially affected populations that they should seek shelter. Officials are recalled from leave, and additional human resources are activated.

The red alert is declared if a disaster has already occurred or is in progress. During a red alert, CENOE or a CENOE branch may be fully activated to coordinate the response and produce a daily bulletin. The civil defense is dispatched to carry out search and rescue operations. Emergency relief is initiated, and partners are asked for assistance. By international practice and tradition, external partners are unable to undertake emergency assistance without some form of invitation from the government, usually a declaration of a state of emergency, an international appeal for assistance, or a direct request for support.

The initial relief is provided by shifting existing resources toward the emergency response; usually, some contingency funding is available. Depending on the magnitude of the crisis, United Nations agencies may appeal for application of the Central Emergency Response Fund. An additional appeal through the Consolidated Appeal Process may follow. NGOs and the Red Cross also issue independent appeals.

The Emergency Response in 2007

The Emergency

How Goes the Zambezi?

The rainy season in southern Africa lasts from October to March and, almost every year, causes localized flooding along one or more of the several big rivers in Mozambique, a downriver country. As the rainy season of 2006–07 progressed, the anticipation grew that, this time, it was going to be the Zambezi.

The Zambezi is the fourth longest river in Africa and the third largest river in volume. It drains water from an area of about 1.4 million square kilometers, including large parts of Angola, Malawi, Mozambique, Zambia, and Zimbabwe. The discharge at the mouth of the river averages about 3,000 cubic meters per second.

Before the construction of two big dams, one at Cahora Bassa, in Mozambique, and the other at Kariba, between Zambia and Zimbabwe, the Zambezi flooded every year. Now, major floods occur on the Zambezi in Mozambique every 5 to 10 years. The flooding takes place for several

reasons. The dams may not have sufficient capacity to hold back the water accumulated in catchment areas because of sustained periods of heavy rain, because of imperfect coordination in the discharges of the two dams, or because the Zambezi tributaries downstream from Cahora Bassa, such as the Shire River, may themselves bring enough water to cause flooding.

Much depends on dam management. Before 2007, the most recent flood on the Zambezi had occurred in 2001, when the Kariba dam reached full capacity for the first time in 20 years, and the operators there had to discharge water at the maximum possible rate. This meant that the operators at the Cahora Bassa dam had to spill at the highest rate (about 10,000 cubic meters a second), sending a massive wave of water through central Mozambique. These floods resulted in the displacement of about 200,000 people.

The key factors determining the deadliness of a flood are the speed of the rise in the water and the amount of advance notice received by people living along the river. The early warning systems and water management initiatives along the Zambezi in Mozambique, such as rainfall and river monitoring devices, as well as orderly discharges from the Cahora Bassa dam, should give a few days' notice.

The Zambezi Floods in 2006–07

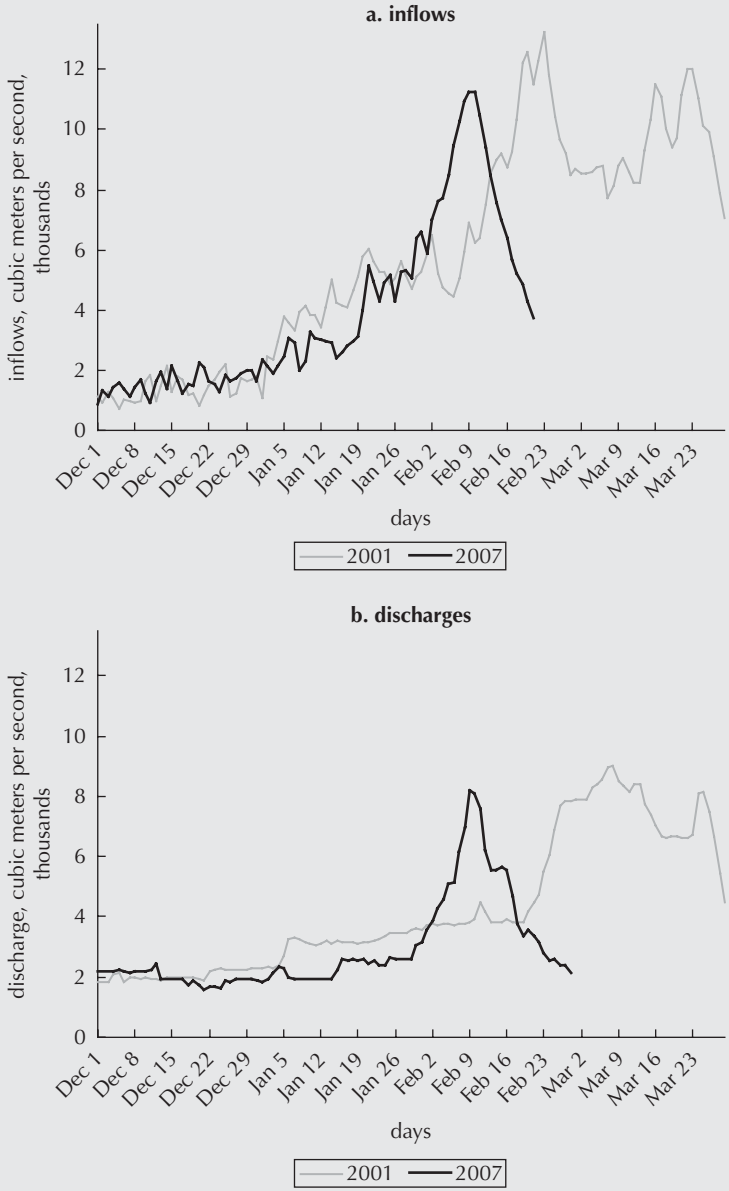
In Mozambique and neighboring Malawi, Zambia, and Zimbabwe, the torrential rains began in December 2006 and reached over 100 millimeters a day on some days. By January 2007, the Zambezi, its tributaries, and nearby smaller rivers were rising dangerously. The alert levels in Caia had already been exceeded in mid-December.

The first localized flooding occurred around Beira and Quelimane in central Mozambique in December and January, though not along the Zambezi, and the flooding was dealt with locally. The flooding in Mutarara that began later in January was initially caused when the Shire, which is downstream from the Cahora Bassa dam, burst its banks at a point near the confluence with the Zambezi. In mid-January, the districts of Caia and Marromeu on the Zambezi also experienced inundations.

Around January 20, the inflow from the Cahora Bassa reservoir began increasing rapidly. Soon, it was obvious that the dam would have to step up the discharges significantly. The INGC started planning for a fully fledged flood of the Zambezi.

The increase in discharges at the dam from 2,500 to 8,400 cubic meters of water a second was staged in coordination with Zambian water authorities over 10 days between January 30 and February 9 (see figure 6.1). On

FIGURE 6.1 Water Flows at Cahora Bassa Dam, 2001 and 2007



Source: INGC 2007.

February 4, the coordination council announced a nationwide (red) alert and activated emergency procedures. The flood wave swept through the Zambezi River valley on February 10–15, adding to ongoing localized flooding. The floods displaced over 100,000 people, who found shelter in temporary accommodation centers. Ten districts in the provinces of Manica, Sofala, Tete, and Zambezia had been flooded.

Between February 12 and February 18, because of the easing rains, the decreasing water inflows at Cahora Bassa, and the return of the reservoir to manageable levels, the discharge rate was scaled back to average rates. On February 27, as the river waters gradually receded, the INGC reduced the alert level from red to orange.

The distribution of relief items continued into March and April because some people were obliged to remain in or nearby the accommodation camps while they waited for their permanent resettlement to be organized.

The response represented a remarkable achievement for one principal reason: such a relatively small number of people injured or killed was unheard of during flooding along the Zambezi.

Cyclone Favio

The picture of the 2007 flood emergency is not complete without mention of Cyclone Favio.

Within the context of the weather patterns in and around Mozambique, existing cyclone tracking technologies are able to provide a one- or two-day warning and give an approximate impact location before a cyclone makes landfall.

Meteorologists were tracking Favio's path across the Indian Ocean from the outset, on February 11, 2007, in the midst of the Zambezi floods. After unexpectedly gaining power and veering into the Mozambique Channel on February 20, the cyclone approached southern Mozambique. Favio made landfall along the coast near Vilanculos on February 22 as a category 3 tropical cyclone with wind speeds near 200 kilometers an hour. It swept through Inhambane Province, and, on February 23, was downgraded to a severe tropical storm. It eventually dissipated over Zimbabwe.

In Mozambique, the strong winds uprooted trees, tore off roofs, destroyed crops, and damaged infrastructure. The heavy rains caused localized flash flooding, particularly in the Buzi River basin. Fortunately, the impact area of Favio was mainly separate from the flooded areas along the Zambezi. Although the number of people affected by the cyclone was high, only about 2,500 required shelter in accommodation centers.

The Response

The Government Response: CENOE

Since the onset of the rainy season in 2006–07, the INGC, CENOE headquarters in Maputo, and the CENOE regional center in Caia had been operating in a heightened (yellow or orange) state of alert. Daily updates were received from the meteorological service and the water authorities on rainfall and the levels of rivers.

When the situation began to deteriorate in the Zambezi valley, CENOE issued a recommendation to provincial counterparts to take measures as agreed and as required so as to be prepared for a flood disaster. Accordingly, on January 8, 2007, provincial emergency operations centers in Sofala and Tete were placed on orange alert, and local authorities were asked to activate the relevant contingency plans, including the immediate evacuation of the islands in the Zambezi, the transfer of vital stocks to staging areas, the identification of temporary shelters for the displaced populations expected in certain districts affected by flooding, and the immediate preparation of stores of food and water for distribution among these districts and in accommodation camps.

During the week of January 21–27, the water flows at the hydrometric stations were above alert levels and still rising. When Cahora Bassa reservoir started rapidly taking in water, CENOE alerted ministerial focal points to the possible need for a response from the capital. In Caia, the administrators of 13 districts along the Zambezi were briefed about the situation and asked to begin the implementation of district contingency plans. CENOE, members of the technical council, and the focal points started regular meetings, and relevant government officials were recalled from leave.

During the week of January 28 to February 3, the gates of the Cahora Bassa dam were gradually opened. It seemed likely that the situation that had occurred in 2001 might be repeated (see p. 206, above). On February 3, 2007, a red alert was issued to assist the four affected provinces and initiate a national response. CENOE headquarters at the air base in Maputo was fully activated. The INGC national director was named the national disaster coordinator. The CENOE branch in the village of Caia, on the banks of the Zambezi, was also activated and became the command center of the response. Over the following weeks, INGC teams, including some of the focal points, worked in shifts and traveled back and forth between Caia and Maputo.

Because of the approach of Cyclone Favio, the CENOE branch in Vilanculos was also placed on red alert, and an INGC coordination team was sent to there. The human capacity of the INGC was stretched thin.

Local Response: The implementation of Contingency Plans

The local response is critical. Local authorities are the ones who have the most accurate information and who must act most decisively. The initial response is guided by district contingency plans.

In 2007, the flood early warning system functioned as planned. Water authorities and meteorological services warned the INGC and provincial governments about the dangerously high rivers and the impending flood wave. District administrators were warned in turn. The district administrators notified village leaders and the volunteers on community risk management committees to identify places of safety and begin informing communities. Warnings were broadcast by radio. The INGC and local authorities prepared boats for evacuations. Although many people refused to leave until the last moment, they were prepared and did so on foot, in their own canoes, or through evacuation teams on boats as soon as the water reached their doors. Altogether, more than 100,000 people were evacuated. Many were assigned to accommodation camps and resettlement centers.

The local response was coordinated by district emergency committees, usually headed by the district administrator or an INGC representative. They frequently included representatives of NGOs, such as Save the Children and Concern, or other partners. The district committees often operated out of warehouses or other temporary facilities. According to observers, the local response was underresourced. Reserves were soon depleted, and fuel and communication equipment were in short supply, so partners and other levels of government needed to step up with resources. Though the local contingency stocks and contingency plans were inadequate to support a full response, they were critical during the first days while more help was being organized.

International Response: The Cluster Approach

The UN Disaster Management Team in Mozambique was aware of the developing flood emergency; its representatives were participants at the INGC technical council meetings. The deputy director of the INGC was therefore invited to brief the UN country team on the situation. Four days into the red alert, the UN country team decided to respond to the crisis by

establishing a humanitarian country team, initiating the cluster approach, and preparing a request to cover the immediate needs of an international response through the Central Emergency Response Fund.[4] The United Nations Office for the Coordination of Humanitarian Affairs dispatched a staff member to coordinate the preparation of the request for the emergency funding. Meanwhile, agencies utilized prepared stocks and began redirecting resources.

Cluster meetings took place in various places in Maputo, including the CENOE building at Mavalane Air Base. The two most active or, perhaps, most visible clusters were logistics, which was led by the WFP, and water, sanitation, and hygiene, which was led by UNICEF. These two clusters had a substantial field presence in Caia. UNICEF also had a hub in Mopeia and another hub in Mutarara. The other seven clusters that became operational during the relief effort were food security, telecommunications, nutrition, health, education, civil protection, and emergency shelter.

CENOE: Coordination, Communication, and Information

The purpose of CENOE is to ensure coordination among the actors involved in an emergency response. To achieve this purpose, it is supposed to (a) gather relevant information, (b) facilitate information sharing, and (c) promote priority setting and decision making based on the information. In theory, CENOE would acquire sufficient information to obtain an accurate picture of the situation and have the credibility and authority to ensure effective coordination.

Information

The relief phase of the flood disaster response in 2007 occurred when the number of people sheltered in accommodation camps was still rising or peaking, and the floodwaters had not yet begun to recede. During this phase, the broad categories of the information needs expressed by CENOE partners were (a) meteorological and hydrological forecasts, (b) the number and location of the people affected by the flooding and access to these people, (c) the amounts and locations of the resources available to relief agencies, and (d) the needs of the affected populations, the damage to infrastructure, and any gaps that may occur in services.

Daily meteorological forecasts were essential. They provided clues about the possible course of the situation. A National Institute of Meteorology focal point working with CENOE was responsible for supplying daily forecasts of the amount of precipitation in subsequent days. This information was sent out by fax and, later, by e-mail; it was also available on the meteorology institute's Web site. Meanwhile, a CENOE information officer was responsible for gathering data on river levels from the National Directorate of Water.

The INGC and key partners initially estimated the number of people affected by the flooding at 285,000. This was the sum of the population at risk of flooding in the contingency plans of the flooded districts. The estimate was used for planning purposes, including the financial appeal, and was the number appearing in headlines and articles during the entire relief operation.[5]

The number of people in the accommodation camps was actually lower. It was monitored closely. The number continued to rise until the floodwaters started to recede. It peaked at about 110,000. Updates on the population registered in the camps were brought daily to CENOE by assessment teams returning from the field. The numbers provided by camp leaders, district authorities, the INGC, and NGOs often did not correspond. The various reports were reconciled and recorded in a flip chart maintained at CENOE.

At the beginning of the emergency, registrations at the accommodation centers were carried out by district authorities and the INGC. The registration process was rudimentary, not much more than taking down the names of the people who claimed to have been affected by the flooding. No distinction was made among people according to how much property they had lost, and there was no disaggregation by age, gender, and other operationally relevant variables. Later, authorities were reluctant to continue with the registrations because it had become obvious that people unaffected by the flooding were flowing into the camps in anticipation of the distribution of relief goods. Thus, several unofficial accommodation camps appeared that were reportedly underserved, not least because the distribution of food from the largest United Nations agencies was supposed to be restricted to people on the officially recognized registries. The lists of names were handed by camp authorities to the United Nations agencies, which, in turn, handed them to their implementing partners for verification.

Properly describing the location of people was problematic during the crisis, because no maps showed the precise locations of homes and settlements along the Zambezi, and population data were unreliable. Even where

settlements were correctly indicated, population data might be mistaken or lacking. Place names were sometimes unclear or not uniform. Riparian populations typically live in dispersed communities and relocate occasionally. Many flights were required along the Zambezi during search and rescue operations to locate stranded people. Boats had to wend their way along the floodwaters to pick the people up and transport them to the accommodation camps. Once in the camps, they were confined with many other displaced persons in a well-defined space in which it was easier to assist them. There were 53 official accommodation camps, plus around 20 unofficial ones.

Maps were generally adequate to help in understanding the crisis situation. Accommodation camps, airfields, helicopter landing zones, and other key locations were identified using the global positioning system and [added to] maps. A joint mapping center was established at the WFP premises in Maputo and handled requests for specific maps. The CENOE center in Caia did not have many maps available, and of those distributed, the scale was too large for proper transport planning. (A scale of at least 1 to 50,000 was required.) In the district and provincial centers, maps prepared during previous floods were being used.

Information on the access to the camps by road, boat, or air was critical in relief planning. Many roads were flooded. Some camps were surrounded by enough water to be accessible by boat. Around other camps, the water was too shallow for boats, and air transport was the only option. Access information was collected for each accommodation camp and compiled in a single file at CENOE. The agencies participating in the logistics cluster, the INGC, and teams returning from field assessments were asked to help keep this information updated. Although this was done, the effort was not systematic; helicopters were sometimes dispatched to places accessible to trucks, and trucks often had to return to their base because the roads had become impassable.

The district contingency plans contained inventories of the resources available for disaster response. These resources, particularly fuel, food stocks, and cash, were quickly depleted, and local authorities turned to NGOs and other partners to fill the gap.

During the contingency planning process, the INGC asked its partners to indicate the resources they would make available to the INGC in case of an emergency. The responses were not considered satisfactory, partly because partner agencies were not in a position to commit resources at that time; funding depended on too many uncertain circumstances. This

left the INGC with an incomplete understanding of the mechanisms used by its partners to mobilize resources.

During the response, partners supplied the INGC with inventories of the goods stored in their warehouses. This information was consolidated at CENOE. An inventory of transport capacity and transport networks was maintained. The CENOE consolidated inventory was not comprehensive, however. Agencies working through channels that were separate from CENOE or the logistics cluster were often not included; such was the case also of goods in the pipeline—that is, they had been ordered and were on the way but had not yet arrived. Reportedly, on one occasion, a provincial warehouse was discovered stocked to the rafters amid the shortages at the height of the emergency.

Information on the needs of the people affected by the flooding was gathered in several ways. The first estimate involved a simple multiplication of the displaced population by the average relief standards in terms of goods and services per person or household. These estimates were used for planning purposes. Later, in February, as soon as the rivers had stabilized, a five-team, multisectoral, multiagency assessment mission was organized to visit many of the camps, conduct interviews, assess needs, and produce recommendations.

During the emergency, the CENOE branch in Caia focused on identifying gaps rather than needs. Teams were dispatched every morning to visit accommodation camps, appraise the situation, assess outstanding gaps, and monitor the progress of the emergency response. Similar daily assessment missions were carried out through district emergency operations rooms, from which INGC representatives reported their findings directly to the CENOE branch in Caia. Some agencies had their own channels of acquiring information. Thus, the Ministry of Health had a network of health posts that reported information to district health centers and provincial health departments. The Ministry of Health focal point was expected to deliver this information to CENOE.

Communications

Communication was a major problem during the disaster response. The flooding occurred in some areas that had no telecommunications infrastructure whatsoever even in the best of times. There was only a basic radio network belonging to the Ministry of State Administration in district capitals and a few administrative posts. The emergency team brought eight satellite phones; some of these were positioned in major accommodation

camps and district emergency operations rooms. A fax machine, two fixed landlines, and an erratic mobile network were also available at the CENOE regional center, and a radio room was eventually installed there by the WFP. Although a faint-signal mobile network was occasionally available in Mopeia, in the operations center, and a few other places, district emergency personnel were rarely able to take advantage of the connection because there were few mobile handsets. The communications links in the field were nonexistent. Information about the situation in the accommodation camps had to be carried back to district capitals or to CENOE.

Voice communications by radio or telephone proved inconvenient for sharing data. Communications improved enormously after broadband transmissions became available in key locations because of a broadband global area network installed by UNICEF and Télécoms sans Frontiéres. Communications between Caia and Maputo were not without difficulty. Focal points and INGC staff sometimes had to stand in line to telephone their counterparts.

The most common means of data transmission between the agencies collaborating with CENOE and the clusters was through exchanges of portable flash drives. E-mails were popular wherever connections were possible.

The logistics cluster set up a Web site that provided the minutes of meetings and other documents and common resources.

Coordination

The Division of Labor

Tasks and responsibilities were divided up along natural lines during the response. There was thus an implicit functional division within CENOE (Caia and Maputo), whereby major policy decisions were taken in Maputo, while most operational decisions were made in Caia. The INGC asked the United Nations to coordinate the international component of the response. Accordingly, almost all the clusters were led formally or informally by the WFP or UNICEF. The only exceptions were the emergency shelter cluster, which was led by the Red Cross, and the education and civil protection clusters, in which Save the Children was a coleader.

At the central level, tasks were generally divided up according to the sector (or, in some cases, the item) and the accommodation camp involved. The INGC in Caia initiated planning on who would be responsible for what and where. The drafting and maintenance of this action plan was later taken over by the two key United Nations agencies: the WFP and UNICEF.

In general, the WFP took charge of food distribution, while UNICEF was responsible for the distribution of nonfood items, particularly items distributed through water and sanitation initiatives. Through the system of implementing or executing partners, the coordinating agencies ensured the coverage of each accommodation camp and identified the organizations responsible for each area of activity within the camps. In most cases, these organizations were international NGOs (Concern Worldwide, Food for the Hungry, Oxfam, Save the Children, World Vision, and so on), the Red Cross, or departments of district governments (health, water, public works, and others). There were glitches; because of their inadequate field presence, some NGOs committed to certain tasks were unable to manage the tasks or deliver promised goods or equipment.

In the districts, the division of labor was straightforward and less formal. Usually, only a few partners were working with each local authority. Typically, these partners were local and international NGOs already involved in longer-term development projects in the districts. These partners often continued to support the same districts through the provision of resources after the contingency stocks had run out and before more help had arrived.

Mechanisms for Coordination and Decision Making

Daily briefings and meetings were the key vehicles for coordination. Information was shared, and decisions were taken each day during these gatherings. In Caia, meetings were organized by CENOE and held at least once a day, usually after the teams had returned from their assessment trips. The meetings were chaired by the INGC. They included a review of the situation and forecasts for the following few days. Focal points and team members presented details about operations, including relevant updates on initiatives and assistance projects, the latest statistics on the distribution of food and other goods and equipment, and emerging challenges. Any problems requiring decisions by CENOE or others were raised, and solutions were worked out.

Thus, for example, during the relief stage in a disaster response, an assessment team might determine that an accommodation camp's water supply is low. In this case, the agency or agencies responsible for the camp and for its water supply would be consulted during a daily meeting about the best way to deliver more clean water: by dispatching a cistern, setting up a pump, sending water purification tablets, or some other procedure. During such a daily meeting, if a district runs out of fuel or if a national disaster management authority has no more cash available to cover the per diems

of barge crews, then the focal points representing agencies capable and willing to take up the slack might be asked to address the issue. Commitments may be made on the spot and recorded, and coordinating agencies or cluster leaders are expected to follow up.

Although, in our case, the daily meetings were somewhat long, meandered occasionally if the agenda was not well managed, and represented a strain on human resources, they were universally recognized as instrumental in successful coordination.

Similar arrangements on a smaller scale existed in the district emergency operations rooms. After morning assessment missions, meetings took place to plan for the responses to the issues raised. Coordination in the districts was easier to the extent that fewer partners were involved. However, the decision-making power of district personnel was generally restricted to matters of only a local scope, and a smoothly functioning system for decision making by district focal points with links to provincial governments was not always available. An attempt was made to address these shortcomings in the system by requiring provincial representatives of the ministries to take part in deliberations at district emergency operations rooms and visit accommodation camps overnight or even for longer periods. Still, the ability of districts to be heard and obtain assistance from provincial authorities or CENOE usually depended on the importance and influence of the local coordinators, district administrators, or INGC representatives. Not all administrators were able to organize the delivery of relief goods and equipment by helicopter, and goods often arrived with some delay. Moreover, many districts lacked computers, cellular telephones, and fuel and were typically not equipped or sufficiently supported to take on a coordinating role.

The meetings in Maputo occurred somewhat less frequently and were less concerned with specific tasks. They tended to encounter and discuss issues involving interagency coordination and broader questions about the division of labor and responsibility. For example, the delivery of relief assistance was sometimes delayed by customs officials, and government intervention had to be negotiated to release the goods or equipment quickly. In this case, a focal point might call a minister to seek action. The coordination council met more or less on a weekly basis during the emergency to make any necessary high-level policy decisions.

Cluster Coordination

The cluster approach has been developed to guide the coordination of the international component of an emergency response. The cluster approach

and the strong leadership and coordination role played by the INGC were useful in many situations. According to the United Nations real-time evaluation, the system worked well (see Cosgrave et al. 2007). The water, sanitation, and hygiene cluster and the logistics cluster appear to have been the best coordinated; the other clusters were smaller and less visible. It seems that the success of within-cluster coordination depended mainly on the expertise and resources available to the cluster leads, the inclusiveness of the leadership, a collegial style in deliberations, an emphasis on partnerships rather than one-way relationships, the quality of the field presence of the participants, the existence of prior working relationships among cluster members, and the influence and decision-making power of the cluster.

The cluster leads met weekly, but between-cluster coordination was considered a fragile link. The cluster leads and the INGC also held weekly meetings to share information. The INGC did not appear to be particularly interested in the workings of individual clusters, perhaps with the exception of the logistics cluster, and it seemed to expect United Nations agencies to act as intermediaries. Focal points representing individual ministries attended cluster meetings, sometimes irregularly, and they often appeared unsure of their role and responsibilities.

Dispatching Relief

Coordination among the INGC, governmental agencies, the United Nations, and NGO partners was most often centered on the logistics cluster, which took charge of data management and helped in matching relief deliveries to needs. The logistics cluster met at CENOE in Maputo and Caia. The Maputo meetings tended to revolve around transport schedules, camp accessibility issues, the status of relief deliveries in the pipeline, operational updates, and discussions about needs and constraints. An exchange board was created to show stock inventories and information on requests for goods, equipment, and services. The minutes of the meetings were made available on a Web site. At Caia, the logistics cluster was oriented toward operations. At least once a day, the status of agency requests for transport and storage facilities was updated and cross-checked, and transport schedules and distribution plans were adjusted.

Data Management

Each accommodation camp was a basic unit in the organization of information during the disaster response. A flip chart on the accommodation camps occupied a central place at CENOE. The flip chart contained information

on the number of the potentially affected population in each relevant area, the number of people in each accommodation camp (including the newly registered), and the number of people transferred to resettlement camps. The information on the flip chart was updated daily, and a copy was stored on computer. In local emergency operations rooms, an analogous one-page list of nearby camps represented a key piece of information.

CENOE also issued a daily bulletin containing meteorological and hydrological forecasts, short reviews of the situation, and a narrative summary of noteworthy occurrences and recent steps taken in response. However, in general, a single, integrated information system was not available to serve the needs of the emergency response. The CENOE branches were not yet fully operational at the time of the floods. As a result, many of the operational arrangements and data management procedures were ad hoc.

The data management system used by the WFP was the most sophisticated. This was the joint supply tracking system, the generic United Nations logistics system used globally during the response to emergencies, particularly food aid emergencies. The WFP, which is custodian of the system, set up a database in Caia to help track the dispatches of food and nonfood aid (UNJLC 2007a).

Generally, the information systems used in Mozambique might be called file systems. Information was stored and transmitted, usually in computer files, via flash drives or e-mails. The most common data file format was the Excel spreadsheet. Many agencies had individual, well-developed approaches to spreadsheet presentations. Lists of accommodation camps, data on aid deliveries, needs assessments, comments on the situation, and other information were recorded at various levels of detail. Separate spreadsheets were used to store and update data on warehouse stocks, delivery status and inflows of aid, and other indicators.

The information content of data was only partially standardized. The types of relief items were ultimately rather limited; they were encompassed in a few categories, such as big or small jerry cans, kitchen sets, buckets, blankets, tents (by capacity), cooking oil, maize or grain, soap, tarpaulins, water pumps, learning kits, and others. In this sense, achieving a common language was possible. Nonetheless, there was often confusion because the units were not clear (how many blankets are in a set of blankets?). Moreover, it was frequently difficult to determine how to translate the information into numbers of people whose needs were met.

There were no commonly accepted standards for assessing needs. The information was usually gathered as narratives. This is the reason

the consolidation and analysis of information on needs, beyond the initial estimates, were never satisfactory. An innovation was UNICEF's rolling assessment, which was a spreadsheet presentation of regularly updated quantitative and qualitative information on the situation in each camp under UNICEF responsibility, including information on steps taken to address particular issues.

These spreadsheets and other information were supplied each day to the INGC and CENOE for processing and consolidation. INGC information managers compiled and updated various Excel tables to help understand the big picture. These tables included data on the arrival of goods in warehouses, the dispatches of goods to accommodation camps, daily distribution plans, and population flows in and out of camps. Unfortunately, CENOE only had the full-time equivalent of eight information management specialists dispersed among Caia, Maputo, and Vilanculos. Even if the specialists had worked without letup, the INGC did not have sufficient capacity to process the large volumes of incoming data in diverse formats. The mass of spreadsheets tended to grow quickly.

Conclusions

Lessons Learned in Coordination and Information Sharing

Government Leadership Is Critical

The instrumental role of INGC leadership in the preparedness and contingency planning exercises and during the subsequent disaster response has been universally acknowledged. The INGC took direct charge of the emergency response, addressed coordination issues, and exercised its authority confidently.

In such an environment of decisive leadership, international coordination was relatively straightforward. The participating agencies were tied to the response effort by a solid line of accountability; there was a strong incentive not to lose the faith and trust of the INGC.

That the INGC was prepared for its role and ready to exercise its authority was the result of substantial investment following the flooding in 2000 and 2001. The agency had been significantly strengthened, provided with a direct line of contact with the prime minister, and placed within an institutional structure appropriate for such an important actor in civil defense, including access to a common emergency radio frequency and command of various military and paramilitary services.

The Application of Authority Needs Structure

Together with its branches and the focal points, CENOE provided the INGC with an institutional structure through which to channel authority. Observers attributed some of this outcome to CENOE's interministerial character and its separate institutional identity.

The Common Physical Space at CENOE Facilitated Information Sharing

Participants found that the common working areas made available at CENOE and its branches fostered information sharing. Proximity encouraged communication and interaction. Emerging issues were dealt with quickly and efficiently through formal and informal meetings. It was still easy to agree. However, it was also easy to disagree, but then talk and seek compromise.

Decision Makers Should Be Directly Involved

The participation of decision makers and the focal points—their direct authorized delegates—in CENOE deliberations and operations was critical to successful coordination. One may conclude that the terms of reference of the focal points were well conceived. Major issues were resolved quickly. Some observers felt that the eyewitness factor—the more direct experience of issues by decision makers—that was promoted by the CENOE approach may have contributed to the rapidity of the response. This principle seemed to apply equally at the central level and at the district level, where the eventual presence of the provincial representatives of ministries in district operations centers reportedly boosted performance.

Good Data Management Is Important

Data management was a weak link in the emergency response in 2007. The data management capabilities of CENOE were not fully developed at the time of the flood. It was therefore difficult for CENOE to provide a satisfactory picture of the emergency response and of disaster preparedness. Not all relevant information flowed through CENOE, and not all information that did flow through CENOE was comparable. Data were being sent in different formats, according to different units and standards of measurement, and as outputs from different systems. Thus, for example, the logistics management system supplied information only on the movement of goods through the logistics cluster. There was no real-time or near

real-time monitoring and no automatic updating or consolidation. The updating efforts undertaken manually, however heroic, were insufficient. Moreover, the global database on needs was incompatible with the database on the status of aid deliveries, and data quality could not be guaranteed.

Any imperfections in the broad picture may impair decision making and lead to imperfect priority setting. For example, there were reports that accommodation camps were less well provisioned and serviced, the more distant they were from Caia. It seemed sometimes that CENOE was only able to identify and fill gaps or wants as they emerged, rather than follow any coherent plan of response. (In principle, such an outcome may be acceptable.) Though most of the data were available at CENOE, they were never quite at the fingertips. Therefore, the value added by a proper, well-functioning information system would have been high.

Recommendations: The Information Management System

Information systems encompass all the mechanisms for the creation, capture, analysis, sharing, transfer, and use of information. In general, the purpose of an information system is to provide timely, relevant information to people who need it and in a manner that supports decision making. A proper information system facilitates the integration of information, helps ensure that the information is shared, and provides decision makers with insights into the options for action, together with information about the possible consequences of taking (or not taking) such action.

An information system is not merely a computer and content management software. It is also people, institutions, and procedures. If an information system fails, it is almost always because the incentives embedded in institutions have prevented people from sharing information and using it effectively.

That no consistently successful information system has been developed for large rapid onset disasters despite decades of effort suggests the solution is not straightforward or easy. One is inevitably tempted to try to create a comprehensive, custom-built, cutting-edge system that foresees all conditions and circumstances, sets rigid specifications, and is imposed on users. This temptation may gain intensity if funds and resources suddenly become available.

The temptation should be vigorously resisted. There is no one-size-fits-all solution for complex situations such as emergencies. In any case, the cost of custom-built systems tends to balloon; the categories conceived by computer technicians often fail the test of operational relevance; and

users are more easily won over, the more they have to do with the development of the solutions.

Several more or less well-established principles have emerged in information system design for disaster management, for example:

- Information systems perform more effectively if they have been designed with a clear purpose, such as addressing a specific information problem.
- An inventory of sources of information, the identification of users and their specific information needs, and an analysis of general information requirements are necessary and important steps in the design process. These steps are not straightforward in disaster management. The nature of the information to be collected and the information needs of practitioners in planning and monitoring disaster preparedness, relief, and recovery are still controversial.
- The information provided by the system must be useful in decision making. To this end, system designers must determine, for instance, the characteristics of operationally relevant output and data formats that support decision making. Much time was spent during the response to the floods in 2007 in collecting and analyzing information that was never acted upon.
- Procedures and protocols are normally required for capturing, analyzing, sharing, and acting upon relevant information, once identified. The roles and responsibilities of decision makers and other actors must be clear.
- Simplicity and ease of use are usually rewarded by good results. It is not realistic in a country such as Mozambique to expect that a sophisticated, complicated system will be understood and taken up by all partners and that the high maintenance costs of the system will be maintained. A set of simpler, more well focused tools may be taken up more naturally by users. The technical demands and training requirements of the system must be limited. System training costs alone may otherwise easily reach two-thirds of the total system budget.
- The system should be sufficiently flexible to respond to evolving needs, incorporate the information provided by various partners during a disaster response, and allow for expansion to include fields and functions not foreseen by the system designers. The system should accept formats and other data components that are interoperable, easy to understand and use, and well supported.
- Common data standards are essential in collecting and sharing information from different sources. In disaster management, this means an effort must be undertaken to standardize the methods used in creating

needs assessments and conducting surveys. Data reports must be compatible and comparable. To a large extent, this requirement was not met during the response to the floods in 2007. Standard units of measurement and analysis must be defined (accommodation camp, household, family, village, district). Georeference codes and the georeferencing system must be agreed upon and must also be flexible and accept variations. Special terminology—such as the terms affected, at risk, basic needs, pledged, and committed—must be defined and be recognizable. In any case, one should be conscious of the balance required between the precision of assessments of needs and the speed of action in relief and reconstruction.

The wheel does not have to be reinvented. Many initiatives have been undertaken, and much experience has been accumulated. The United Nations Office for the Coordination of Humanitarian Affairs has been researching the topic for years, although the approach tends to favor the needs of the international humanitarian community over the needs of national authorities. Structured humanitarian assistance reporting standards have been developed (GIST 2000). The Tsunami Recovery Impact Assessment and Monitoring System is developing monitoring and evaluation indicators for disaster recovery and examining methods for their application (UN, WHO, and IFRC 2006). The Pacific Disaster Center is conducting research on a common disaster management information system, including performance standards and indicators (http://www.pdc.org/iweb/pdchome.html). The Southern Africa Human-Development Information Management Network has been successfully consolidating disaster management information in the region and may offer lessons (http://www.sahims.net/default. htm).

Accordingly, we now present recommendations for establishing and improving the CENOE information management system.

A Common, Flexible Platform (Web Site)

Many stakeholders tend to believe (and we concur) that a sensible solution involves building the information system as a shared platform (for example, a Web site or a portal), a data repository, and an information clearinghouse for multiple users. The system and data standards should be defined. The system should permit automatic real-time updating based on inputs. Access to the system might be restricted. Such a platform, accessible over a network (not necessarily Internet), would naturally facilitate information sharing and collaboration. It would be capable of hosting multiple sources, systems, and tools.

Ideally, the platform would be based on simple or well-known interoperable components such as spreadsheets or text files. It should also support mapping and other geographic information system applications.

Web site systems show drawbacks in the context of disaster management in Mozambique: (a) The technical requirements may be substantial, including access and connection costs. (b) The system may turn out to be too sophisticated for the limited capacity of a country such as Mozambique. (c) The volume of information tends to grow quickly because it finds an outlet, but this also means there should be active content management and easy ways to classify and filter information. (d) Data downloads take time in a computer- and network-poor environment in which electricity and telephone lines may also be scarce.

Information Management as a Full-Time Job

Preparing information so that it may be shared is not the highest priority of operational staff in an emergency. Time is in short supply, and there is much to do, particularly among development and aid agencies that do not receive reinforcement from their headquarters during a disaster. In Mozambique, relief staff often had to compile and submit data during times meant for rest.

It is important to acknowledge that information management is a resource-consuming activity and that it requires investment. The creation of an effective disaster information management system means that training in information management and information sharing must be introduced explicitly into the terms of reference of staff. There may also need to be other incentives to motivate people to share.

Also, there will be no data quality without expert human oversight. Data without metadata—data that provide information about the source, format, quality, and other relevant characteristics of the original data—are often useless. Metadata are essential to the credibility of a data-based system.

Build the System with Partners

The INGC may be able to build the system in Mozambique alone and then present it to partners. However, a more promising approach might involve building the system together with users, that is, line ministries, United Nations agencies, and NGOs. This should, first, help create a sense of ownership among participants. A tool imposed by one agency has a smaller chance of success. A tool developed jointly engages many in the effort to succeed.

Second, the process of creating the system jointly would promote the agreement on data and information standards that is necessary if the system is to work. Good solutions might be borrowed and implemented together. Methods would be agreed on for the classification, organization, and coding of standard types of information, including information on the decisions taken during a disaster response. The procedures for the entry, presentation, and processing of information on the system would have to take into account the needs and capabilities of typical first responders, but also be relevant to the needs of an effective response. For example, the system would reflect the importance of age and gender breakdowns in beneficiary registrations; the importance of caloric intake data in health monitoring; and the importance of baseline data in calibrating the response and facilitating future evaluations. This was all lacking during the response to the floods in Mozambique in 2007. The INGC should explicitly seek agreement among its partners on these issues.

Third, user buy-in is necessary if a system is to succeed. There are many reasons for user reluctance to participate. The preparation of information for sharing may be costly, particularly if one must alter internal systems. Information is power, and agencies may fear that full transparency and full revelation of their capabilities will reduce them to passive subordinates of others. Building the system together will minimize these problems in buy-in and help designers and agencies understand the benefits of sharing information. Although political endorsement, INGC's authority, and decisive leadership may be sufficient to encourage users to adopt the system, acceptance is not guaranteed. Laws and regulations may be necessary to impose an obligation to supply information. This would be the stick to go with the carrot of quick access to an information system that helps solve real problems. Certification for fast-track customs clearance and the other incentives might be offered to increase the number of users and contributors participating in the system and sharing information.

Incorporate Local Knowledge and Ability to Respond

The integration of local information and the empowerment of district emergency response capabilities mean that local inhabitants must be involved in the system and in the response. Local contingency plans—a critical, yet underfunded component of the response—deserve to become incorporated in the information system. Providing district staff with better access to information should empower the local level, which, together with adequate resources, should improve the effectiveness of the response and strengthen accountability and transparency.

This became clear during the 2007 emergency. The rich knowledge already available in the affected districts was not fully utilized. Reportedly, many hours of helicopter flight time and the use of many other resources might have been spared during search and rescue operations if emergency staff had understood the habits and coping strategies of local populations and been more aware of where to look for people and which people to move to higher ground.

Facilitate Self-learning

Facilitate self-learning during emergencies. Learning from experience is the most effective way of improving. Documenting an emergency response is necessary if one is to scale up best practices and correct mistakes. The information system should include data that answer the following questions: What's the optimal amount of emergency stocks? Where should stocks be positioned in preparation for an emergency? What are the scenarios for planning for relief and reconstruction? What is the anticipated cost of each scenario per displaced person? By agency? Which methods of transport and delivery are most effective? The drafting of evaluation reports, participation in workshops on lessons learned, and other self-learning exercises that are based on evidence should become part of institutional practice and staff training.

Satellite Communications

Communications was a weak point of the response. Because of inadequacies in the telecommunications networks available in Mozambique and because the emergency information network should be disaster-proof, a satellite link with data transmission capabilities emerges as a viable option for communications during emergencies. Accordingly, the data formats used in the information system should be economical to reflect the cost and bandwidth limitations of the satellite solution; speed and performance may matter more in the user experience and, hence, in the take-up of the system.

Longer-term Caveats

Better Information Infrastructure

A proper information system relies on a comprehensive information infrastructure. Mozambique lacks such an infrastructure. Except for the Limpopo River, in the south, detailed flood zone mapping does not exist. Such mapping should indicate settlements, data on the sources of livelihoods,

and other relevant baseline and historical data. The network of monitors for early warning and evaluation is inadequate and lacks real-time data transmission capabilities. No hydrological models of the major rivers exist to facilitate near real-time flood modeling and short-term detailed prediction. There are not many recent fine-scale maps. Once installed, modern geographic information systems and capacities depreciate quickly through staff attrition and lack of maintenance. The population has not yet become educated about the nature of disasters and the remedies, and policy makers have not adequately understood the value of disaster preparedness. Data collection is not well developed or part of institutional practice; even the best information system will only deliver the data that are available.

It will take time and investment to build the infrastructure. Until then, islands of cutting-edge disaster management technology such as CENOE will never achieve their full potential.

A Culture of Using Data for Decision Making

A culture of the systematic use of information in decision making needs to be vigorously encouraged in Mozambique. No information system will be useful if policy makers and decision makers do not demand accurate information.[6] Have reports been requested by senior government officials that exploit and analyze the wealth of information created through disaster preparedness schemes and experiences in relief and reconstruction? Is any senior manager actively interested in the amount of resources spent in total and by each actor? Is anyone interested in the impact? It is unrealistic to expect an information system to perform well if no one is interested. Even good people need motivation. Knowledge that one's work is demanded by decision makers and used for important purposes is motivating.[7]

With time, a self-reinforcing community of practitioners will emerge and exert a steady demand that will nourish the system. Demand will grow for national statistical systems that cover disasters more comprehensively. Hopefully, the issue will be taken up by local research institutes, and local expertise will start to develop. As the subject gains a more prominent position in the public debate, more questions will be asked, and there will be more government accountability for disaster reduction.

Build Trust in the System

During emergencies, information is an asset that gives its custodian bargaining power. This reduces the incentives to share information and reveal

one's own capabilities. Although the example of Mozambique in 2007 appears positive in the sense that there was more sharing, many agencies and other partners failed to be transparent and straightforward.

This is a matter of trust. The new management of the INGC has been building trust, but the process is long. Partners do not wish to cede control over their information systems especially if they feel that their information and their physical assets will be used for political purposes or in a wasteful manner.

Institutionalize Capacity

The relatively smooth coordination among the actors during the flood response has been credited largely to the extensive working relationships and personal connections already existing among the agencies prior to the emergency and to the personality and drive of the current INGC management. There is a perception that insufficient effort has been directed toward integrating this capacity in institutions; the capacity is currently exposed to loss because of staff turnover.

A Change in Donor Attitude

In general, the prevailing approach in the humanitarian community is to fund relief and reconstruction rather than mitigation and preparedness and to empower the United Nations and NGOs to hurry in and run the response if a disaster strikes. In southern Africa, this has been the approach for decades, so local capacities for preparedness and emergency response have either failed to develop or become easily marginalized by the more well-resourced external assistance.

However, there is no excuse for such an attitude in a country with a benevolent and functioning government and in which disasters are so recurrent that they have become a part of everyday life. Despite all the problems inherent in being the 10th poorest country in the world, Mozambique needs to be given a chance to develop its own capacities. Some mistakes will inevitably be made on the way, but, without them, there will be no gain.

Donors have the means to facilitate coordination and promote discipline in information sharing among external partners and with the government. This may be accomplished by creating better incentives, for example, by explicitly making information sharing and collaboration with the government, including local authorities, a requirement if partner agencies are to receive donor funding.

Notes

1. Invaluable help has been provided to the author by Aniceto Bila and Luisa Matsinhe of the World Bank, in Maputo; Melissa Fernandez of the United Nations Children's Fund; Noè Machado, Olga Morar, and Casimiro Sande of the National Institute for Disaster Management (INGC); and Wolfgang Stiebens of the German Agency for Technical Cooperation. The author wishes to thank the following for their time and their insightful consultations: Rita Almeida, Valdemar Jessen, Cesar Manfate, Ana Cristina Manuel, Elizete Manuel, Feliciano Mataveia, João Ribeiro, Josè Sande, and Paulo Zucula (all of the INGC); Olanda Bata (Famine Early Warning Systems Network, United States Agency for International Development); Moises Benessene and Salvador Domingos (National Institute of Meteorology); Antonio Nucifora and Osborne Shela (World Bank, Maputo); Domingos Chiconela, Jeremy Hopkins, and Patricia Sousa (United Nations Children's Fund); Noel Cooke, Albert Losseau, and Erik von Pistohlkors (Delegation of the European Commission to Mozambique); Vincento Costudio and Rodrigues Dezanove (Southern Regional Water Authority); Xavier Domingos (Ministry of Health); Lisa Frist (Jacana); Sune Gudnitz and Georges Tadonki (United Nations Office for the Coordination of Humanitarian Affairs); Will Helyar (Concern Worldwide); Chris McIvor (Save the Children United Kingdom); Celio Mugabe (Ministry of Public Works and Housing); Kerry Selvester (Save the Children United States); Jeronimo Tovela and Nadia Vaz (World Food Programme); Jorge Uamusse (Mozambique Red Cross Society); and the village disaster risk reduction committee and others who participated in a group interview at the Bras accommodation camp.
2. In specific areas of disaster preparedness, coordination is traditionally carried out by an agency other than the INGC. For example, the Ministry of Agriculture leads the food security assessment exercise through the Technical Secretariat for Food Security and Nutrition, and the avian flu contingency plan is coordinated by the Ministry of Agriculture and the Ministry of Health.
3. Moral hazard is the prospect that, by not behaving as expected, one party may be able to avoid assuming the full consequences of its actions and to maximize its own benefit at the expense of another party.
4. An issue arose as the international response was being organized. The government seemed unwilling to issue an official international appeal for assistance. It had determined that the country had the capacity and resources to respond to the crisis, especially because these could be combined with the resources of partners already active in the country. However, the government's red alert and the INGC's informal requests for assistance proved sufficient for the United Nations to declare an emergency and use the Central Emergency Response Fund.
5. Many observers suggested that the number was inaccurate because not all people at risk of a disaster are actually affected by it, and not all people affected by a disaster need emergency food aid. Thus, not all crops were lost; maize kernels were sticking out above the water in many places, and many people switched to fishing in the meantime. In any case, no consistent effort was made to adjust the estimates of the number of people affected by the flooding, and the total of 285,000 was often repeated.

6. For example, because of a malfunction in the radio network, the top-notch Limpopo model project has not received new data for a year, and no one has made a fuss.
7. The broader question is whether agencies involved in disaster response are interested in using the data at all. The culture of the humanitarian community revolves around action and saving lives. The urgency of a disaster situation may warrant some disregard for orderly information processes early on. However, it is more difficult to argue that within a week or two after a disaster has struck, a greater concern for efficiency and evidence-based decision making will not help save people's lives.

References

Cosgrave, John, Célia Gonçalves, Daryl Martyris, Riccardo Polastro, and Muchimba Sikumba-Dils. 2007. "Inter-Agency Real-Time Evaluation of the Response to the February 2007 Floods and Cyclone in Mozambique, May 2007." Report, Inter-Agency Standing Committee, Geneva.

de Ville de Goyet, Claude, and André Griekspoor. 2007. "Natural Disasters: The Best Friend of Poverty." *Georgetown Journal on Poverty Law and Policy* 14 (1): 61–94.

FTS Database (Financial Tracking Services Database). United Nations Office for the Coordination of Humanitarian Affairs. http://ocha.unog.ch/fts2/ (accessed September 2007).

GIST (Geographic Information Support Team). 2000. "SHARE: Structured Humanitarian Assistance Reporting." Concept paper (April 20), United Nations Office for the Coordination of Humanitarian Affairs, Geneva.

Government of Tete Province, Mozambique. 2006. "Plano Provincial de Contingência para Época Chuvosa e de Ciclone 2006/07." Report (September), Government of Tete Province, Tete, Mozambique.

INGC (National Institute for Disaster Management). 2005. "Mozambique National Report on Disaster Reduction." Paper presented at the "World Conference on Disaster Reduction," Kobe-Hyogo, Japan, January 18–22.

———. 2006a. "Proposta para Estabelecimento e Funcionamento do Centro Nacional Operativo de Emergência." Report (October), INGC, Maputo.

———. 2006b. *Boletim de Ocorrências*. Periodical report (October), INGC, Maputo.

———. 2006c. "Plano de Contingência de 2006/07." Report (October), INGC, Maputo.

———. 2006d. "Plano Director de Prevenção e Mitigação das Calamidades Naturais." Report, INGC, Maputo.

———. 2007. "Diagnóstico Preliminar e as Acções de Reconstrução Pós Calamidades." Report (March), INGC, Maputo.

Lucio, Filipe, Americo Muianga, and Mike Muller. 2007. "Flood Management in Mozambique." In *Climate Risk Management in Africa: Learning from Practice*, eds. Molly E. Hellmuth, Anne Moorhead, Madeleine C. Thomson, and Jim Williams, 15–30. Climate and Society 1. Palisades, NY: International Research Institute for Climate and Society, Earth Institute at Columbia University.

OCHA (United Nations Office for the Coordination of Humanitarian Affairs). 2007a. "Flash Appeal: Mozambique Floods and Cyclone." Flash Appeal, Consolidated Appeals Process, OCHA, Geneva.

———. 2007b. "Mozambique Floods." OCHA Situation Reports (February-March), OCHA, Geneva.

UN (United Nations), WHO (World Health Organization), and IFRC (International Federation of Red Cross and Red Crescent Societies). 2006. "(TRIAMS) Workshop, Bangkok, 3–5 May 2006: Tsunami Recovery Impact Assessment and Monitoring System." Workshop report, United Nations, WHO, IFRC, and Swedish International Development Cooperation Agency, Geneva.

UNDMT (United Nations Disaster Management Team). 2005. "United Nations System Mozambique Inter-Agency Emergency Preparedness and Response Plan, 2006." Report, UNDMT, Maputo, Mozambique.

UNDP (United Nations Development Programme). 2006. *Human Development Report 2006; Beyond Scarcity: Power, Poverty and the Global Water Crisis*. New York: Palgrave Macmillan; New York: UNDP.

———. 2007. *Human Development Report 2007/2008; Fighting Climate Change: Human Solidarity in a Divided World*. New York: Palgrave Macmillan; New York: UNDP.

UNJLC (United Nations Joint Logistics Center). 2007a. "Mozambique 2007: Highlights." Archived database, UNJLC, World Food Programme. http://www.unjlc.org/23003/moz/.

———. 2007b. "Logistics Cluster Meeting." Report series, Mozambique, February-March, UNJLC, World Food Programme, Rome.

Wiles, Peter, Kerry Selvester, and Lourdes Fidalgo. 2005. "Learning Lessons from Disaster Recovery: The Case of Mozambique." Disaster Risk Management Working Paper 12, Hazard Management Unit, World Bank, Washington, DC.

7

Data Management Systems after the Earthquake in Pakistan: The Lessons of Risepak

Samia Amin

Overview of the Disaster

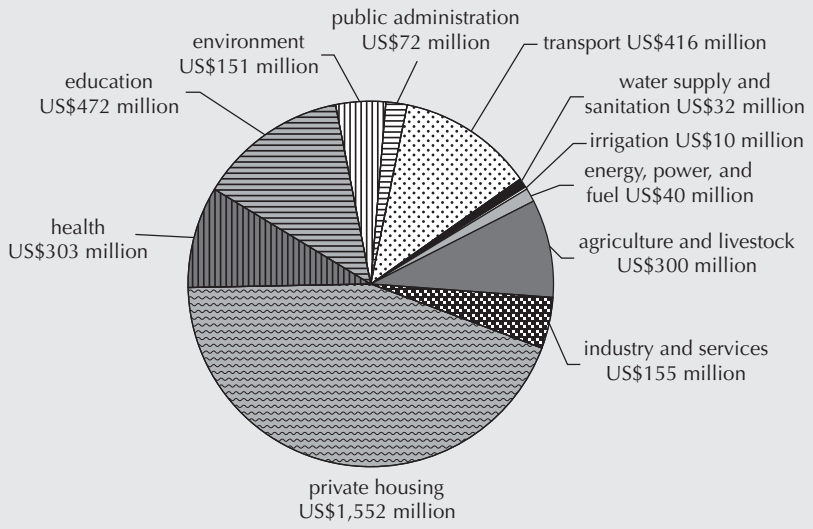
On the morning of October 8, 2005, a massive earthquake measuring 7.6 on the Richter scale struck Afghanistan, India, and Pakistan.[1] The earthquake devastated a large portion of Pakistan-administered Kashmir—known as Azad Jammu and Kashmir—and the eastern districts of Pakistan's North West Frontier Province.[2] Over 73,338 people died in the earthquake; 69,412 people were seriously injured; and nearly 3.5 million people were rendered homeless. Although this death toll was a quarter that of the Asian tsunami, the number of people left homeless was three and a half times greater (ERRA 2006a; UNHCR 2006).

The total area affected was 30,000 square kilometers, encompassing 9 districts, 25 *tehsils* (municipalities), and 4,000 villages. The damage to economic assets and infrastructure was equally debilitating: 600,000 houses were leveled, and 6,298 schools and 796 health facilities were either destroyed or severely damaged (ERRA 2006a). The initial damage and needs assessment, conducted jointly by the World Bank and the Asian Development Bank between October 24 and November 5, 2005, estimated that the overall cost of recovery would be US$5.2 billion (ADB and World Bank 2005). This included the estimated cost of relief, livelihood support, and reconstruction.

It excluded the US$576 million in indirect losses arising from losses in incomes. Figure 7.1 illustrates the cost estimates, by sector, of long-term reconstruction.

The earthquake posed a significant humanitarian challenge: most of the villages affected were in remote mountainous areas that were difficult to reach in normal times. Moreover, the earthquake had damaged over 6,440 kilometers of roadway, and the landslides that accompanied the earthquake blocked roads, making access more difficult. Still, the prospect of the onset of a brutal winter added to the urgency of the humanitarian crisis. There were fears of a second wave of deaths due to infection, starvation, or cold. Telecommunications were disrupted by the earthquake, as was the supply of electricity and water. Continuing aftershocks—numbering 147 the day after the earthquake and more than 1,000 over the next three weeks—complicated the disaster response. The humanitarian threat was rendered even more urgent by the refusal of many to leave their land to relocate to safer and more secure valleys.

FIGURE 7.1 Reconstruction Costs by Sector, Estimates, November 2005



Source: ADB and World Bank 2005.
Note: The total costs were estimated at PRs 208 billion (US$3.5 billion).

There were political and administrative constraints as well. Because of the proximity of Azad Jammu and Kashmir to the border with India and given India's and Pakistan's long-standing tensions over the status of Kashmir, telecommunications in the region were limited, and basic information tools such as maps and censuses were not readily available. Prior to the earthquake, cell-phone companies were not operating in the region. Before the disaster, administrative capacity in Azad Jammu and Kashmir was relatively weak compared with the situation in North West Frontier Province. Several interviewees working in the government, international humanitarian organizations, and nongovernmental organizations (NGOs) indicated that staff capacity and resources were more abundant in the province, particularly with respect to information technology resources. The earthquake exacerbated the various weaknesses. The proximity of Muzaffarabad, the capital of Azad Jammu and Kashmir, to the epicenter of the earthquake resulted in significant casualties among government officials and caused extensive damage to government infrastructure.

The Mobilization of Assistance

As news of the scale of the devastation spread, governments and NGOs quickly mobilized to provide relief. The government of Pakistan issued an urgent appeal for help and deployed the army to act as a primary actor in relief: two army divisions were sent to North West Frontier Province and to Azad Jammu and Kashmir to assist in relief efforts. The difficulty of the terrain necessitated a significant deployment of aircraft, one of the largest deployments ever recorded in response to a natural disaster.

The government response was coupled with a tremendous response from civil society. Over 100 local and international nonprofit organizations were involved in the mobilization of funds and the provision of relief. Thousands of private citizens organized independent initiatives to collect and distribute goods. According to estimates, civil society groups mobilized US$100 million in donations within the first three weeks of the earthquake (ADB and World Bank 2005). There were huge in-kind donations of goods and services as well. Local, expatriate, and foreign professionals flocked to Azad Jammu and Kashmir and to North West Frontier Province to volunteer their expertise.

The international response by bilateral and multilateral donors was also substantial. After a ministerial level donor conference in Geneva, the secretary-general of the United Nations issued a flash appeal for

US$550 million for immediate relief assistance. By November 11, 2005, 83 bilateral and multilateral donors had pledged US$2.5 billion in monetary support (ADB and World Bank 2005). There have been many more commitments since then by a variety of bilateral and international donors.

The Distribution of Responsibilities

At the time of the earthquake, there was no designated agency in Pakistan with the mandate and the capacity to deal with a disaster of this magnitude.[3] The government quickly established the Federal Relief Commission, on October 10, 2005, two days after the earthquake, to supervise and coordinate relief efforts and mobilize resources. Search and rescue efforts were primarily conducted by the Pakistan army and local residents, with some, albeit limited, international assistance. On October 24, 2005, the government also established the Earthquake Rehabilitation and Reconstruction Authority (ERRA) to take charge in planning a comprehensive response to the disaster. ERRA took some time to gain momentum, however, and did not become a key player until after the relief phase had been completed (OCHA, UNDG, and UNDP 2006).

The primary actors during the relief phase were the Federal Relief Commission, the army, and the United Nations. Whereas supply management and the logistical distribution of goods were primarily facilitated by the army, the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) quickly became the hub for the coordination of the relief phase. President Pervez Musharraf had requested help from the United Nations on the afternoon of the disaster, and a United Nations Disaster Assessment and Coordination team had arrived in Pakistan within 24 hours.

This team, the humanitarian coordinator, and the United Nations country team decided to field the first full application of the cluster approach in the humanitarian response in Pakistan. In the cluster approach, specific lead organizations are made responsible for areas in which there is an identified gap in the humanitarian response (OCHA 2005). These areas, as well as the corresponding groups of organizations and their branches, are known as clusters. Ten cluster headquarter units were quickly established in Islamabad, the capital of Pakistan. The clusters dealt with food and nutrition, water and sanitation, health, emergency shelter, early recovery and reconstruction, logistics, information technology and telecommunications, camp management and protection, and education. Field cluster sites were also established at all locations where the United Nations had a strong presence.

All interviews with actors involved in the relief phase indicate that the cluster meetings served as valuable and, often, primary sources of information sharing and coordination during the relief phase. There was, however, substantial variation in performance from cluster to cluster, depending on the initiative of the individuals in charge. (For an evaluation of the cluster approach, see ActionAid International 2006; IASC 2006).

The Transition from Relief to Recovery and Reconstruction

Overall, the efforts during the relief phase were generally considered a success. The much-dreaded second wave of deaths never materialized. In large part, this was because the relief effort was fairly well conducted and because of the good fortune of a mild winter. Much of the credit for the success of the relief phase has been attributed to the efforts of the government and the efficient deployment of the armed forces (IASC 2006).

The relief phase officially ended on March 31, 2006. The Federal Relief Commission was integrated into ERRA. Although the relief phase was declared over, residual issues persisted. In August 2006, nine months after the disaster and five months after the official end of the relief phase, many people were still living in tents. A transitional relief cell was therefore created within ERRA to coordinate an early recovery plan devised to bridge the gap between relief and reconstruction. OCHA was supposed to withdraw completely by the end of the relief phase and transfer its authority to the government and to the newly created Office of the Resident Coordinator.

There is general consensus that some momentum was lost in the transition from relief to recovery. The winding down of OCHA's participation occurred more slowly than anticipated. The clusters were disbanded in March 2006 and replaced by working groups. During the relief phase, the primary responsibility for coordination lay with the agency acting as cluster lead; the relevant government ministry provided backup. Beginning with the early recovery phase, the roles were nominally reversed, and government ministries were made responsible for taking the lead in heading these groups. As might be expected, as in any sudden institutional shift, there were problems during the transition. Successor arrangements were implemented less quickly and less smoothly than anticipated. This was caused in part by the initial capacity gaps in ERRA and among the provincial and Azad Jammu and Kashmir authorities (OCHA, UNDG, and UNDP 2006). For example, there are mixed views regarding the timing of the handover of responsibilities. Some

interviewees felt that the transition was premature and that the working groups were less efficient than the clusters. Others indicated that the clusters had remained in place too long and had supplanted government ownership and leadership in the recovery process.

After initial teething problems, ERRA went through a process of internal reform between March and May 2006. The key actors in the new organizational structure that emerged include (a) ERRA as a central Islamabad-based agency responsible for coordinating, planning, financing, and monitoring; (b) secretariats servicing governments in North West Frontier Province and in Azad Jammu and Kashmir and responsible for provincial and state strategy formulation; the secretariats are known as the Provincial Earthquake Reconstruction and Rehabilitation Authority (PERRA) in the province and the State Earthquake Reconstruction and Rehabilitation Authority (SERRA) in Azad Jammu and Kashmir; (c) district reconstruction units and district reconstruction advisory committees in each district to execute all reconstruction and rehabilitation projects, disburse funds for projects, and submit monthly and quarterly progress reports to PERRA and SERRA. Interviews with some district officials and local NGO staff reflected the sentiment that because of the creation of PERRA, SERRA, and district reconstruction units, decision-making and monetary power had shifted from district and provincial line ministries to these new administrative structures.

ERRA identified 14 reconstruction sectors. These consist of housing, education, health care, livelihood, transportation, agriculture and livestock, environment, power generation, protection, water supply and sanitation, industries and tourism, transitional relief, telecommunication, and governance. ERRA adopted a policy to build back better, specifying strict guidelines for building seismically resistant homes and facilities (ERRA 2006b). International and local organizations working with the government on home and facility reconstruction must abide by these guidelines.

ERRA adopted an elaborate monitoring system to oversee the reconstruction process and to ensure that reconstruction guidelines are met. Partner organizations must have their reconstruction plans approved and obtain a no-objection certificate from ERRA. To obtain the certificate, they must agree to submit regular reports to district reconstruction units, which collate the reports and send them to PERRA and SERRA. Although relief and reconstruction agencies understand the necessity for quality control and

close monitoring, there is some frustration with the delays associated with the approval process and the heavy reporting requirements.

Disaster Management Information Systems in Pakistan

The earthquake in Pakistan resulted in a deluge of organizations and individuals eager to provide assistance. For weeks after the earthquake, the roads to Azad Jammu and Kashmir and to North West Frontier Province were blocked by the influx of people trying to reach the affected districts. Coordination of this response posed an enormous challenge, particularly in the absence of readily available information on the districts. One of the most urgent problems that emerged after the disaster was the lack of information on the location and number of people and villages in need of help. Everyone knew the location of the larger urban centers with substantial casualties, and villages that were close to roads were also likely to get help, but smaller and more remote villages were likely to be missed.

To cope with this situation, a number of information-sharing and disaster management information systems cropped up over the course of the weeks following the earthquake. These originated from a range of sources: private sector information technology firms eager to lend their expertise, nonprofit organizations, and, later, governmental and humanitarian agencies. This chapter focuses on one such system: the Research and Information System for Earthquakes–Pakistan (Risepak).

In the immediate aftermath of the earthquake, there were desperate calls for reliable maps of the earthquake-affected areas and for basic pre-disaster census information to help in tracking the needs of moving populations. Risepak was created within 10 days of the earthquake to meet this demand. It sought to provide village-level information on baseline needs and gaps in assistance to offset the lack of a comprehensive current list of affected villages and their needs.

Risepak has been selected as the subject of this case study because of the innovations in the model, the fact that Risepak was established rapidly soon after the disaster, and the potential for adaptation of the system to cover the full cycle of the disaster response, from relief to recovery and reconstruction.

Before analyzing Risepak in detail, we situate the system among the many other information systems that were established to facilitate the disaster

response in Pakistan, and we describe relevant operational issues and barriers involved in implementing the systems.

Information Systems: Assisting Disaster Response in Pakistan

Numerous Web sites, many now no longer active, sought to fill the information gap in Pakistan during the early days of the earthquake response. Thus, Halcrow International, a private corporation, established a Web site that pulled together maps and documentation from other Web sites. The Web site proved so useful and popular that the Federal Relief Commission adopted the site as its own. Contrary to expectations, the government was not averse to partnering with private sector efforts and was, indeed, happy to support those that worked.

Some public access systems were also established to assist with search and rescue and the identification of missing persons. The Federal Relief Commission, the International Federation of Red Cross and Red Crescent Societies, the Earthquake Victims and Relief Information System, and the Missing Persons Information Exchange each created systems listing searchable information on missing persons and permitting missing persons reports.

Although interviews indicate that the Federal Relief Commission required some feedback from relief actors, the commission relied heavily on OCHA for information sharing and coordination relating to needs and activities. OCHA quickly became the primary means of collecting and disseminating information on needs and activities during the relief phase, mainly through the United Nations cluster system. Some clusters used simple Excel spreadsheets, which participants updated frequently and circulated by e-mail. While this rudimentary mechanism was effective, it was not adopted by all clusters and did not facilitate intercluster coordination. Moreover, the information gathered is in danger of being lost; OCHA has ended its efforts and seems to be facing difficulty finding a local repository for the data.

OCHA also established a center that was responsible for providing information to support coordination during the natural disaster response. The Humanitarian Information Center for Pakistan was managed by OCHA and operated in collaboration with a host of actors, including the United Nations Joint Logistics Center, the U.K. Department for International Development, and the Humanitarian Aid Department of the European Commission.

The center launched a Web site for the dissemination of informational material on the earthquake (see http://www.humanitarianinfo.org/hic-pakistan/default.aspx, now only an archive). These materials included a list of actors involved in disaster coordination and complete contact information that seem to have been widely used, as well as a timetable of weekly cluster meetings. In terms of baseline information, the site provided a list of p-codes (place codes) so that all actors could use common identifiers for villages, given the widespread confusion in matching villages with the correct names. It is worth noting that the p-codes did not become available quickly, and it took even more time to establish a comprehensive list.

The center also generated maps and tables depicting who was doing what and where. Some of the information from cluster meetings was amalgamated into these tables. The maps were not published until well after February 2006, however. For an excellent appraisal of the center's activities, see the Joint Review Mission Report (DFID et al. 2006).

In contrast to the fairly decentralized and ad hoc nature of assistance during the relief phase, the early recovery and reconstruction process has been fairly tightly controlled by ERRA and the government. This is particularly true in sectors such as housing, education, and health. All organizations seeking to use bilateral or multilateral funds for reconstruction must obtain a no-objection certificate from ERRA. To obtain the certificate, they must commit to providing monthly and quarterly reports to the relevant district reconstruction unit, which then turns over this information to the provincial or state reconstruction authority, PERRA or SERRA.

ERRA has helped develop sophisticated management information reporting systems by relying on partner organizations with sufficient capacity to undertake system development. It also accepts paper documentation from organizations that are less technologically equipped. ERRA provides some analysis of these data on its Web site, at http://www.erra.gov.pk, and has established a portal that allows partners to access information.

ERRA has also established an information clearinghouse, ERRA-Infoch, which is located at the monitoring and evaluation department of ERRA and is administered by the International Agency for Source Country Information. The staff at ERRA-Infoch process requests for information by accessing the results of primary data collection by field offices located in each of the nine earthquake-affected districts. ERRA-Infoch also publishes geographical and thematic profiles and is creating a library of reliable information collected from the information management systems of ERRA and leading contributing agencies. This information is available

free of charge, but only to registered clients, that is, people who are working in collaboration with the government.

Whereas ERRA collects information on activities and monitors the progress of projects, the financial tracking of the funds committed and disbursed by international donors and organizations is carried out by the Economic Affairs Division, Ministry of Economic Affairs and Statistics. This division, with the assistance of the United Nations Development Programme, has assembled the Development Assistance Database Pakistan. The database provides a great deal of information on pledges, commitments, and disbursements by international agencies and governments. This information may be disaggregated by a wide variety of factors, including sectors, funding types, funded projects, and implementing agencies.

Many of these mechanisms for data distribution have only taken root since early 2007, more than a year after the earthquake. ERRA-Infoch was established in early January 2007. The Development Assistance Database was created a few weeks after the disaster, but only managed to gather momentum beginning in February 2007. Given that the United Nations started winding down its coordination and information-sharing role in April 2006, there seems to be a dearth of data management mechanisms to prevent the loss of information and expertise during the transition from relief to early recovery. The interviews conducted as part of the case study described here confirm this hypothesis and indicate the urgency of developing management information systems that are designed at the outset to cover the full cycle of disaster response from relief to recovery and reconstruction.

System Operational Issues during Disaster Response

Analysis of the evolution of the multiple layers of disaster management in Pakistan reveals the complex political economy issues that determine the nature of a disaster response and the critical challenges involved in effective information sharing and coordination. We now review these issues and challenges to provide context for the examination of Risepak that follows.

Political economy issues have a bearing on disaster management information systems because there is a public good aspect to effective coordination and information sharing during the response to a disaster. Experience in other countries shows that the success of disaster information systems is likely to hinge less on technical design and more on the incentives underpinning the use of the systems and the local and national political and institutional environment.

Ownership was salient as a theme during the course of the case study in Pakistan. Satisfaction with the disaster response seemed contingent on the effectiveness of the response, but also on who was executing the response. The question about responsibility is particularly important because it is closely related to capacity, continuity, and credibility.

Efficiency is often used as an argument for admitting external control of the disaster response process. A number of the interviewees in Pakistan indicated that the United Nations assumed such a large role in coordinating the earthquake response because of the resource and capacity constraints at the district and national levels. Similarly, the government established a centrally controlled disaster response infrastructure under ERRA because it felt that local governments lacked the capacity to cope with the demands of the immediate response and the additional demands of reconstruction. Given the urgency of the need to overcome the constraints and assist the disaster-affected populations, the emphasis on efficiency is understandable. However, it raises some troubling questions.

In each instance, a new parallel system was created to supplant existing local mechanisms. During the relief phase, district government officials were heavily involved in the administration of relief, in the disbursement of funds, and so on. As ERRA came on line, the locus of power shifted from local governments to the central government. District officials passionately involved in the relief phase and with intimate knowledge of local realities felt sidelined from the recovery process. Likewise, although the United Nations cluster approach facilitated coordination substantially, it tended to marginalize domestic actors. Cluster meetings were normally conducted in English and, not surprisingly, were disproportionately attended by representatives of international organizations.

This had several drawbacks. First, this way, the wealth of knowledge that local governments and nongovernmental officials possess is not allowed to inform the disaster response sufficiently. The United Nations and central government officials may have more technical capacity than local officials, but they also often have less local knowledge. Inadequacies in local knowledge may cause disaster information systems and other response mechanisms to lose some effectiveness and relevance in assisting disaster-affected populations.

Second, attempts to enhance knowledge about local areas by hiring local personnel may actually exacerbate the problem of low residual capacity. At the district level, some local ministry officials complained that PERRA and SERRA were redeploying money and personnel away from

local governments by offering local personnel far higher salaries and benefits. Similarly, officials in ERRA complained that international aid agencies were cherry-picking the brightest and most capable personnel away from them. Short-term gains in disaster response may thus be offset by the drain on local capacity over the long term. Many interviewees indicated that this problem is especially acute in Azad Jammu and Kashmir, where domestic administrative capacity, which was low to begin with, was badly affected by the earthquake and has been increasingly supplanted by aid agencies and the central government.

Third, as the locus of power shifts away from the local level, there is often an erosion of faith in the system. Some district and provincial line ministry officials complained that decisions were made by Islamabad on grounds that were unclear to them. There is now a greater unwillingness to invest in nonlocal systems, particularly in attempts to coordinate the activities of numerous actors, because the externalities are substantial: the benefits do not necessarily accrue to those who bear the costs or, for the most part, even to people living in areas where a system is implemented.

Finally, external disaster response systems tend to be temporary structures. This means that, after they are dismantled, there is the danger of a loss of valuable information, experience, and responsibility. As the humanitarian agencies withdraw from the affected regions and the clusters are disbanded, there is tangible concern about who should take over. If there were sufficient engagement with more permanent governmental structures and greater concentration on local capacity building, then a home might be built for the information and expertise. This issue is likely to resurface in Pakistan when ERRA and the associated structures are closed in 2009.

The lack of local technical capacity means that information systems are being established and run by nonlocal entities. This failure in disaster information management systems to trust and engage local actors affects overall disaster management. The local actors never become structural parts of the response.

The Development of Risepak

Many of the systems described above made significant contributions toward enhancing the response to the disaster in Pakistan. Nonetheless, the primary means of coordination and monitoring were the United Nations cluster system during the relief phase and the ERRA monitoring system during the recovery and reconstruction phases. A significant number of studies have

already been conducted on the application of the cluster system in Pakistan. Meanwhile, it may be too early to assess ERRA's role. We have therefore decided to examine Risepak, which attempts to address the needs of all phases of a disaster response.

Risepak is an online portal established to collect, collate, and display information on damage, access, and relief at the village level so as to facilitate earthquake relief coordination. Risepak was created by a consortium of academics, researchers, students, and policy makers. The consortium worked through the World Bank and universities in Pakistan and the United States.

In the aftermath of the disaster, as people scrambled to provide material and physical assistance during the relief effort, professors at Lahore University of Management Sciences, in Pakistan, and at Pomona College and Harvard University, in the United States, and economists at the World Bank wondered how they might contribute their expertise to facilitating the disaster response. They realized that there was an information gap; people and organizations were eager to assist, but uncertain where they should direct their efforts. They noticed, in particular, that there was little information on villages and felt that, if the needs of all those affected were to be met, a complete database of villages was required, together with publicly available village-level data. Given that the earthquake had affected a region in which the villages tend to be widely dispersed, the requirement for village-level data was considered urgent. They decided to establish an online portal displaying these data. The portal came to be called the Research and Information System for Earthquakes–Pakistan, Risepak. Their chosen motto was No Village Left Behind.

After extensive discussions, the creators of Risepak decided that the system should provide baseline data from the most recent census (1998) before the earthquake; information on needs, including that on injuries, disaster levels, and damage to facilities; and information on the supply of assistance. The core model of the portal had three components: the database providing predisaster information, a network of relief actors providing real-time updates from the field, and a public notice board where people were able to post comments, complaints, and suggestions. This model, they hoped, would result in a self-coordinating environment providing regular information that might be used to improve the targeting of relief.

The portal was established with remarkable speed and was online by October 20, 2005, within 10 days of the earthquake. A large number of people and organizations collaborated closely to make this possible.

The Web site was created through a public-private partnership between the Risepak team and a Pakistani Internet services provider, World Online. The management of World Online agreed to design and host the Web site free of charge. Technologix and the Punjab Information Technology Board later also provided technical support. The portal was housed at Lahore University of Management Sciences. The university donated office space and computers, permitting the creation of a physical hub for operations. University student volunteers conducted a beta test of the system. The Web site underwent a major overhaul to make it more user-friendly, and it was relaunched by November 1, 2005. Student volunteer teams also conducted an outreach and data-gathering exercise. They carried out a phone survey among all relief actors they were able to identify. They told the relief actors about Risepak and requested information and comments.

World Bank personnel provided extensive help, in particular with the creation of maps, the use of geographic information technology, and the release of census information by the government. Several of these maps were created using data and technical assistance supplied by the National Database and Registration Authority. The team provided maps of districts, tehsils, and patwar circles (small administrative divisions) that contained information on population, roads, and distance to the epicenter of the earthquake. At a time when maps of these regions were scarce, these maps proved extremely useful (see http://www.risepak.com/maps_2.aspx for examples). In a visit to Muzaffarabad in January 2006, we found that even organizations that seemed not to have heard of Risepak had Risepak maps pinned on their walls.

In the beginning, Risepak's founders were anticipating a huge inflow of information. They created a roster of volunteers, working in four-hour shifts to update the data on the system. When the data did not come pouring in, they realized that they would have to gather information more directly. Teams of professors and students from Lahore University of Management Sciences were planning to visit the earthquake areas to perform volunteer relief work in early November during the holidays for Eid, the Muslim festival at the end of Ramadan. The Risepak core team persuaded many of these students and professors to spend some time encouraging local district governments and organizations to provide information to Risepak.

Some teams headed to Islamabad to establish close networks with organizations and to help them systematize their data and submit them. Other teams went to district headquarters and field offices to work with district governments and local and international relief organizations to

promote and facilitate data submissions. Volunteers spent substantial time training district government officials in the use of data techniques. Where district governments had low technical capacity (such as in Bagh and Muzaffarabad), the university teams were welcomed for their help in setting up rudimentary data systems. It was at this point that many of the village-level updates were received and uploaded and that Risepak began gaining greater visibility. Prior to the field visits, Risepak had been maintaining updated information on 200 villages. Within a week of the field visits, 500 villages showed updated information. While some teams were responsible for data collection, others were responsible for parsing, collating, and adjusting the data provided through these field exercises, but also through fax transmissions, e-mails, online entry, and the short message service.

To generate momentum and additional support for Risepak, the Risepak team publicized the system during the international donors conference held in Islamabad on November 19, 2005, and at cluster meetings. As a result of these activities, updates on 950 villages were received and 1,800 notice board messages had been posted within the first two months after the disaster. Some organizations provided substantial data; these included the Omar Asghar Khan Development Foundation, the Sungi Development Foundation, Islamic Relief, the Rural Support Program Network, and the government.

The next big round of data inflow was generated when a survey was conducted by the Risepak team and other volunteers from November 30 to December 5, 2005. Twelve teams of volunteers surveyed more than 3,210 households in 18 villages. This was the largest independent survey of households since the earthquake. A second survey conducted in January 2006 consisted of a more-intensive exercise using a smaller sample size. This survey was conducted among 193 households and included questionnaires on demographics, disaster damage, relief, and rehabilitation, as well as village networks. The survey was fielded by students enrolled in Humanitarian Crises and Research Methods, a new course on earthquake disaster relief being taught at Lahore University of Management Sciences. The survey yielded useful insights, some of which were written up into reports by the university team (for example, Haider, Das, and Zaidi 2006; Zaidi 2006a). There were, however, some complications in the survey methodology and in the application that necessitated extensive data cleaning. Information from the January survey had still not been uploaded on the portal many months after the earthquake.

As the relief phase progressed, the level of the Risepak tracking and reporting activity waned significantly. In January 2006, the original founders

of Risepak appointed a local project coordinator and scaled back their involvement in Risepak substantially. This was particularly true of the academics and policy makers based outside Pakistan. From the outset, they had agreed on the necessity of an early exit, based on their conviction that the project needed to be country owned. Many of the locally based actors involved in the inception and creation of Risepak reduced their involvement, too, feeling the pressure to return to their regular jobs and catch up on the backlogs of work. With the disengagement of the original creators of the system, Risepak began to lose steam. The volunteer model that had made Risepak such an interesting example of postdisaster management may ironically have contributed to its decline. Risepak still has a volunteer team, which maintains the portal, but there have been few updates to the database since the spring of 2006, and little attempt has been made to modify the database to show the disaster recovery and reconstruction.

Description of the System

Risepak was designed to provide village-level information on needs (demand) and response (supply), thereby permitting gap analysis during the initial disaster response. In the hours and days after the disaster struck, little information was publicly available about the extent of the damage and the exact location and condition of the survivors. For the first 24 hours after the earthquake, much of the media attention was focused on the collapse of a high-rise apartment complex in Islamabad, 100 kilometers from the epicenter. Because communications systems had been disrupted by the earthquake, few people realized the havoc wreaked to the north, in Azad Jammu and Kashmir and in North West Frontier Province. As information trickled in over the next days, Pakistani government and society mobilized to offer assistance. The central government and the army swung into action. Local nonprofit organizations across the country started donation collection drives and planning for relief campaigns. Thousands of volunteers headed to Azad Jammu and Kashmir and to North West Frontier Province to help in search and rescue, the distribution of aid, and relief assistance. Most people were eager, but many seemed unclear about who they should help, what the needs were, and how to get there. Risepak was established to help fill this information gap.

Risepak was created based on the conviction that village-level information is the key to effective disaster response. As hundreds of actors rushed to areas where the effects of the disaster were most apparent, to cities such as Balakot

and Muzaffarabad, there was a strong concern that smaller, more remote villages would be neglected. This concern was particularly acute given the wide geographical dispersion of villages in the mountainous terrain of Azad Jammu and Kashmir and of North West Frontier Province. The tendency of many relief actors to distribute and track aid at the district, tehsil, union council, or patwar circle level, rather than at the village level, exacerbated this risk of neglect. The founders of Risepak thus felt there was an urgent requirement for publicly available village information to ensure that no village was neglected. They hoped that other organizations would follow their lead in treating the village as the relevant unit of analysis.

Risepak was also created to provide a forum to facilitate the flow of information from the bottom up. A frequent complaint in the aftermath of disasters is that the voices of the victims are not heard and that information is channeled by the government and the largest relief actors in a top-down fashion. Risepak was meant to serve as a venue for displaying information collected from the villages. The information was to be aggregated up to provide a composite picture, rather than presenting needs and activities in broad strokes that obscured the condition of specific villages.

Functions

The scope of the functions Risepak was expected to fulfill was fairly ambitious. The functions are as follows:

- Risepak was designed to map needs against the supply of assistance, thereby permitting *gap analysis* to identify the villages with residual needs. Risepak was created primarily to ensure that all those affected received help and to enhance aid effectiveness through improved targeting.
- Risepak was meant to facilitate *coordination* by allowing the exchange of information among multiple actors and across sectors. It was therefore designed as an open access system, available to all. In the rush to supply assistance that often occurs in the aftermath of disasters, there may be duplication of efforts in some places and neglect in others. Duplication tends to occur in more densely populated areas that are more easily accessible, while the needs of smaller, more isolated communities tend to fall by the wayside. Risepak was intended to help minimize this danger through coordination.

- By providing public information, the creators of the system hoped that the portal might also act as a *monitoring tool that encouraged accountability* among relief actors. If organizations provided publicly available information on the distribution of aid in specific localities, this would permit third parties to verify whether the purported recipients had indeed received the reported aid. Risepak was therefore intended to introduce greater transparency in the distribution of aid and to offer a means of holding relief actors accountable in the long term.
- Finally, the portal was also designed to supply a forum for individuals to *voice* their needs and concerns. The comment board was created explicitly for this purpose and seems to have been frequently used: 1,800 notice board messages were posted in the first two months after the disaster.

Risepak's relative allocation of emphasis among these objectives seems to have evolved. At the beginning, the portal focused on generating information flows for decision making. Now, there appears to be a greater emphasis on using Risepak as a source of data for researchers. There also seems to be a greater desire to leverage Risepak as a third-party check on relief and reconstruction work conducted by the government and others.

Technical Design and Inputs

At the time Risepak was created, it was not clear that Risepak personnel (and many other relief workers) were viewing the disaster in terms of distinct or even overlapping phases. It was clear that the immediate and potential uses of Risepak went far beyond the relief phase. Nonetheless, the categories included in the database appear to indicate that the database was created primarily for the relief phase.

Baseline Data

The work on Risepak started with the collation of baseline data from the most recent census (1998) conducted before the earthquake. The baseline data collection included village identifiers, village population data in 1998, housing and utility indicators, surface areas, and distance indicators, as detailed in table 7.1. Data on these fields were available for most villages. It appears that Risepak proved especially useful because it provided these baseline indicators to actors working among the villages. The information on distances and road access and the accompanying maps generated by Risepak were particularly

TABLE 7.1 Baseline Data Collection

Variable name	Variable description
Village name	name of the village or town in the 1998 Population Census of Pakistan/Azad Jammu and Kashmir
Patwar circle	name of the patwar circle in the 1998 census
Tehsil name	name of the tehsil in the 1998 census
District name	name of the district in the 1998 census
Province name	name of the province in the 1998 census
Total population	total population in the village or town in the 1998 census
Male population	male population in the village or town in the 1998 census
Female population	female population in the village or town in the 1998 census
Total housing structures	total housing structures in the village or town in the 1998 census
Number of pakka (cement construction) houses	number of pakka houses in the village or town in the 1998 census
Number of houses with electricity, potable water	number of houses with electricity, potable water in the village or town in the 1998 census
Area	area (in acres) in the village or town in the 1998 census; area is not available for urban regions
Distance from Islamabad	distance in kilometers from the village to Islamabad; the coordinates of Islamabad are provided in ESRI (2002)
Distance from district headquarters	distance in kilometers from the village to the district headquarters
Distance from a major road	distance in kilometers from the village to the nearest major road; the road data set is a composition of the Digital Chart of the World (ESRI 1993) and Vector Map Level 1
Distance from epicenter	distance in kilometers from the village to the epicenter; the coordinates of the epicenter provided by the United States Geological Survey were 34.493N, 73.629E; villages at a distance to the epicenter of 999 are in districts thought to be unaffected by the earthquake

Sources: Risepak team, Lahore University of Management Sciences; 1998 population census.

helpful. Risepak users assumed that the data gathered before the earthquake supplied an approximate indicator of needs: it was possible to extrapolate from the population counts based on the 1998 population census to derive measures of village sizes in 2005; distance from the epicenter represented a ready proxy for mortality and injury; distance indicators could be turned into measures of remoteness (and likelihood of neglect); and the proportion of permanent housing structures and the availability of electricity and potable water were rough indicators of village wealth.

Unit of Analysis

In determining the unit of analysis for the system, Risepak had to make a tough choice between the older administrative units, the patwar circles (clusters of revenue villages), and the relatively new union councils. In 2001, the Pakistani government introduced local governments by eliminating divisions and creating a new unit of administration known as the union council, which is now used in lieu of patwar circle. Unlike North West Frontier Province, Azad Jammu and Kashmir has not yet implemented union councils. Union councils are used as the electoral units for the election of local government officials known as nazims (chief executives). Political and administrative officers tend to consider the union council as the relevant administrative unit. Meanwhile, the revenue officer, known as the *patwari*, continued, in many cases, to be the repository of information, particularly information relating to income and property ownership (Loureiro 2005). The impact of this bifurcated structure on relief coordination was that while some information was available on the union councils, the rest was still based on the patwar circles. The difficulty lay in mapping villages and patwar circles to union councils. The boundaries of the new union councils and old patwar circles are not identical. The union councils tend to be bigger than the patwar circles, and union council boundaries sometimes cut across patwar circles, making it difficult to match information on patwar circles to union councils. The pooling of data thus became a problem in establishing effective relief and reconstruction activities.

Because the patwar circle was the unit of analysis in the latest census data, as well as in administrative records on income and property ownership that would likely be used to determine government compensation schemes and thus baseline levels of need, Risepak chose the patwar circle rather than the union council as the unit of analysis in the system. The repercussions of this choice are discussed elsewhere below.

Village identification also proved difficult for many relief actors in Pakistan for a number of reasons. First, organizations tended to spell village names differently, resulting in multiple identifiers for the same villages. Second, villages were often comprised of multiple settlements spread far apart, and this was a problem in determining which settlements belonged to which villages. Experiencing these obstacles in identification, the Risepak team adopted innovative uses of satellite imagery to estimate population densities and determine the location of villages.

Needs

The Risepak team added fields detailing the needs of the affected populations and the levels of damage. These included indicators on disaster levels, accessibility, mortality and injury counts, the destruction of public facilities, the condition of public facilities, the availability of utilities, the availability of food and water, and the security situation. Table 7.2 lists and describes these variables. The responses in the needs category on questionnaires were supposed to highlight conditions among earthquake survivors.

Supply of Assistance

To measure the supply of disaster assistance and thereby estimate residual need, Risepak also sought to collect data relating to the distribution of blankets, tents, food, cash, and medicines (table 7.3). The questionnaires clearly indicate the degree to which Risepak was focused on the relief phase. Almost all the indicators included in the list relate to basic needs. The only indicators in Risepak that are relevant to the early recovery phase are surveyed through questions evaluating the status of school and health facilities; however, note that Risepak only inquires about the damage inflicted on facilities, not about the status of reconstruction.

Data Collection Methods

The data were to be provided through field reports from actors and other individuals. The means of data entry included fax, telephone, mobile text messages, and online submission. The Risepak Web site featured a submit information box that linked to a data submission template form. Risepak team members presumed that there would be an inflow of data once they had provided a forum for the submission of information. They therefore assembled volunteer teams to enter data. They also initiated a partnership with Resource Group, a call center in Pakistan, to manage the phone-in

TABLE 7.2 Damage and Needs Assessment Indicators

Variable name	Variable description	Variable values
Access indicator	subjective indicator of access	jeepable, drivable, walking required, difficult to access
Disaster indicator	subjective indicator of physical damage	high, medium, low
Houses unlivable	categorical indicator of how many houses are no longer livable	<10, 10–50, 50–100, >100
Status of school	categorical indicator of whether school exists and is functional	fine, unusable, no school
Status of health facility	categorical indicator of whether any health center, basic health unit, and so on exists and is functional	fine, unusable, no health facility
People needing medical assistance	categorical indicator of how many individuals need medical attention	<10, 10–50, 50–100, >100
Mortality count	categorical indicator of the mortality count	<10, 10–50, 50–100, >100
Status of electricity	categorical indicator of whether the village or town has electricity	available, not available
Drinking water available	categorical indicator of whether the village or town has drinking water	yes, no
Food available	categorical indicator of whether the village or town has adequate food supplies	yes, no
Security situation	categorical indicator of the security situation in the village or town	poor, normal, not known

Source: Risepak team, Lahore University of Management Sciences.

TABLE 7.3 Measures of Assistance and Residual Need

Variable name	Variable description	Variable values
Assistance indicator	categorical indicator of whether the village or town has received any assistance	high, low
Name of NGO, organization, individual	name of the organization, NGO, or individual providing assistance in the village or town	name
Date relief distributed	date the organization, NGO, or individual provided assistance in the village or town	date
Number of blankets distributed	reported number of blankets provided in the village or town by the NGO, organization, or individual	quantity
Number of tents distributed	reported number of tents provided in the village or town by the NGO, organization, or individual	quantity
Volume of food distributed	reported volume, quantity of food provided in the village or town by the NGO, organization, or individual	weight
Amount of cash distributed	reported amount of cash assistance provided in the village or town by the NGO, organization, individual	rupees
Volume of medicine distributed	reported volume, quantity of medicine provided in the village or town by the NGO, organization, individual	rupees
Type of medicine	reported type of medicine provided in the village or town by the NGO, organization, individual	first aid, advanced
Most important need	most important need identified in the village or town by the NGO, organization, individual	blankets, tents, medicines, food, security, multiple

(continued)

TABLE 7.3 *(Continued)*

Variable name	Variable description	Variable values
Distance to nearest relief base camp	distance of the village or town to the nearest relief base camp	kilometers
Doctors available	whether any doctors are available in the village or town	yes, no
People evacuated	categorical indicator of the individuals evacuated from the village or town	<10, 10–50, 50–100, >100
Relief information consistency	consistency is high if all information posted regarding the village or town is in agreement, average if there is some discrepancy in the information posted, and low if there are large discrepancies	high, average, low

Source: Risepak team, Lahore University of Management Sciences.

data submissions. The anticipated flood of information never materialized, however. Risepak had to switch strategies and solicit information from organizations and individuals more directly. Risepak's text messaging methodology was considered an innovation in data sharing among organizations in the field. Interviews with the Risepak team indicate, however, that this method was rarely used.

Data Processing

Risepak expressed a commitment to posting data within 24 hours of submission, and, for the most part, it seems to have been prompt in transferring and uploading data. Data sometimes required substantial cleaning before being entered into the database. Volunteers tried to ensure that all fields were complete and contained the correct units. (Organizations often entered information without village identifiers or otherwise failed to follow the prescribed format.) Risepak staff also checked each submission for consistency across records. If the information provided was in agreement with reports from other informants in the village, then the consistency indicator was labeled high. If there were some discrepancies, the consistency

was labeled average. In the event of large inconsistencies, the consistency was labeled low. This was the full extent of the verification of data conducted by the team. Risepak did not institute a policy of performing third-party checks to determine the accuracy of self-reported data.

Outputs

Risepak's primary output is a searchable database, exportable Excel spreadsheets, and a notice board. The Web site portal permits a quick search of villages. The system site also permits guided searches based on the name of an organization or on village characteristics.

Risepak generated maps that proved extremely useful among workers in the field in the early days of the disaster. Interviews reveal that Risepak's baseline data assisted relief organizations. Thus, staff members at relief organizations who had been tasked with preparing reports for grant requests found that Risepak village statistics and maps were helpful.

A number of articles were published by members of the Risepak community highlighting their experiences and findings in the field (see the references section at the end of the chapter). Preliminary reports were written on the findings of the winter surveys (see Haider, Das, and Zaidi 2006; Zaidi 2006a). However, there was limited analysis by the Risepak team on the distribution of needs and aid based on the data entered in the Risepak portal. The team published a note based on the data in November 2005 that consisted of a number of illustrative graphs (Risepak 2005a; also see Risepak 2005b). The team likewise published a note dealing with district level data (Risepak 2006). A more thorough analysis of the data was not conducted until October 2006, when a volunteer researcher wrote a detailed report examining the distribution of relief aid across indicators of remoteness and need (Habib 2006). Aside from a few newspaper articles, most of the dissemination of Risepak products occurred through the Internet. Given that Web access may often be problematic in the aftermath of a disaster, particularly among workers deployed in the field, this may have limited Risepak's reach.

The Risepak team and volunteers were involved in conducting surveys, setting up rudimentary data systems for district governments in Bagh, Mansehra, and Muzaffarabad, and other activities that were tremendously valuable, but are not featured as measurable outputs on the portal. Some members of the Risepak team wondered whether the ancillary survey activities detracted from the effort to establish Risepak as a viable disaster

management system, particularly because the survey data never appeared on the database.

Accessibility

Unlike many disaster management and data tracking systems, the Risepak portal is entirely open access. Anyone may see the information and anyone may submit information. The premise is that the wide exposure and the threat of correction by peers are sufficient to guarantee that most of the data that are submitted will be honest and true. The creators of the system cite the success of Wikipedia as evidence that data systems relying on spontaneous reporting may be surprisingly informative and accurate. They also emphasize the power of such systems to allow ordinary citizens and those most in need to get their voices heard.

The multiple applications of Risepak data meant that Risepak targeted the broadest possible categories of users. By seeking to provide information for relief coordination and gap analysis, Risepak targeted practitioners in the field, as well as disaster victims. The interested practitioners included staff in local and central government agencies, international humanitarian agencies, multilateral and bilateral donors, local and international nonprofit organizations, and individual volunteers.

Risepak began by targeting NGOs, particularly those NGOs known within the volunteer society at Lahore University of Management Sciences. Risepak was able to draw on close relationships with organizations such as the Sungi Development Foundation, the Omar Asghar Khan Development Foundation, and the National Rural Support Program. In November 2005, the Risepak team initiated an effort to establish institutional arrangements with local district governments by offering technical support in establishing basic data systems. District officials in Muzaffarabad remain deeply grateful today for the assistance provided by the university team in creating a system to track the distribution of compensation grants. But the gains from the relationships the team formed did not translate into a steady stream of data for the project. This was because the responsibility for relief and reconstruction was relocated from the district and provincial line ministries to the district reconstruction units and to PERRA and SERRA.

Moreover, Risepak does not seem to have been successful at establishing close ties with implementing agencies such as ERRA or the United Nations agencies. The team began focusing on these organizations only after the data inflow from the NGOs failed to materialize. It appears that although

attempts were made to solicit data from implementing agencies such as the government and the United Nations, Risepak did not succeed in encouraging these partners to adopt the system as their own and take a stake in its success.

Evaluating Risepak

In evaluating the impact of the Risepak effort, one should remember that the system was established by a large network of volunteers during the relief phase soon after the disaster. Information systems for tracking and coordinating a disaster response are rarely created in the hectic weeks following a disaster. In most disasters, such systems are created, if at all, during recovery and reconstruction, after there has been a decline in the urgency of supplying the needs for daily survival. The Risepak team's achievement is impressive in light of the magnitude of its task and the limitations on its resources. For a government seeking to follow the Risepak model or establish another kind of data system for disaster management, information on what worked well and what did not in the case of Risepak may be useful.

Risepak generated a substantial amount of national and international interest when it was first noticed. The idea was novel for a number of reasons. First, Risepak provided a venue for channeling information from the bottom up, rather than from the top down, which was the norm. Second, it focused on a disaggregated unit of analysis, the village, rather than the district. It therefore demanded a higher level of specificity in the targeting and monitoring of needs and aid distribution flows. The enormity of the international response and the mostly untracked distribution of huge amounts of aid in the aftermath of the Asian tsunami had raised awareness of the importance of aid monitoring systems, and here was one that focused on the village level, where many of the effects of the disaster were most felt, but where aid tracking rarely reached. Third, Risepak sought to create a common, open access platform to facilitate coordination among multiple actors, including the victims, individual donors, nonprofit organizations, the government, and international agencies. Finally, the system was volunteer driven, and the volunteers came from a wide variety of domains and disciplines. The speed and efficiency with which the intellectual capacity and skills of a diverse group of people were harnessed to produce this low-cost template were impressive. In recognition of these efforts, Risepak won a 2006 Stockholm Challenge award for innovative information and communication technology projects.

Risepak's concept was undoubtedly innovative, but the application had more checkered results. Risepak's uptake may be measured on three fronts: (a) the number of people using information generated by Risepak; it is useful to distinguish between baseline data and data on disaster response activities because these data are used for different purposes (revolving around needs assessment and coordination); (b) the number of users supplying information to Risepak; and (c) the number of people using Risepak as a medium to air their opinions, comments, and suggestions.

Risepak had some success in encouraging uptake initially. Although exact counts are not available, interviews with relief actors indicate that Risepak was used fairly widely at first by humanitarian actors because of the baseline data. These data, particularly the data relating to roads and the maps, were useful during early disaster relief efforts. The lists of affected villages and the population figures seemed especially useful among personnel analyzing operations and writing reports or funding proposals. Similarly, Risepak's notice board seems to have been fairly popular at the start.

Risepak data were less successful in facilitating coordination and residual needs assessments in the field. The Risepak model would only become useful for these purposes once the portal reached a critical mass of regularly updated, comprehensive data. To some degree, Risepak was confronted with a chicken-and-egg problem: to persuade organizations to submit data, the usefulness of Risepak had to be illustrated; to be useful, Risepak required sufficient data.

Risepak was initially successful at keeping the information on activities up to date. A mix of 53 local and international governmental and nongovernmental actors provided Risepak with updates on their activities. More difficult was attracting the interest of repeat users who consistently submitted data to the system and used data from the system. Although a great deal of thought was dedicated to the potential applications of Risepak once the system reached a critical mass of data, less attention seems to have been paid to creating immediate incentives for organizations to provide the information in the first place. The creators of the system clearly understood that information is a public good, but they did not account sufficiently for the fact that this public good may seem a less urgent priority for relief organizations facing severe time and personnel constraints in the hectic months following an earthquake. Unless organizations believed that engagement with Risepak entailed low costs and yielded fairly quick benefits, they were unlikely to provide information on a regular basis. Organizations

tend to participate regularly if the costs of data submission are low and if there are clear benefits in participation.

Costs

The Risepak portal is an open access system requiring no user fees and no membership. Nominally, it seems like a low-cost system. In the aftermath of a disaster, however, time is a scarce resource, and the time required for data entry is a price that organizations inundated with relief tasks and requests for help are reluctant to pay. Risepak data submissions relied on a self-entry model within a rigid reporting format. According to interviewees, this was one of the impediments to Risepak uptake. Despite the relative brevity of the Risepak data entry form, some organizations reported finding the requirement to disaggregate their own monitoring data according to Risepak's needs difficult and time consuming. Organizations were far more willing simply to submit data in the format in which they collected them. Risepak volunteers report that even contributing organizations sympathetic to the Risepak mission were reluctant to modify their data collection practices to match Risepak standards.

The fact that Risepak used patwar circles as the administrative unit, while many organizations reported according to union councils, raised the costs in submitting and using Risepak data. Even though the Risepak team reportedly devoted significant energy to mapping village and patwar circle information onto union council information, it did not include these data on the Risepak Web site. If Risepak had been more open to accepting data not conforming to its reporting requirements or if it had designed more flexible data entry forms, organizations might have been more willing to feed into the system. Such a policy would, however, have necessitated additional resources for sifting through the data.

The Risepak team soon realized that the costs of data submission were obstacles to the spontaneous submission of data and sent out volunteers to collect the data and train personnel in the central offices and the field offices of organizations and district governments. The effort in training bore little fruit, however, and firsthand data collection by Risepak now accounts for much of the data in the system. Experiences in other countries indicate that reliable data collection may mean finding dedicated personnel to track down the data and modify them to meet reporting requirements, rather than relying on spontaneous self-reporting. (See the chapter on Indonesia.)

Risepak attempted this by sending volunteers to the field but, because of a lack of time and resources, was unable to sustain this effort. To minimize costs among users and create a sustainable system, Risepak would need to establish an in-house capacity to shoulder the burden of data collection. This might entail abandoning the volunteer model and seeking local funds to hire staff and ensure long-term sustainability.

Benefits

Some organizations supplied information to Risepak because the system provided a means of generating greater visibility. These tended to be smaller organizations depending on fundraising, which was facilitated by the ability to indicate an external reporting component. This also included groups unlikely to receive appropriate credit for their efforts elsewhere (such as banned Islamic groups that were vigorous in the relief effort).

The interviews with participants provide scant evidence that people contributed to Risepak because they hoped to benefit from the collective pool of information thereby generated. (By contrast, the benefits of providing information at cluster meetings seemed more tangible for respondents.) Most interviewees who had submitted data to Risepak had done so because they had been contacted by Risepak, because they vaguely understood that information sharing was worthwhile, or because they had close ties with members of the Risepak team. Few seemed to know what was done with the data after submission. Data submissions occurred mostly for altruistic rather than self-interested reasons. There was a danger that the lack of other incentives would discourage regular participation in the system. This hypothesis is borne out by an analysis of the range and frequency of the data submissions. Few organizations were repeat data contributors to Risepak.

Institutional Framework

The disaster response personnel who were interviewed indicated that they were overwhelmed because of the reporting requirements of their own organizations, as well as of donors, the government, the Federal Relief Commission, United Nations agencies, and the clusters. All these entities were able to deploy a more convincing combination of carrots and sticks, and their data demands therefore took precedence over those of Risepak. The government had the administrative capacity that organizations needed for assistance and the authority to mandate the submission of data.

The United Nations was providing crucial field assistance and was a potential source of future partnership and logistics support. Risepak, which was perceived by some to be an academic exercise based far from the field, was not able to bring similar leverage to bear in asking for data. Risepak was not alone in facing such problems. Relative to NGOs, the United Nations clusters attracted significant attention among international organizations in part because these organizations were dependent on United Nations assistance. Similarly, ERRA-Infoch and the Development Assistance Database Pakistan appear to have faced far more difficulty in gathering information from organizations than did ERRA, because, unlike ERRA, they were unable to deny requisite permissions or withhold substantial funding from organizations that failed to cooperate.

In this context, Risepak could only hope to develop a steady inflow of regular data by adopting one of two options: making the cost of data submission negligible (see elsewhere above) or partnering with an implementing agency capable of requiring or attracting data submissions. Risepak may have missed an opportunity by not pursuing the second option more vigorously. Implementing agencies had the power, the resources, and the field presence to mandate data submissions. Some clusters created under the United Nations were particularly successful at getting participant organizations to submit regular updates on activities. In the early recovery and reconstruction phases, ERRA was able to require monthly progress reports from organizations working in housing, education, and health. If Risepak had been able to combine the leveraging power of these implementing agencies with its model of open access coordination among multiple actors, a powerful system might have been established for disaster response management.

Sustainability

Risepak was developed rapidly, and there was little time to consider long-term sustainability. Risepak did not transition well from the relief to the recovery phases, although it had a clear potential for applications in multiple phases of the disaster response. Although Risepak personnel seemed aware of this potential, they did not systematically think through the technical adaptations that might have been necessary to make the portal relevant for different phases of disaster response. As one of the interviewees pointed out, Risepak was not sufficiently sophisticated to appreciate that the disaster response would occur in phases, and it was therefore often a step behind. Risepak thus appears to have been relied on in the initial weeks

of the disaster primarily because of the baseline information (the maps, the data on roads, the lists of villages, and the population sizes), but, as the relief phase progressed, it seems to have been relied on far less for updates on the relief effort and for gap analysis. Usage of the system for decision making declined rapidly.

Another important sustainability issue is the institutional identity of a portal host organization such as Risepak. Risepak's volunteer-driven model gave the team a veneer of impartiality, but it also meant that Risepak had insufficient resources in permanent manpower, time, and capacity to create and maintain a credible and sustainable data management system. The fact that the system was located at a university and was created by researchers also made it seem less relevant to the policy world. Finally, its physical location in Lahore, which was far from both the capital, where disaster response decisions were made, and the field, where they were implemented, impeded Risepak's ability to maintain visibility and relevance for relief and reconstruction agencies.

Lessons Learned

Relief and reconstruction were fairly well coordinated in Pakistan. Coordination during the relief phase was enhanced through the cluster approach, which was fully deployed in Pakistan for the first time anywhere in the world. A survey of information systems for coordination and of Risepak reveals the following lessons.

Think Carefully about User Costs, Benefits, and Incentives

Although actors, by and large, appreciate the importance of information sharing, the real costs of coordination are felt particularly acutely during the relief phase. Institutional arrangements for coordination should therefore take costs and incentives carefully into account.

Costs Should Be Reduced as Far as Possible

This case study highlights that, in the aftermath of a disaster, organizations are trying to cope with urgent needs in the field, while facing demands from multiple actors for data, often in different formats. Self-entry data submission models are unlikely to result in useful information. A better model may involve requesting the data directly from data providers even if the data are not strictly comparable. The Risepak team eventually realized this and adopted a more proactive approach to data gathering.

In Risepak's case, the costs and other impediments that acted as obstacles to data submissions revolved around the self-entry submission procedure and the rigid format. The system was based on the Internet and telecommunications technologies in situations in which there was limited access to these services. It relied on an administrative designation (villages and patwar circles) that did not conform with the administrative designations used by most organizations (union councils). The system was not updated sufficiently frequently. The strength of the Risepak approach was the brevity of the Risepak questionnaire and the contribution Risepak made to the establishment of a culture of tracking donations and aid distribution during disaster response.

Benefits Should Be Demonstrated as Early as Possible to Create Buy-in

In Risepak's case, buy-in was created by (a) providing useful baseline data, (b) providing opportunities for publicity for smaller organizations, and (c) offering services in exchange for data submission (such as help in building capacity and establishing data systems for district governments). Risepak had difficulty realizing its potential as a disaster coordination system because data providers saw little personal benefit in submitting data. Even organizations that submitted data did not seem to know what happened to the data afterward. Had the results been presented back to them in the form of decision-making tools within a system, they might have found a reason to continue (or start) feeding data into Risepak. That this did not occur demonstrates that insufficient thought was given by the creators of the system regarding the incentives for data submission and the applications of the data.

Systems Must Strike a Balance in Cost and Benefits to Generate and Sustain Buy-in

Organizations are likely to volunteer information if the cost is low and the benefits are demonstrated. The problem is that benefits are difficult to illustrate unless a critical mass of inputs has been reached. There is a vicious circle. The system will not be useful until it aggregates information from multiple users. Users have little incentive to provide data until they consider the system beneficial. If the benefits lag too far behind the costs, early contributors to the system lose interest. In general, users spend little time deciding whether a system is helpful or not. If they do not find the system Web site navigable the first few times they visit, they are unlikely to return.

Think Carefully about the Implementation Strategy

Innovative ideas require sound implementing strategies to find success. Two issues are particularly important, as follows.

Partner with an Implementing Agency

The Risepak case illustrates that an alliance with an implementing agency is crucial for a data management system. Otherwise, the system has little leverage for soliciting information and risks becoming irrelevant. The United Nations cluster approach worked fairly well as a coordination tool because the primary organizations for implementation in each sector were placed at the helm (for example, the Word Health Organization for health and the World Food Programme for nutrition). These organizations had specialists in the field, were recognized as major actors, and were aware of daily changes in the needs on the ground. They were therefore able to provide tangible benefits to other actors (such as information and secretariat support) in exchange for information. Partnering with an organization with clout means that less time is needed to chase down data and that more time may be spent on analyzing the data, making the data useful, and returning data to the users. Risepak had a real opportunity to become the institutional memory of the United Nations cluster system in Pakistan; it might have become the intersectoral aggregator of information and helped avert the loss of information that occurred during the transition from the relief to the early recovery and reconstruction phases.

Location Matters

Situate the data management organization as close as possible to central offices and field offices. The fact that Risepak was located in Lahore rather than Islamabad reduced the system's ability to be effective. Risepak's location created additional problems. The Risepak team was perceived to be remote from the relief effort and therefore less relevant. It was more difficult for Risepak staff to be available at venues where actors were congregating and information would be shared. Risepak was able to generate greater interest and collect more information when its volunteers went out into the field and when its founders undertook a publicity drive at cluster meetings. The field presence needed to be nurtured and become sustained.

Risepak is not unique in facing this constraint. The United Nations cluster system experienced a variation of the problem. Initially, the great strength of the clusters was their coordinating ability in Islamabad. But this

was not matched by a strong field presence. The combination generated a sense that the clusters were a bit remote from the realities in the field. Only when the clusters made an attempt to bolster their field presence did they become more productive. Risepak suffered from a more extreme version of the same problem because it was neither in the field nor in the capital.

Consider Trade-offs Carefully; Choose to Fulfill a Few Well-Defined Functions

Risepak illustrates the danger of trying to fulfill too many functions. Different organizations have different data needs, and the system may cater to many data functions. Creators of a disaster management data system should take care in choosing the needs and functions the system will fulfill, and they should consider the resulting trade-offs in time, money, and priorities. The following trade-offs may merit careful attention.

Timeliness versus Accuracy and Detail

It is important to think carefully about which of these needs and functions the system will fulfill and about the resulting trade-offs in time and money. In principle, village information may be more useful than union council information, but most organizations were functioning within the union councils. Risepak spent too much time and effort trying to obtain and adjust information at the village level. In the interim, organizations tried to use Risepak, found it unwieldy, and abandoned it.

Independence versus Relevance

Tying Risepak closely to an implementing organization such as the government or the United Nations might have enhanced the leverage of the system in data collection, but might have compromised the credibility of the data. By remaining strictly independent, Risepak became a potentially useful means of cross-checking reports issued by the government and the United Nations, but this independence also risked rendering Risepak irrelevant in the ongoing disaster response.

Level of Reporting

Actors desire data at different levels of aggregation. Donors are often more interested in financial tracking data at the district or tehsil level and less interested in village data or detailed project data. Nonprofit actors, especially smaller local organizations, are more interested in region-specific

data. It may be a challenge to cater to all audiences equally, and systems may need to define their primary audience to function effectively.

Allocate Resources so that Coordination Is Immediate and Continues across All Phases of the Disaster Response

Permanent Full-time Staff Are Necessary

Creating and maintaining a disaster management data system require a full-time commitment. Risepak generated great interest in large part because it was volunteer driven, but this may have reduced its sustainability. Risepak lost momentum because the volunteers who created it could no longer give it their full time and attention. People often favor fully volunteer-driven organizations such as Risepak because they consider such organizations impartial. However, as the student volunteers and researchers who created Risepak leave the university or move on to other projects and responsibilities, there is a real danger that the knowledge and expertise generated by the Risepak exercise will be lost.

Successor Arrangements Should Be Carefully Devised and Properly Implemented

Risepak lost momentum after the rapid withdrawal of its founding team. While the creators of Risepak seemed to have a clear sense of Risepak's purpose and potential, their successors do not seem to share in this vision. This situation may have arisen in part because of logistical mistakes, such as an insufficient number of data-handover meetings, or in part because of deeper strategic issues, such as the level of capacity and implementing power necessary in the institution chosen as a home for the system.

A Long-Term In-Country Funding Source Is Required

The recommendations for improving Risepak's performance all indicate that long-term funding is needed to finance the hiring of permanent staff. Given that international organizations are not permanent and tend to have high turnover rates, an in-country funding source is ideal for building country capacity and for ensuring continuity in disaster management systems. The United Nations clusters played a crucial coordination role during the relief phase. But with the disbandment of the clusters, no domestic agency is aggregating the sector-specific information already gathered or systematically carrying over the data from the relief phase to the reconstruction phase.

Notes

1. The author is grateful to the following people for their time and input for this case study: Kamran Abbasi, Fawad Hussain, Nawaz Khan Jadoon, and Muhammad Arif Malik (all of the United Nations); Humaira Ahmed, Lt. General Nadeem Ahmed, Altaf Saleem, Air Cdre Naunehal Shah (Retired), and Brigadier Javed Villayat (Earthquake Reconstruction and Rehabilitation Authority); Moneeza Ahmed (Citizens Foundation); Kamran Akbar (Pakistan Poverty Alleviation Fund); Virginia Appell (National Rural Support Program); Raja Rehan Arshad, Jishnu Das, and Tara Vishwanath (World Bank); Ali Asjad, Ali Cheema, Sana Faraz, Ahsan Kamal, Miguel Loureiro, Kasim Noman, and Sarah Zaidi (Research and Information System for Earthquakes–Pakistan and Lahore University of Management Sciences); John Blunt (Asian Development Bank); Wolfgang Gressman and Nicholas de Zwager (Information Clearinghouse of the Earthquake Reconstruction and Rehabilitation Authority–International Agency for Source Country Information); Liaqat Hussain (District Reconstruction Unit, Muzaffarabad); Khurram Javed Khan and Mariam Riaz (United Nations Development Programme and the Economic Affairs Division, Ministry of Economic Affairs and Statistics); Maheen Khizr and Sultan Mahmood (Islamic Relief); Asim Mehmood (Economic Affairs Division, Ministry of Economic Affairs and Statistics); Sohaib Ahmad Khan (Lahore University of Management Sciences); Shandana Khan (Rural Support Program Network); Farman Ali Khilji (Information Clearinghouse of the Earthquake Reconstruction and Rehabilitation Authority); Amjad Pervez (district commissioner, Bagh); and Masood ur Rahman (assistant commissioner, Muzaffarabad).
2. Azad Jammu and Kashmir is the Pakistan-administered portion of an area over which India and Pakistan have been in dispute since 1947. The chapter does not intend to make any judgment as to the legal or other status of any disputed territories or to prejudice the final determination of the parties' claims.
3. At the time of the earthquake, the disaster management organizations included the Federal Emergency Relief Cell, provincial level emergency relief cells, and district level civil defense organizations. The resources and infrastructure of these entities were inadequate for dealing with the disaster (ERRA 2007).

References

ActionAid International. 2006. "The Evolving UN Cluster Approach in the Aftermath of the Pakistan Earthquake: An NGO Perspective." Report, ActionAid International, London.

ADB (Asian Development Bank) and World Bank. 2005. "Pakistan 2005 Earthquake: Preliminary Damage and Needs Assessment." Report, Asian Development Bank, and World Bank, Islamabad.

Bari, Faisal. 2005. "Coordination Failure." *The Nation*, October 24.

Cheema, Moeen. 2006a. "The Appraisal of the Government Compensation Scheme for Citizens of Azad Jammu and Kashmir Affected by the October 8 Earthquake." Report, Risepak team, Lahore University of Management Sciences, Lahore.

———. 2006b. "Victims Bracing for Harsh Winter." *The Post*, October 10.

———. 2006c. "Relief Effort and Structural Problems." *Friday Times*, October 13.

Development Assistance Database Pakistan. Economic Affairs Division, Ministry of Economic Affairs and Statistics, Pakistan. http://www.dadpak.org (accessed November 2007).

DFID (U.K. Department for International Development), ECHO (Humanitarian Aid Department, European Commission), OCHA (United Nations Office for the Coordination of Humanitarian Affairs), and USAID (United States Agency for International Development). 2006. "Humanitarian Information Centre in Pakistan: Joint Review Mission Report." Report, OCHA, Islamabad.

ERRA (Earthquake Reconstruction and Rehabilitation Authority). 2006a. *Rebuild, Revive with Dignity and Hope: Annual Review 2005–2006*. Islamabad: ERRA.

———. 2006b. "Building Back Better: Rural Housing Reconstruction Strategy of Earthquake Hit Districts in NWFP and AJK." Strategy document, ERRA, Islamabad.

———. 2007. *Converting Adversity into Opportunity: Annual Review 2006–2007*. Islamabad: ERRA.

ESRI (Environmental Systems Research Institute). 1993. *Digital Chart of the World*. Redlands, CA: ESRI

———. 2002. *World Cities*. ESRI Data and Maps Series. CD-ROM. Redlands, CA: ESRI.

Habib, Bilal. 2006. "Roads Less Traveled: Analyzing the Effects of Remoteness and Need on the Distribution of Earthquake Assistance." Report, Risepak, Lahore University of Management Sciences, Lahore.

Haider, Erum. 2006. "Market Economics in Earthquake-Affected Regions." *The News*, April 24.

Haider, Erum, Jishnu Das, and Sarah Zaidi. 2006. "Pakistan October 8th Earthquake in NWFP and AJK; LUMS Team Surveys (December 2005 and January 2006): Preliminary Observations." With detailed inputs from Yasser Hashmi, Miguel Loureiro, Shandana Mohmand, and Sadia Qadir. Observation Note, Risepak team, Lahore University of Management Sciences, Lahore.

IASC (Inter-Agency Standing Committee). 2006. "Real-Time Evaluation Cluster Approach: Pakistan Earthquake, Final Draft." Report, IASC, Islamabad.

Loureiro, Miguel. 2005. "Ensuring That No Village Is Left Behind." *Daily Times*, November 30.

———. 2006. "Social Safety Nets: Before and After." *Friday Times*, October 13.

Muhammad, Zeeshan. 2005. "Information at Your Fingertips." *Dawn: Sci-Tech World*, November 26.

OCHA (United Nations Office for the Coordination of Humanitarian Affairs). 2005. *Humanitarian Response Review*. Geneva: OCHA.

OCHA (United Nations Office for the Coordination of Humanitarian Affairs), UNDG (United Nations Development Group), and UNDP (United Nations Development Programme). 2006. "Joint OCHA/DGO/UNDP Mission to Pakistan, 16–19 August 2006: Final Report." Report document, UNDP, Geneva.

Qadir, Sadia. 2006. "Pakistan Earthquake October 8th 2005: A Case Study on Internally Displaced Persons." Risepak, Lahore University of Management Sciences, Lahore.

Risepak (Research and Information System for Earthquakes–Pakistan). 2005a. "Risepak Earthquake Update." Report, November, Risepak team, Lahore University of Management Sciences, Lahore.

———. 2005b. "Analysis of Affected Areas and Relief Response, December 12, 2005." Report, Risepak team, Lahore University of Management Sciences, Lahore.

———. 2006. "Technical Assessment of District Level Data: Pakistan October 2005 Earthquake." Report, Risepak team, Lahore University of Management Sciences, Lahore.

Saeed, Zainab. 2006. "Fourteen Days: Balakot Diary, One Year Later." *Friday Times*, October 13.

UNHCR (Office of the United Nations High Commissioner for Refugees). 2006. *The State of the World's Refugees 2006.* New York: Oxford University Press.

Zaidi, Batool, Ali Asjad Naqvi, and Ahsan Kamal. 2006. "District Level Data Procedures for Oct 8 Earthquake: A Case Study of District Mansehra." Report, Risepak, Lahore University of Management Sciences, Lahore.

Zaidi, Sarah. 2006a. "Results of the Risepak-LUMS January Household Survey in the Earthquake-Affected Areas of Mansehra and Muzaffarabad." With the assistance of Ali Asjad Naqvi, Ahsan Kamal, and Sadia Qadir. Report, Risepak, Lahore University of Management Sciences, Lahore.

———. 2006b. "Accountability and Transparency, Anyone?" *SHE*, May: 95–97.

———. 2006c. Guest Column. *The Herald*, October.

8

Ex Ante Preparedness for Disaster Management: Sahana in Sri Lanka

M. A. L. R. Perera

The case study on Sahana is the story of a group of young Sri Lankan experts who responded to the humanitarian coordination needs raised by the Asian tsunami with an innovative information technology (IT) solution: a disaster management system. The chapter provides a detailed description of the system and identifies effective attributes, useful innovations, and some shortcomings.

System as a term refers to the database and its technical design elements, together with the institutional mechanisms and procedures for information oversight, management, coordination, financing, input, processing, and sharing. The description covers the perceptions of a variety of interviewees and key informants on the original concept and design of the system, the adaptation of the system to respond to changing needs and circumstances, and the system's potential to fulfill a current need for preparedness for disaster management.[1]

The chapter also relates a tale of missed opportunities. There were mistakes. The system remained untested in Sri Lanka, and it failed to take root there. The chapter highlights lessons learned during this experience. It does not attempt to analyze the disaster response in Sri Lanka except in the context of this description of the experience of Sahana, an interesting and useful technology application. Much of the appeal of the chapter arises

from the scale of the ambition of the Sahana system and the comprehensiveness of the Sahana team's approach to the project.

Background

Historically, Sri Lanka has experienced few natural disasters. Floods and droughts have constituted the main ones (for example, see table 8.1). Historical records point to what appears to be a tsunami around 2,000 years ago. An ancient tale written about Vihara Maha Devi recounts that the princess—the daughter of a provincial king and the mother of a great king of Sri Lanka—had been offered as a sacrifice to the sea gods in the hope that this would appease their wrath and prevent the seas from swallowing villages (Sri Lanka Virtual Library Database 2007). More recently, a cyclone affected the east in 1978 and caused major damage. Major floods and landslides occurred in Sabaragamuwa and southern provinces in May 2003, causing much destruction. This was the worst flooding in 50 years. Though earthquakes are unheard of, geologists warn that this may change, and the island may be subjected to earthquakes eventually; a local newspaper, *The Sunday Leader*, reported on April 3, 2005, that C. B. Dissanayake, senior geologist at the University of Peradeniya, was among the first locals to warn that a new tectonic plate was being formed south of the island by the fragmentation of the Indo-Australian plate near southern Sri Lanka (Leader Publication 2005). Experts at the National Building Research Organization have predicted that a major threat of landslides caused by tremors will materialize in Sri Lanka in the near future (NBRO Web site 2007). Two decades of ethnic war have also brought the country face to face with disasters generated by people. Mass displacements, both external and internal, have resulted, and refugee camps have dotted the eastern, north central, northern, and northwestern provinces.

The Tsunami of 2004

The land area of the island of Sri Lanka is approximately 62,705 square kilometers. The island stretches to a maximum length of 435 kilometers and a width of 225 kilometers. It is situated in the Indian Ocean, close to the southern end of the Indian peninsula, at 5 to 9 degrees north latitude and 79 to 81 degrees east longitude.

On Sunday morning, December 26, 2004, tsunamis triggered by massive earthquakes in the Sumatra and Nicobar regions plunged Sri Lanka into

TABLE 8.1 Summary of Natural Disasters in Sri Lanka, 1957–2007

Event type	Number of events	Killed	Injured	Homeless	Affected	Total	Damage, US$, 000s
Drought	10	0	0	0	8,613,000	8,613,000	0
Average per event		0	0	0	861,300	861,300	0
Epidemic	5	58	0	0	206,777	206,777	0
Average per event		12	0	0	41,355	41,355	0
Flood	37	948	1,000	2,746,601	6,455,127	9,202,728	370,444
Average per event		26	27	74,232	174,463	248,722	10,012
Landslide	3	119	0	0	130	130	0
Average per event		40	0	0	43	43	0
Wave, surge	1	35,399	23,176	480,000	516,130	1,019,306	1,316,500
Average per event		35,399	23,176	480,000	516,130	1,019,306	1,316,500
Windstorm	5	1,151	5,000	100,000	1,913,000	2,018,000	137,300
Average per event		230	1,000	20,000	382,600	403,600	27,460

Source: EM-DAT Database 2007.

crisis (Government of Sri Lanka 2005). The destructive waves initially lashed the eastern coast and subsequently hit many areas of the southern and western coasts of Sri Lanka, leading to loss of life and extensive damage to property. While district authorities and local communities responded quickly, they were soon overwhelmed by the magnitude of the disaster. The government immediately declared a state of national emergency and requested international assistance. Five of the nine provinces (the primary subnational administrative level) and 13 of the 25 districts (the secondary administrative level) of the country were affected. The total estimated mid-year population of these districts in 2003 was 1.3 million (Department of Census and Statistics 2003). The initial number of displaced persons was estimated at approximately 1 million (table 8.2). Assets valued at US$900 million were estimated to have been destroyed. The disaster severity index (the ratio of the number of affected and killed relative to the total population in the affected area, multiplied by 100) was 7.1. The district severity indexes ranged from 0.2 in Puttalam to 60.6 in Batticaloa.

Oxfam has found that women died disproportionately in the tsunami, indicating a gender imbalance (Oxfam 2005). The Oxfam report estimates that four times more women were killed in some areas hit by the Indian Ocean tsunami, creating long-term social problems for the devastated communities. In certain areas, up to 80 percent of the dead were women. The report suggests that the imbalance occurred because many men were working inland or fishing offshore when the waves hit, while the women were at home. According to the report, camp surveys in Sri Lanka suggested that there was a serious gap between the number of men and of women who had survived. The National Child Protection Authority Sri Lanka found that, of those affected, more than a third were children.

The Humanitarian Response

The live international television coverage of the tsunami was mirrored by local television stations that mobilized their own teams. The media had called successfully for assistance in past disasters and now launched an emergency appeal. The public response was immediate, heartwarming, and generous beyond all expectations. Public offices were closed on the fateful Sunday, and the premises of television stations were inundated with relief material (raw food provisions, clothing, medicines, bottled water, roofing materials, toiletries, baby food, packaged milk, sleeping mats, cooking utensils, and much more). Transport was made available

TABLE 8.2 People Displaced by the Tsunami, Survey Results of March 4, 2005

Province, district	Affected families	Displaced families	Displaced persons: In welfare centers	Displaced persons: With relatives or friends	Total	Deaths	Injured	Missing	Damaged houses: Completely	Damaged houses: Partially	Camps, number
Northern Jaffna	14,767	10,827	7,625	33,381	41,006	2,640	1,647	540	6,084	1,114	12
Killinochchi	2,297	407	0	1,603	1,603	560	670	0	246	—	0
Mullaitivu	6,745	6,007	11,993	10,564	22,557	3,000	2,590	421	5,033	424	23
Eastern											
Trincomalee	30,547	30,545	13,778	59,208	72,986	1,078	1,328	45	4,830	3,835	33
Batticaloa	63,717	12,494	20,962	35,047	56,009	2,975	2,375	340	13,530	5,839	34
Ampara	58,616	38,002	26,085	80,357	106,442	10,436	6,711	340	17,117	10,455	67
Southern											
Hambantota	13,493	3,334	1,803	12,362	14,165	4,500	434	1,341	2,303	1,744	11
Matara	19,744	2,235	30,086	6,405	36,491	1,342	6,652	601	2,362	6,075	22
Galle	24,583	23,278	2,272	119,662	121,934	4,288	313	564	7,032	7,680	25
Western											
Kalutara	9,752	7,707	2,306	32,641	34,947	279	401	68	2,683	3,835	10
Colombo	9,647	8,140	5,446	30,614	36,060	79	64	12	3,388	2,210	26
Gampaha	6,827	308	876	573	1,449	6	3	5	278	414	2
Northwestern											
Puttlam	232	18	66	—	66	4	1	3	23	72	2
Total	260,967	143,302	123,298	422,417	545,715	31,187	23,189	4,280	64,909	43,697	257

Source: Data of the Disaster Relief Services Center.
Note: — = no data are available.

through the appeal. Deficiencies were made known directly during the full-time, 24-hour media coverage. Volunteers delivered goods on their own to needy areas.

Appeals for medical services were broadcast as well, and volunteer medical teams responded. The armed services carried out rescue operations, assisted by local volunteers. National community-based organizations, local nongovernmental organizations (NGOs), and, subsequently, international NGOs also undertook relief operations. One television station organized a mobile emergency service that crisscrossed the country with convoys of trucks to collect goods. Soon thereafter, the government machinery kicked in and began delivering relief supplies. The international community sent teams to carry out search and rescue operations; provide medical care and telecommunications, data collection, and mapping equipment; and ensure water and sanitation services. Large amounts of supplies arrived in affected areas, including medicinal drugs, medical equipment, temporary shelters, water purification equipment, ambulances and other vehicles, refrigerators, electrical generators, helicopters, water tanks, and body bags. Despite the difficult circumstances, the information gathering and distribution network established by local information and communication technology experts has, in retrospect, been praised as impressive (Perera 2005).

Given the magnitude of the catastrophe and the outpouring of support from a multitude of sources, effective coordination became a necessity (Government of Sri Lanka 2005). A United Nations Disaster Assessment and Coordination team, supported by the United Nations Office for the Coordination of Humanitarian Affairs, was immediately deployed to assist in the coordination of relief operations. In addition, the United Nations resident coordinator facilitated coordination meetings, which provided a common forum for relevant multilateral, bilateral, and international and national NGO partners. At a meeting held on December 27, specific agencies were asked to carry out needs assessments in the affected districts. These agencies included the Department for International Development (United Kingdom), the United States Agency for International Development, the Humanitarian Aid Department of the European Commission, the German Federal Agency for Technical Relief, and the embassies of France, Italy, Sweden, and Switzerland. Visiting international teams were expected to coordinate with local authorities, particularly district administrators, together with United Nations volunteers and United Nations staff in the field. In an effort to coordinate international assistance, the government and the United Nations collated the various assessment reports drafted by these agencies, the United Nations

Disaster Assessment and Coordination team, and several other United Nations agencies, and synthesized these reports by district (Government of Sri Lanka 2005). The aim of this exercise was to provide a quick snapshot of the immediate needs in the districts and thereby facilitate a coordinated response to the needs. It is pertinent to note that no disaster management system had been created to prepare for such a disaster and carry out effective needs identification and monitoring for disaster relief and recovery management.

The Sri Lanka Disaster Management Act, passed in 2005 after the tsunami, spelled out the functions of the National Council for Disaster Management. One of the responsibilities of the council was to formulate a national policy and program on the management of disasters that would provide for the effective use of resources to prevent and prepare for disasters and to respond to disasters through relief, reconstruction, and rehabilitation.

Preparedness, disaster warning, and situation assessment are—according to a draft national plan for disaster management drawn up before the tsunami (NDMC 2002)—key areas in the efforts of government organizations, communities, and individuals to respond rapidly and effectively to a disaster. Clearly, this implies the existence of a special-purpose management information system that would help enhance the state of disaster preparedness and facilitate the identification of practical procedures to provide speedy relief to persons affected by disasters and to organize reconstruction in the wake of them. Such a system requires the application of information tools and monitoring mechanisms. It also requires transparency and accountability. However, the draft national plan had not adequately addressed these needs and requirements. Moreover, in the aftermath of the tsunami, it became clear that coordination is the most challenging aspect of disaster management. A user-friendly coordination procedure acceptable to all stakeholders would be of immense help in preparing for and responding to disasters.

The Sahana System

The tsunami of December 26, 2004, resulted in a massive outpouring of relief for the nearly 1 million people it affected (Government of Sri Lanka 2005). When thousands of people from multilateral organizations or on their own initiative arrived to help, it became clear immediately that without IT, it would be difficult to coordinate this effort and maximize the impact on the affected people. Despite the value of IT in disaster management, there were few relevant systems in existence, and none had been widely deployed.

The most widely used systems were not based on the Web and relied on outdated technology. While various specialized elements of such a system existed, no single cohesive system was ready to be deployed.

To fill this void, the Sahana project was born. In Sinhalese (the language of the majority community in Sri Lanka), *sahana* means assistance in time of distress. The Sahana project was created to provide a free, open-source disaster management system. The system is a Web-based tool that addresses the common problems in coordination that arise during a disaster. These problems revolve around the need to find the missing, manage humanitarian aid, organize the numerous volunteers, survey temporary camps, and coordinate effectively among government groups, donors, civil society, NGOs, and the victims themselves.

The Sahana project was developed over a two- to three-week period around the time of the Asian tsunami to help coordinate the relief effort in Sri Lanka. It was initiated by a group of volunteers from the Sri Lankan IT sector and spearheaded by the Lanka Software Foundation, a nonprofit organization involved in research and development in free, open-source software (FOSS).

The Swedish International Development Cooperation Agency funded a second phase of development through the Lanka Software Foundation to adapt the system for global application in large-scale disasters. That the system has become widely used is demonstrated by deployments during disasters such as the earthquake in Pakistan (2005), the mudslide disaster in southern Leyte in the Philippines (2006), and the Yogyakarta earthquake in Indonesia (2006). The second phase funded by Swedish cooperation enhanced the capability of the system and helped rally support among the global community. In line with the philosophy of open-source software, the system is available for free download, and users may change and improve the design. The latest release of the Sahana system has been downloaded thousands of times by users around the world. The system is also available on compact disc, which may be used without installing the system on the hard drive. It is versatile and may be run stand-alone on a single laptop for an individual user or on a server cluster. The design focus has been on robustness so that the system is adaptable to many disaster scenarios.

The Initial Application

A presentation on the fledgling Sahana system at a coordination meeting at the Center for National Operations within two weeks of the onset of

the tsunami crisis was well received, and the center authorized the deployment of the Sahana system to help coordinate data collection on the disaster and the recovery effort. The center invested in the necessary hardware for all divisional secretariats. (The center was eventually closed and replaced; see elsewhere below.) The Sahana system was installed on around 250 personal computers. Data were to be collected among the numerous emergency camps where displaced persons were being cared for.

The initiative did not catch on, however. It seems to have been lost among the profusion of proposals that were emerging at that time for dealing with the disaster, including proposals for the creation of new institutions. There was no systematic effort to assemble relevant data that had previously been or were being collected. Few officials had any expertise or experience in disaster management. The only organization possessing the appropriate knowledge, the National Disaster Management Center, had been sidelined. (It was eventually closed and replaced; see elsewhere below.) If this institution had been allowed to play a lead role, the Sahana system might have taken root. Other stakeholders had little familiarity with the use of free software systems, and they had reservations regarding the sustainability of the Sahana system. Moreover, a comprehensive IT-based system would have promoted transparency, and some key stakeholders had the perception that transparency was not a high priority.

The immediate adoption of this promising IT solution was confined to the largest charitable organization in Sri Lanka, Sarvodaya, and a branch of the Swiss NGO, Terre des Hommes, which was active in one eastern district. The Sahana system was tailored to Sarvodaya requirements and installed, and trials were initiated. The Disaster Management Center (not to be confused with the National Disaster Management Center; see above), which was established under the National Council for Disaster Management in May 2005, after the tsunami, is in the process of holding discussions on the wider use of the system. It hopes to upload its own data on the temporary camps for displaced persons in the country to the Sahana system. Ironically, the system has found greater appeal elsewhere and has been adopted in other countries. Thus, for example, after the earthquake in Pakistan in 2005, two Sahana developers traveled to Pakistan to help set up the software. Sahana experts also helped set up the system after the mudslide disaster in the Philippines in 2006 to track and coordinate the disaster relief efforts of organizations and individuals.

The Response of Sahana to Evolving Needs

The long-term objective of the developers of Sahana is to grow the system into a complete disaster management tool that addresses prevention, preparedness, relief, and recovery. Sahana played a seminal part in spawning a community founded by Paul Currion, a humanitarian consultant, and Chamindra de Silva, the Sahana project leader, based on the more generic ideals of humanitarian FOSS applications. The ideals of FOSS have been applied in building humanitarian information and communication technology responses to help alleviate human suffering. The particular contribution of Sahana has been recognized by the Free Software Foundation, which is dedicated to promoting the right of computer users to apply, study, copy, modify, and redistribute computer programs. Indeed, Sahana inspired a new Free Software Foundation award for projects of social benefit that reflect broad humanitarian ideals.

The main actors at Sahana hope to see the system applied not only in response to major disasters around the world, but also in other areas, including wide-ranging health programs. The flexibility and ease of development of the Sahana framework should allow it to evolve into other domains as well. The developers would like to focus on deployment before needs arise, so that if a disaster strikes, no time is wasted (Nah 2006).

The IT Solution

The Sahana system is an integrated set of Web-based disaster management applications that help provide solutions to large-scale humanitarian problems, especially in the relief phase of a disaster. The philosophy of the project is captured in the project's goals:

- Alleviate human suffering and save lives through the efficient use of IT
- Coordinate the efforts of diverse actors in the disaster response, including government, local and international NGOs, volunteers, and victims
- Empower victims and their families to help themselves
- Protect data on victims to prevent data abuse
- Provide a free, open-source IT solution to those in need

Subsequently, the scope was extended to all phases of the disaster cycle. The system provides solutions to critical issues in disaster management. These issues are now described.

Problem 1: Tracing Missing Persons

The Sahana missing person registry functions as an online bulletin board of missing and found persons. It captures information about people who are missing or who have been found and information about the individuals seeking the missing. This facility adds to the chances that people will find each other. For example, if two members of a family are looking for the head of the family who has been found elsewhere, the facility may be used to put these people in touch. The features of the facility include the following:

- Information about the individual: identity card number, visual appearance, the location where the person was last seen
- Sounds-like name search (using metafore and soundex algorithms)
- Uploading the missing person's photo
- Grouping by family unit or other suitable grouping

Source: Sahana Demo Module Database 2007, "Missing Person Registry." http://demo.sahana.lk/cvs/index.php?mod=mpr.

Problem 2: Coordinating Aid Groups and Helping them to Operate in Harmony

In the aftermath of the tsunami, there was a tremendous outpouring of support for the victims from donors, local and international NGOs, and civil society. In Sri Lanka, more than 300 registered NGOs provided support. If the efforts of such groups are not coordinated effectively, the difficulties that result may include congested supply routes and competition for the provision of support in some areas, while others suffer a dearth in support. Without coordination, the work of aid groups may be wasted, underutilized, or undervalued.

An IT solution via an organization registry may help keep track of the location and the nature of each organization's intervention and, perhaps more importantly, areas in need where nothing or little is being done. With such a tool, organizations might even ensure, on their own, that they do not interfere or duplicate the work of others and that they cover all areas in need.

The registry keeps track of organizations working in each area, including the range of services covered. The registry features include the following:

- Comprehensive information on each relief organization and its activities in each area

- Registry information on volunteers offering services
- Information on the nature and location of the core services each group is providing
- Information on areas in which there is a convergence of services and support and on areas in which no aid is being provided

Source: Sahana Demo Module Database 2007, "Organization Registry." http://demo.sahana.lk/cvs/index.php?mod=or.

Problem 3: Finding All Temporary Shelters

Homes, schools, and large government-run facilities may serve as temporary shelters or camps. Information on the location of such shelters and the number of people they house is required for the effective distribution of aid. Without this tool, small or remote shelters may be omitted during the distribution of aid.

The registry provides basic data on each shelter. It also supplies a geospatial view to allow the location of each shelter to be accurately determined. The registry features include the following:

- The integration of Google maps to provide a geographic view of each shelter region
- The ability to tailor the priority services provided at each shelter
- Reports on shelters by geographical and administrative area

Source: Sahana Demo Module Database 2007, "Shelter Registry." http://demo.sahana.lk/cvs/index.php?mod=cr&act=default.

Problem 4: Matching Aid Pledges and Requests

Even long after the tsunami, a significant proportion of the pledges of assistance have not materialized or have not been used. The main reasons are a lack of widespread awareness of the existence of the pledges and a lack of links between people who require assistance and assistance providers. A single NGO might be alone in receiving a specific request, but only one in hundreds of NGOs may actually have a supply of the requested item. It may therefore be difficult for the first to discover the second.

The system provides a central online repository where relief organizations, relief workers, government agencies, and shelters may match requests, supplies, and pledges. The relevant registry serves as an online system for

tracking aid requests until the requests are filled. The registry features include the following:

- Information on all assistance requests and pledges according to category, unit, contact details, and supply status
- Aid catalogues that may be tailored to the needs of users (see elsewhere below)
- A search filter for aid pledges and requests

Source: Sahana Demo Module Database 2007, "Sahana Request/Aid Management." http://demo.sahana.lk/cvs/index.php?mod=rms&act=default.

Problem 5: Managing Inventory

The inventory management system tracks all inventory related to relief work. System features include the following:

- Find items: search items available in warehouses
- List inventories: manage multiple inventories to enable end users to edit and transfer items among inventories
- Reorder: enable addition, editing, or deletion of the reorder level defined for particular items
- Reports: list expired items, destroyed items, and items of which the amount available is lower than the reorder level
- Optimization: list the amount of items sent to or received from another inventory; users may set relationships among items and track items that may be used as alternatives

Source: Sahana Demo Module Database 2007, "Inventory Management System." http://demo.sahana.lk/cvs/index.php?mod=ims&act=default.

Problem 6: Cataloguing Aid Items

The aid catalog and classification facility captures information on the catalogues, subcatalogues, items, and measurement units that are used in the inventory management system and the request/aid management system. The features include the following:

- Add main catalogue: enables users to add root catalogues
- Add subcatalogue: each subcatalogue may have several levels

- Add item: enables the addition of items used in the inventory management system
- Add type of measurement unit: enables the addition of measurement unit types (volume, mass, length, and so on)
- View and edit the items, catalogues, and unit types in the catalogue system
- Supplier report: enables information on registered suppliers to be entered in the catalogue

Source: Sahana Demo Module Database 2007, "Aid Catalog and Classification System." http://demo.sahana.lk/cvs/index.php?mod=cs&act=default.

Problem 7: Keeping Track of Children

The child protection system is in development. A model has been built specifically for the NGO Terre des Hommes. The model keeps detailed track of children and their needs.

Problem 8: Managing and Coordinating Volunteers

The volunteer coordination and management facilities track volunteers working in the disaster area. They capture the places where volunteers are active and information on the range of services they provide. The features include the following:

- Tracking volunteers, their skills, and their availability
- Allocation of volunteers to projects
- Ability to search for volunteers based on skills

Sources: Sahana Demo Module Database 2007, "Volunteer Coordination." http://demo.sahana.lk/cvs/index.php?mod=vol&act=default; Sahana Demo Module Database 2007, "Volunteer Management." http://demo.sahana.lk/cvs/index.php?mod=vm&act=default.

Problem 9: Messaging

The messaging module is the main active communication tool of the Sahana system. It is used to exchange short text messages (short message service), e-mail alerts, and send other messages among various groups and individuals before, during, and after a disaster. It also provides a convenient

way of collecting relevant mobile phone numbers and e-mail addresses. The features include the following:

- Creation of ad hoc groups of short message service numbers and e-mail addresses
- Transmission of short text messages through mobile phones linked to computers
- Transmission of messages using the common alerting protocol

Source: Sahana Demo Module Database 2007, "Messaging." http://demo.sahana.lk/cvs/index.php?mod=msg&act=default.

Problem 10: Keeping Abreast of an Evolving Situation

The situation mapping module supplies an overview of a situation and allows individuals to add information on events as they occur. The module features include the following:

- Situation mapping with map markers for incidents, locations, and objects
- Attachment of pictures and texts to markers

Source: Sahana Demo Module Database 2007, "Situation Mapping." http://demo.sahana.lk/cvs/index.php?mod=gis&act=default.

The Advantages for Intended Users

Among the potential system users are disaster administrators and managers, governmental organizations, NGOs, civil society, and disaster victims. There are many reasons why the use of FOSS is suitable for humanitarian applications of information and communication technology and why there seem to be limited commercial alternatives available. These include the following:

- Few countries and organizations are able to afford the investment of substantial resources in disaster management if there is no direct threat. This is also true of wealthier developed countries since there are always higher priorities that need funding in preference to preparations for a disaster that may not occur. The FOSS approach provides a low-budget, volunteer-driven, global method to build such systems.

- There is little commercial interest in developing such solutions because during humanitarian disasters, software licenses often become freely available. With FOSS, there need not even be delays in obtaining licenses given that the system may be downloaded and used without charge and without obtaining a license.
- Such systems should be developed and owned globally because the problems they address are common to countries confronted by disasters. The systems therefore represent a global public good. FOSS mechanisms have a proven track record as a public good.
- The global IT volunteer community may readily and willingly contribute to improving such applications.
- Barriers arise between governments and local and international NGOs during disasters because of the urgent circumstances, the lack of transparency, and differences in coordination capacity. An open, transparent, and globally owned system is more likely to be trusted in mediating among these groups.

Governance of the System

The Lanka Software Foundation is the custodian of the Sahana system, and the foundation's board acts as the system manager. The board includes representatives of most of the major IT players in the country. Aside from the practical advantages of the system, the foundation is also interested in advancing the image of the country as a developer of open-source software.

Currently, the structure of the Sahana organization includes the following:

- The *board of directors* is responsible for promoting the adoption and sustainable growth of Sahana. It actively seeks to engage with the private sector, the academic community, and public sector partners in promoting the adoption of and support for Sahana. It is establishing a mechanism for evaluating the success of Sahana deployments and clarifying key issues in Sahana development and implementation.
- The *project management committee* seeks to ensure that the Sahana community acts in accordance with principles of good governance that are consistent with the objectives of Sahana. This includes operational, legal, and procedural oversight over Sahana releases.
- The *system developers* are those committed individuals who have gained the trust of the main contributors to Sahana and have direct access to the system so as to contribute to the Sahana code and documentation and other Sahana resources.

- The *Sahana community*, the largest group within Sahana, consists of more than 200 people who help to promote, provide feedback on, and deploy the system.
- The *sponsors* keep Sahana operational and running by donating funds, infrastructure, and other resources.

Building Capacity among Users

Sahana staff work with users to build capacity so that, ultimately, users are able to run the system with their own resources, while Sahana staff perform troubleshooting. The case of Sarvodaya, the charitable organization, offers an example. Sarvodaya has invested human resources, hardware, and other resources into the system. However, Sarvodaya has a shortage of volunteers who are competent in IT and who speak English. The Hazard Information Center of Sarvodaya also therefore acts as a help desk on the system for Sarvodaya operators in branch organizations in the field. The program is also available in other local languages, and this makes building capacity easier.

Input, Processing, and Output

Users may select the data they wish to incorporate in the system depending on their individual requirements. Users may also decide who has access to the system to input data. This may be accomplished through online uploads; via e-mails, from which data are uploaded by system management; the use of flash drives; and so on. Data in spreadsheets may be converted and introduced by the system.

A common system vocabulary is being developed that covers both generally accepted IT terminology and the specialized terminology in disaster management. For instance, emergency managers refer to people affected by disasters as victims, whereas NGOs refer to the same individuals as beneficiaries. Sahana is looking to develop standards, but these are not yet mature. A common set of machine-to-machine protocols are being developed by an international group. There is a system to match names phonetically even if spellings are not correct. The classification level built into the system enables clients to determine which data are critical.

Tabulated reports may be generated by the system in graphic form and downloaded to a handheld device in a format that may be easily read. Newly introduced information, such as information on a missing person who has been located, may be highlighted by means of a flashing icon.

Evaluation of the System

The evaluation has been based on interviews with 16 individuals, most of whom had been involved in the initiation, development, deployment, management, or use of the Sahana system. The interviewees were actual, potential, or intended system users in governmental organizations (five individuals), local NGOs (four), international NGOs involved in disaster management (two), and international disaster management consulting (one).

The objective of the evaluation was to obtain information on the impressions and experiences of the key informants regarding Sahana. Awareness of the system was generally high among the interviewees. In the absence of specific awareness, the opinions of the interviewees were sought on the potential uses of the system.

The interview material was analyzed to glean insights into actual and potential uses of the system, distill lessons learned, and make recommendations for the sustainable institutionalization of a disaster management system before disaster strikes.

The Barriers to Adopting the System

Soon after the tsunami, all the interviewees had recognized the need for a disaster management system. At the time, numerous vendors of commercial IT-based data management systems were trying to hawk their systems to individual stakeholders, which created confusion. Stakeholders were wary of evaluating competing systems because of their lack of time and the need to respond urgently. Nonetheless, the Sahana system appealed to staff at the Center for National Operations and the coordinating committee, and the initial response of the committee was positive; some headway was therefore made in adopting the system.

Ironically, institutional changes in the governmental disaster management structure in the aftermath of the tsunami were perhaps the most significant barrier to institutionalization. When the tsunami struck, the president of Sri Lanka was abroad. On the day of the crisis, the prime minister began coordinating the response. The president returned to the country on the third day after the tsunami and immediately took over coordination through the Center for National Operations, which had been established in late December 2004 within the Presidential Secretariat. This center had been dismantled by the end of February 2005 because of the

perception that the acute crisis phase had passed. The Task Force for Rebuilding the Nation was then created. The task force functioned for about six months and was replaced by the Reconstruction and Development Agency, which concentrated on the provision of shelters. This agency has now been replaced by the Ministry of Nation Building and Estate Infrastructure Development.

There was a considerable infusion of private sector human and material resources into these entities. Nonetheless, no proper transfer of accumulated data seems to have been carried out during these institutional changes. If a proper database such as Sahana had been adopted from the start and time-honored methods for passing along resources from one institution to another had been followed, it is more likely the data would have been retained and survived the changes.

The closing of the National Data Management Center, which had experience, expertise, and an institutional memory of past disasters and would have been prepared to lead the response, added to the uncertainty that prevailed in the immediate aftermath of the tsunami. The center benefited from the participation of a large number of officials who were trained and had gained experience in disaster management. It had also developed a draft national disaster management plan put together by several task forces. The plan and the center's expertise were never used. As a result, many stakeholders came to believe that disaster management had become politicized.

Meanwhile, the adoption of a common, government-wide system would have led to transparency, which may have been perceived as a threat by some stakeholders. Thus, the gap between the pledges of assistance and the actual aid received would have become apparent and embarrassed some donors.

There was also difficulty in convincing the Liberation Tigers of Tamil Eelam to adopt a common database for the areas they controlled.

Stakeholders had the impression that the Sahana system was to be tested before implementation; many had reservations about the robustness of the system. Government officials and, to a lesser extent, officials at NGOs were not used to relying on free software systems and were suspicious, especially about the local ability to maintain the Sahana system and carry out troubleshooting downstream. They thought that since the system was free, the Sahana developers had no obligation to provide troubleshooting services. In addition, there was a generation gap between the system creators and the potential users; the Sahana team was young, and the governmental and NGO officials were quite senior.

All governmental departments possessed time-tested management information systems that included data-generation procedures tailored to their individual requirements. To adopt a new, untested system seemed unappealing, and this barrier impeded Sahana.

Advantages of the System

Relevance and Efficiency

Today, numerous users and potential users seem convinced of the relevance of the system to their requirements and the ability of the system developers and managers to troubleshoot, maintain, and guide the generation of new modules to meet evolving needs. Users are comfortable with the ease and efficiency of data access and have not encountered persistent difficulties. Given that the system has not been widely adopted in Sri Lanka, however, it is difficult to determine, based on this case study alone, the ease with which the system lends itself to large-scale application.

Governance

Stakeholders had reservations about the individuals responsible for system oversight, management, and coordination. They felt that the government and NGOs should run their own systems because a purely government-driven system would not be acceptable to the private sector and NGOs and vice versa.

Meanwhile, the Sahana developers have not taken the position that they must exercise strict control. Only access to sensitive information should be regulated through the use of passwords, because, otherwise, sensitive data may be abused for personal gain (for example, by contractors wishing to learn about opportunities for profit through contracted services). There is also the danger of fraudulent claims to parental rights over orphaned children, as demonstrated in a well-known case that ended up in the courts and was resolved only after the use of sophisticated DNA testing.

Cost-Effectiveness

One of the most appealing features of Sahana is supposedly its cost effectiveness relative to available commercial options. A number of commercial solutions are on the market, such as the E Team Incident Management Software Program (http://www.eteam.com/index.html), which was used in New York City in responding to the 9/11 attack, and WebEOC (http://www.esi911.com/home/). These solutions are extremely expensive

relative to the budgets of most emergency management organizations. A single deployment of WebEOC might cost US$50,000, for example. This is a significant amount for a software program, especially because upgrades may have to be purchased, and the anticipated disaster may never occur during the life of the program (Gavin Treadgold, personal communication).

A FOSS approach provides a volunteer-driven, low-budget means to build such a system. While there is not much commercial interest in developing relevant solutions—because during humanitarian disasters proprietary software licenses are often supplied free of charge—there need not be any delay in obtaining a no-cost license in the case of FOSS because anyone may download the FOSS program without condition. The developers believe that such systems should be shared and developed as a global public good. The FOSS development community has a proven track record in following this precept. The assumption is that lowering the adoption costs will encourage the use of coordination systems. Ironically, in Sri Lanka, the free, open-source software label led potential users to doubt the quality of the customer services available and reject the system (see elsewhere above).

Interoperability

While commercial emergency management systems may claim that they are interoperable, the profit motive has held back the development of commercial solutions that provide true interoperability. The standards that are sorely needed are unlikely to come directly from commercial vendors and will need to be sought on a global scale through a nonprofit effort such as Sahana (Gavin Treadgold, personal communication). Indeed, both in the design of the system and in the nature of the support communities involved in the development and application of appropriate standards, Sahana aims directly at interoperability.

Use for Purposes other than Disaster Management

It is possible to adapt the Sahana system to other uses. It is a modular system and therefore may be built up and tailored to individual needs. Other than disaster management, modules may be readily developed for the following applications:

- Hazard risk mapping (geographic information system)
- Vulnerability analysis
- Disaster scenario analysis
- Resource inventory tracking and mapping

- Identification and registration of local and international NGOs specialized in various areas of risk and disaster management and other relevant areas of expertise
- Contact information for community leaders and volunteers
- Demography studies of at-risk populations

The software may be used in drafting morbidity and mortality surveys and reports, epidemiological surveillance, maternal and child health statistics, inventories of health facilities by type, and so on. The data fields might be used in monitoring the impacts of disasters by, for example, tracking affected population groups such as pregnant women, infants, and the elderly.

International Recognition

The Sahana system has received international recognition, including through the following awards:

- Various awards to contributors by the Information and Communication Technology Agency of Sri Lanka
- 2005 Red Hat Summit Award
- SourceForge Project of the Month, June 2006
- Sand Hill Group Foundation Good Samaritan Award, 2006
- Free Software Foundation Award for Projects of Social Benefit, 2006

Lessons Learned

Vulnerable countries should be encouraged to adopt suitable disaster management systems before disaster strikes. It is important that such systems be accepted and approved by governmental and nongovernmental relief coordinators. Relief workers, including volunteers, should be enabled to work together using common data sets.

Any ex ante system should be open so that all relief groups may work together and have access to the appropriate data. Problems sometimes arise because government entities responsible for deploying disaster management system software are reluctant to share the software with NGOs. Any disaster management portal that prevents access to NGOs, civil society, or the government represents only a partial solution and will foster the application of multiple systems. The existence of parallel silos of data tend to cause more confusion because no proper data consolidation can take place.

Dedicated teams should be established immediately after a disaster has struck. The teams should ensure coordination, identification, data exchange, and help desk services. Each disaster environment is characterized by unique and urgent data needs and application and support requirements. Thus, a dedicated professional team should be involved in and support the deployment of any ex ante system.

A help desk and call center should be set up as soon as possible after a disaster incident to assist users in the application of the system and in entering data, especially in nations with low IT literacy. During the initial stages of a relief effort, there may not be enough time to sift through all the relief supplies as these arrive. Later, as operations become more streamlined and the situation stabilizes, greater accuracy in tracking supplies may be introduced to improve the efficiency and transparency of aid distribution. The disaster management system must be sufficiently flexible to handle this evolving data complexity.

Conclusions

The severity of global disaster occurrences and the propensity of disasters to affect developing countries disproportionately point to the urgent need for the establishment of an institutional framework for ex ante disaster management systems. Sahana is a free, Web-based, open-source disaster management system. It has the potential to address the problems in coordination that typically afflict a disaster response in providing relief, finding missing people, managing aid and volunteers, monitoring camps, and coordinating effectively between the government, civil society, NGOs, and victims. The system is designed to handle the overlap between relief and reconstruction and allows for the coordination of all disaster management efforts within one data platform. Sahana may be used in carrying out the following:

- Performing gap analysis for specific towns and villages by mapping aid distribution against needs assessments
- Coordinating aid efforts and avoiding duplication by keeping track of the work of all groups and individuals involved in the response
- Providing a single platform at a single venue for the government, international organizations, bilateral donors, and nonprofit organizations
- Monitoring aid distribution and allowing verifiability and greater accountability

- Simultaneously tracking efforts in both relief and reconstruction so as to cover the full cycle of disaster recovery

The system has the added advantage of transparency, which is required by all stakeholders. Due to its modular platform, the system may be adapted to the database requirements of any management information system. Indeed, using such information as a benchmark facilitates impact analyses of disasters. The system can also feed into national planning databases to address the development needs of vulnerable populations and disaster victims. Although the application of the system has been limited in Sri Lanka, more extensive applications in other Asian countries have demonstrated the robustness of the system in various settings.

Recommendations

- There is sufficient experience among the developers and users of Sahana to chart a road map for moving forward.
- Regional and interregional meetings should be organized to sensitize disaster managers on the lessons learned from relevant studies and to convince them about the need for the ex ante adoption of suitable IT systems for disaster management.
- Participants at local and international disaster management training programs and conferences should be made aware of the Sahana system.
- Multicountry projects should be undertaken in various regions to encourage and ensure acceptance of the system.
- These and other initiatives could be supported by international agencies and other donors that have a demonstrated interest in disaster mitigation and management.

Note

1. The author thanks the following interviewees for taking time to provide information for this chapter and share their perceptions and experiences: Vinya Ariyarathne, Geethike Kadigamuwa, S. Rajive, and Vinitha Wickremesinghe (Sarvodaya); Col Ekanayake and Kelum Jayasoma (Disaster Management Center); Hemantha Herath and Terrence de Silva (Ministry of Health); N. D. Hettiarachchi (National Disaster Relief Coordination Center); Nifan Karim, Prabath, Chamindra de Silva, and Ravindra de Silva (Lanka Software Foundation); Hendricus Raaijmakers (World Health Organization); Gavin Treadgold (consultant, emergency management, New Zealand); and Patrick Vandenbruaene (World Bank, Colombo, Sri Lanka).

References

Department of Census and Statistics. 2003. *Census of Population and Housing 2001*. Colombo, Sri Lanka: Department of Census and Statistics.

EM-DAT (OFDA-CRED [Office of U.S. Foreign Disaster Assistance–Center for Research on the Epidemiology of Disasters] International Disaster Database). Center for Research on the Epidemiology of Disasters, Université Catholique de Louvain, Brussels. http://www.em-dat.net/ (accessed July 8, 2007).

Government of Sri Lanka. 2005. "Assessment of Needs of the Tsunami Disaster, Sri Lanka: Synthesized District Reports as at 3 January 2005." Assessment report, Colombo, Sri Lanka, Government of Sri Lanka.

Leader Publication (Pvt) Ltd. 2005. *The Sunday Leader*. April 3. Colombo, Sri Lanka: Leader Publication.

Ministry of Health and WHO (World Health Organization). 2006. "Health Sector Emergency Contingency Plan." Draft document, Colombo, Sri Lanka, Ministry of Health and WHO.

Nah Soo Hoe. 2006. "Managing Disasters: Sahana, Sri Lanka." In *Breaking Barriers: The Potential of Free and Open Source Software for Sustainable Human Development; a Compilation of Case Studies from Across the World*, ed. Nah Soo Hoe, 56–63. Bangkok: Asia-Pacific Development Information Program, Regional Center in Bangkok, United Nations Development Programme; New Delhi: Elsevier.

NBRO (National Building Research Organization) Web site. Landslide Studies and Services Division, NBRO, Ministry of Disaster Management and Human Rights. http://www.nbro.gov.lk/lssd.htm (accessed October 2007).

NDMC (National Disaster Management Center). 2002. "Draft National Disaster Management Plan." Planning document, NDMC, Colombo, Sri Lanka.

Oxfam. 2005. "The Tsunami's Impact on Women." *Oxfam Briefing Note*, March. Oxford: Oxfam International.

Parakrama, Arjuna. 2006. "Impact of the Tsunami Response on Local and National Capacities: Sri Lanka Country Report." With contributions by Elisabeth Scheper and Sudarshana Gunawardena. TEC country report, Tsunami Evaluation Coalition, Active Learning Network for Accountability and Performance in Humanitarian Action, Overseas Development Institute, London.

Perera, B. J. C. 2005. "Aftermath of 9.0/2004 and the Tsunami." *Sri Lanka Journal of Child Health* 34 (1): 1–2.

Sahana Demo Module Database. Sahana Disaster Management System Demo. http://demo.sahana.lk/cvs/index.php?mod=home&act=default (accessed October 2007).

Senanayake, Manouri P. 2005. *Newsletter of the Sri Lanka College of Paediatricians* 7 (1). Colombo, Sri Lanka: Sri Lanka College of Paediatricians.

Sri Lanka Virtual Library Database. http://www.lankalibrary.com/ (accessed October 2007).

Index

Boxes, figures, notes, and tables are indicated by *b, f, n,* and *t*, respectively.

E

H

I

J

K

N

O

P

Q

R

T

V

W

Z

ECO-AUDIT

Environmental Benefits Statement

The World Bank is committed to preserving endangered forests and natural resources. The Office of the Publisher has chosen to print ***Data Against Natural Disasters: Establishing Effective Systems for Relief, Recovery, and Reconstruction*** on recycled paper with 30 percent post-consumer waste, in accordance with the recommended standards for paper usage set by the Green Press Initiative, a nonprofit program supporting publishers in using fiber that is not sourced from endangered forests. For more information, visit www.greenpressinitiative.org.

Saved:

- 10 trees
- 7 million BTUs of total energy
- 859 lbs. of net greenhouse gases
- 3,567 gallons of wastewater
- 458 lbs. of solid waste

green press INITIATIVE

In recent years, the world has seen both massive destruction caused by natural disasters and immense financial and physical support for the victims of these calamities. So that these natural hazards do not become manmade disasters, effective systems are required to identify needs, manage data, and help calibrate responses. If well designed, such systems can help coordinate the influx of aid to ensure the timely and efficient delivery of assistance to those who need it most.

Data Against Natural Disasters seeks to provide the analytical tools needed to enhance national capacity for disaster response. The editors and authors begin with an overview that summarizes key lessons learned from the six country case studies in the volume. Next, they outline the data needs that arise at different stages in the disaster response and explore the humanitarian community's efforts to discover more effective response mechanisms. The country case studies review the successes and failures of efforts to establish innovative monitoring systems in the aftermath of disasters in Guatemala, Haiti, Indonesia, Mozambique, Pakistan, and Sri Lanka.

Data Against Natural Disasters will be useful to policy makers and others working in post-calamity situations who are seeking to design new monitoring systems or to improve existing ones for disaster response management.

OCHA United Nations Office for the Coordination of Humanitarian Affairs

THE WORLD BANK

ISBN 978-0-8213-7452-8

9 780821 374528 90000

SKU 17452