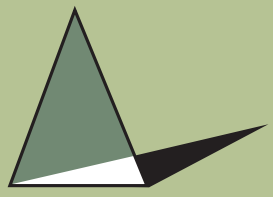
'Measuring Mitigation'

Methodologies for assessing natural hazard risks and the net benefits of mitigation – A scoping study

Charlotte Benson and John Twigg *December 2004*



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Acronyms and abbreviations

ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
ALNAP	Active Learning Network on Accountability and Performance in Humanitarian Assistance
AUDMP	Asian Urban Disaster Mitigation Programme
AusAID	Australian Agency for International Development
BCA	benefit cost analysis
BDRCS	Bangladesh Red Crescent Society
BMZ	*Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung* (Federal Ministry for Economic Cooperation and Development, Germany)
CAMI	Central America Disaster Mitigation Initiative
CAP	country assistance programme
CAS	country assistance strategy
CBA	cost-benefit analysis
CBDO-DR	Citizenry-Based and Development-Oriented Disaster Response (Philippines)
CBO	community-based organisation
CDB	Caribbean Development Bank
CDMO	community disaster management organisation
CDRC/N	Citizens' Disaster Resource Center/Network (Philippines)
CEA	country environmental analysis
CEP	country environmental profile
CIDA	Canadian International Development Agency
CRA	comparative risk assessment
CRED	Centre for Research on the Epidemiology of Disasters (Belgium)
CSP	country strategy paper
CVA	capacities and vulnerabilities analysis
DEC	Disasters Emergency Committee (United Kingdom)
DFID	Department for International Development (United Kingdom)
DG DEV	Directorate General for Development (EC)
DMC	developing member country
DMTP	UN Disaster Management and Training Programme
DP	disaster preparedness
DRC	Disaster Research Center
DRI	Disaster Risk Index
EC	European Commission
ECHO	European Community Humanitarian Aid Office
ECLAC	Economic Commission for Latin America and the Caribbean
EIA	environmental impact assessment
EPHF	Essential Public Health Functions
ERA	environmental risk assessment
EU	European Union
EW	early warning
FEMA	Federal Emergency Management Agency (United States)
GESI	Global Earthquake Safety Initiative
GHI	GeoHazards International
GIS	geographic information system
HIA	health impact assessment
HIPC	Highly Indebted Poor Countries initiative
HIV/AIDS	human immunodeficiency virus/acquired immunodeficiency syndrome
HLS	household livelihood security
HMU	Hazard Management Unit (formerly the Disaster Management Facility) (World Bank)
IACNDR	Inter-American Committee for Natural Disaster Reduction
IAIA	International Association for Impact Assessment

IDB	Inter-American Development Bank
IFI	international financial institution
IFRC	International Federation of Red Cross and Red Crescent Societies
ISDR	International Strategy for Disaster Reduction (UN)
ITDG	Intermediate Technology Development Group
LDC	least developed country
M&E	monitoring and evaluation
MDG	Millennium Development Goal
MoU	memorandum of understanding
NGO	non-governmental organisation
OAS	Organization of American States
OECD DAC	Organisation for Economic Co-operation and Development, Development Assistance Committee
OFDA	Office for Disaster Assistance (USAID)
NAO	National Audit Office (United Kingdom)
NPV	net present value
PAHO	Pan American Health Organization
PED	emergency preparedness programme (PAHO)
PI	project impact
PML	probable maximum loss
PRA	participatory rural appraisal
PRSP	poverty reduction strategy
RRA	rapid rural appraisal
RRP	Report and Recommendations to the President
RSP	regional strategy paper
RUTA	*Unidad Regional de Asistencia Técnica* (Regional unit for technical assistance)
SEA	strategic environmental assessment
SEAN	strategic environmental analysis
SIA	social impact assessment
SIDA	Swedish International Development Agency
SL	sustainable livelihoods
SMART	specific, measurable, attainable, relevant and time-bound (indicators)
SOP	standard operating procedure
SPICED	subjective, participatory, interpreted, cross-checked, empowering and diverse (indicators)
SRA	safety risk assessment
SUMA	supply management system (PAHO)
TOR	terms of reference
UN	United Nations
UNAIDS	Joint UN Programme on HIV/AIDS
UNCRD	United Nations Centre for Regional Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNDR	Office of the United Nations Disaster Relief Coordinator
USAID	United States Agency for International Development
VA	vulnerability analysis/assessment
VCA	vulnerability and capacity assessment
VND	Viet Nam dong
WHO	World Health Organization
WMO	World Meteorological Organization
WPNS	well-prepared National Society

Executive summary

As the human and financial costs of disasters rise, there are increasing demands for evidence that mitigation 'pays'. Until this proof exists, however, many aid agencies remain reluctant to pursue risk reduction as a key objective, or even to protect their own projects against potential hazards.

Underlying the generation of such evidence, it is necessary to have appropriate tools to analyse and measure the costs of mitigation and the nature of the resulting flow of benefits. These costs and benefits can take many forms, including social, environmental and humanitarian as well as financial ones. However, such tools do not already exist in a coherent form. This study therefore aims to facilitate the development of such tools and related guidelines by exploring how cost-benefit analysis, environmental impact assessment and related methodologies as well as evaluation tools can be expanded to consider risks emanating from natural hazards and to measure related costs and benefits in reducing risk. The study is one of a number of projects that ProVention is implementing to develop and demonstrate innovative approaches to the practice of natural hazard risk identification and analysis, risk reduction, and risk sharing and transfer.

This report presents the results of the first, survey or 'scoping' phase of the study. It reviews agency project documentation and related guidelines and procedures, organised around the different stages of the project cycle. It draws conclusions and makes policy recommendations on how risks emanating from natural hazards are currently handled in project appraisal and evaluation, and the scope and need for an improvement in practices. The report is based on an analysis of documentation supported by interviews with selected agencies.

The study finds that many of the standard tools currently used by aid agencies to design projects could also be used to assess risks emanating from natural hazards and potential returns to mitigation. These include a variety of tools for economic, environmental and social appraisal, as well as risk and vulnerability analysis and logical framework analysis. In most cases, they are designed to take interacting hazard-risk-vulnerability issues into account. Often, all that is needed is a shift in emphasis when they are being applied or a more explicitly integrated approach that brings individual methods together. There is nothing intrinsically difficult about either appraising natural hazard-related risks or monitoring and evaluating risk reduction activities.

However, natural hazards and related vulnerability are rarely considered in the design and appraisal of development projects. Similarly, monitoring and evaluation are still relatively neglected in disaster reduction, especially where impact evaluation is concerned.

Existing appraisal guidelines must be revised where necessary to provide more explicit guidance on consideration and analysis of disaster risks and options for reducing vulnerability. In high-risk areas, natural hazards and related vulnerability should then be assessed as part of the appraisal process for all projects. This assessment should be integrated into existing forms of appraisal, as an explicit component of each form of appraisal, rather than confined to environmental review alone or undertaken as a stand-alone assessment. Vulnerability is complex and multifaceted, requiring analysis from social, economic and poverty perspectives too. The recent convergence of previously separate discourses on disasters and development around the linked themes of vulnerability, social protection and livelihoods may already be starting to stimulate greater awareness of the importance of such assessment.

However, the development of appropriate project guidelines is unlikely to be sufficient in itself to stimulate greater consideration of natural hazards and related vulnerability in the design and evaluation of projects. Further critical issues have to be addressed. These include: incorporation of hazard and vulnerability when planning higher-level (i.e., country or regional) programmes, through which most bilateral and multilateral aid is channelled; raising awareness of the various tools and their application among aid agencies and their staff, and enhancing their capacity to use them; and greater dialogue between practitioners of the many different appraisal approaches.

Contents

Chapter 1

Introduction

1.1 Project objectives

There is a strong demand both in the disaster management community and amongst donors for the development of methodologies that demonstrate that mitigation 'pays' – i.e., that it is an efficient use of resources and reaps dividends. This project aims to facilitate the generation of such evidence through the development of guidelines on how cost-benefit analysis (CBA), environmental impact assessment (EIA) and related methodologies can be expanded to consider risks emanating from natural hazards and to measure related costs and benefits in reducing risk. The ultimate objective of the study is to help ensure that risks emanating from natural hazards are considered as a matter of course in the design of all projects in hazard-prone areas, including more socially orientated as well as infrastructure projects, and that appropriate measures are taken to reduce risk and to ensure that projects do not unwittingly create new forms of vulnerability. Risk reduction is about more than physical exposure and technological solutions. Vulnerability also has a socio-economic context and thus should be considered in these terms, too.

The emphasis of the study is very much on process. The study does not seek to identify 'neat' mitigation ideas and practices so much as try to explore how project-related systems and practices can be used to ensure that risks emanating from natural hazards are appropriately considered (relative to levels of risk) and also, more broadly, to explore the challenges of 'mainstreaming' risk reduction and opportunities for success.

The project forms one of a number of projects that ProVention is implementing to develop and demonstrate innovative approaches to the practice of natural hazard risk identification and analysis, risk reduction and risk sharing and transfer. It also supports ProVention initiatives to improve and promote disaster management policy amongst key policy- and decision-makers, and to share knowledge and information about best practices, tools and resources for disaster management.

1.2 Methodology

1.2.1 Structure of study

The project is divided into two phases. Phase 1 is intended to ascertain the need for an improvement in current donor agency practices, based around a primarily desk-based review of project documentation and related guidelines and procedures, and working through the different stages of the project cycle – from identification and appraisal through to evaluation – to see how risks emanating from natural hazards are currently handled by donor agencies. It also examines broader risk assessment policies and guidelines and briefly considers how other sectors undertake risk assessment (commercial sector, insurers, engineers, etc.). The findings of Phase 1 are directed primarily (although not exclusively) at the international donor community.

This paper presents the findings of Phase 1 of the study.

Phase 2, as originally conceived, was to focus on the development of guidelines and working examples for use in amending appraisal methodologies to take account of risks emanating from natural hazards and tools for monitoring and evaluating risk reduction initiatives. The findings of the Phase 1 study and discussion of its conclusions by the project's expert Advisory Group and other stakeholders will direct the activities in Phase 2 more precisely.

1.2.2 Phase 1 activities

Phase 1 has essentially involved a critical state-of-the-art review of development agency practices in assessing and handling risk, organised around the basic structure of the project cycle (see Chapter 2). It is based on a review of documentation supported by interviews with selected agencies focusing on:

- the nature of agency pre-project appraisals – in particular whether and how risks emanating from natural hazards are considered; and
- how risk reduction initiatives are appraised, monitored and evaluated.

The following documentation was sought on web sites and requested from selected donors:

- Operational procedures, guidelines, manuals and handbooks on:
  - pre-project appraisals (e.g., CBA, EIA, social impact assessment (SIA), gender impact and so forth);
  - logical frameworks;
  - risk management; and
  - monitoring and evaluation.
- Documents (all forms of pre-project appraisals, loan/grant agreements, logical frameworks, monitoring and evaluation reports) for projects demonstrating 'good practice' in projects/programmes from the perspective of disaster mitigation and preparedness. Documents were sought for good practice projects (whether completed or ongoing) in the following areas:
  - disaster mitigation and preparedness projects;
  - post-disaster rehabilitation projects that incorporate measures to mitigate against the impact of future disasters;
  - development projects that incorporate mitigation features as part of the project (in any sector – agriculture, education, energy, industry, integrated community development, health, resettlement, transport, urban, water and sanitation, and so forth);
  - country strategies and programmes that integrate and address natural hazard risks as a central concern; and
  - sectoral strategies and programmes that integrate and address natural hazard risks as a central concern.

The review of documentation focused in particular on a pre-selected range of organisations, chosen to provide a cross section of types of agency:

- Multilateral/regional banks:
  - World Bank
  - Asian Development Bank (ADB)
  - United Nations (UN) agencies
  - United Nations Development Programme (UNDP)
  - United Nations Environment Programme (UNEP)
- Multilateral and bilateral donors
  - European Commission (ECHO, DG DEV, EuropeAid)
  - Department for International Development (DFID) (United Kingdom)
  - International non-governmental organisations (NGOs)
  - International Federation of Red Cross and Red Crescent Societies (IFRC)

Supporting and complementing the literature search, face-to-face interviews were conducted with 57 people in 11 organisations during visits to Brussels, Geneva, Manila and Washington DC, including, in addition to the seven organisations listed above, the following:

- Inter-American Development Bank (IDB)
- United States Agency for International Development (USAID)
- Organization of American States (OAS)
- International Strategy for Disaster Reduction (ISDR)

The authors also corresponded (principally by e-mail) with 87 additional people working in other agencies or independently (see Annex A for a full list of interviewees and other informants). Some of these people came forward in response to messages and requests for information posted to the UN's International Strategy for Disaster Reduction (ISDR) online conference on its risk reduction framework in September 2003; the International Association for Impact Assessment's (IAIA) SIA, EIA and health impact assessment (HIA) list serves; the LivelihoodsConnect bulletin board; the natural-hazards-disasters list serve; Disaster Research newsletter; MandE News web site; and the ProVention Consortium newsletter. As part of the research for Chapter 8, a separate formal survey was carried out involving 34 experts.

In addition, the researchers attended the Tearfund conference on 'Supporting natural disaster risk reduction' in London in November 2003, taking the opportunity to discuss the study with several donor and operational agencies and disaster specialists represented at the meeting. The study was also discussed with participants at a meeting of the United Kingdom's NGO Risk Reduction Working Group.

During the process, an Advisory Group of seven members (listed in the preface) advised the researchers. Most correspondence with Advisory Group members was by e-mail and the authors met several members in person over the course of the study. Most attended a one-day meeting in Geneva in March 2004 to discuss the study's preliminary findings and the way forward.

1.2.3 Limitations of Phase 1

Constraints in implementation

Responses to the request for documentation and, where the project budget permitted, face-to-face meetings, were variable, as was the level of documentation available on agency web sites. Guidelines on project appraisal and evaluation were readily available for most of the agencies included in the study. However, very little project documentation was provided due, it seems, to a variety of reasons. First, simple pressures of work limited the time and thought that contacts could give to identifying appropriate projects. Second, review and evaluation of projects in this area have been on a case-by-case basis, with no attempt to identify good practice either in terms of project outcomes or the process by which risk was appraised.

Project versus programme focus

Much of the investigation undertaken for Phase 1 focuses on the design and evaluation of individual projects, as already indicated, due to time constraints. However, much of the discussion presented in this report also applies to the design, appraisal and evaluation of programmes. Many donors follow similar procedures, such as analysis of environmental and social impacts, in determining projects and programmes. The role of programming is discussed in further detail in Chapter 2.

Recipient country policies and procedures

Due to time constraints, the role of recipient country policies and procedures was not explored during Phase 1. These can play an important role in determining to what extent natural hazard-related risks are considered when designing a project, especially where the recipient country is responsible for a project's technical design. Most recipient countries will have some form of building code, land-use planning and environmental compliance standards. If a government so chose, it could also make hazard impact assessment a mandatory part of the project appraisal process.

Legal responsibilities

The potential threat of litigation in the event of disaster-related losses – something that is increasingly practised in the United States – offers another mechanism for promoting mitigation. Donors are also being held increasingly accountable for their actions and have themselves begun to impose standards of compliance on particular aspects of their work, for instance relating to environmental impact.[1] However, it was beyond the scope of this study to consider legal aspects of risk reduction and the case for negligence liability.

1.3 Rationale

1.3.1 Measuring mitigation: current state of the art

Donor agencies have spent billions of dollars on post-disaster relief and rehabilitation efforts – OECD DAC (Development Assistance Committee of the Organisation for Economic Co-operation and Development) donors spent US$ 4.4 billion on emergency relief in 1999 and US$ 3.6bn in 2000 (IFRC 2002: 176–7) – at the same time watching development projects, into which they have put considerable time and funding, faltering, perhaps even failing, as a consequence of these 'natural' disasters.[2] In a recent evaluation, the IDB has even coined a term for this phenomenon, referring to the loss of past investments and the opportunity cost of resources used for post-disaster rehabilitation and reconstruction as 'mission risk', hindering IDB's mission 'to contribute to the process of economic and social development' of its member developing countries (IDB 2004: 5).

Those working in the field of disasters have long asserted that mitigation pays. The United States Geological Survey, for instance, estimated that investing US$ 40bn worldwide in preventative measures in the 1990s would have reduced disaster-related 'economic losses' by US$ 280bn (IFRC 2002). The state government of Queensland (Australia) declares that 'research has shown that every $1 spent on disaster mitigation saves at least $3 in economic and social recovery costs' (Queensland Government c.2001: 2). The World Bank (2000a) reports that regional civil engineering experts in the Caribbean have estimated that spending 1 per cent of a structure's value on vulnerability reduction measures can reduce probable maximum loss from hurricanes by, on average, a third. Non-monetary benefits can also be significant. For example, construction and maintenance of the Bangladesh Red Crescent Society's cyclone shelters, built as part of its cyclone preparedness programme, cost less than US$ 6 per head per year, a meagre price for protecting a human life (IFRC 2002).

However, there is surprisingly little evidence in support of many broad-brush statements. Detailed underlying calculations are not available, suggesting that they may, in fact, be no more than 'back-of the-envelope' – if informed – estimates. Even if they are based on more extensive calculations, the fact that the workings underlying them are not readily available

1. ADB, for instance, is ensuring that some of its policies will be inspected. As part of this process, it has created three inspectorates covering the environment, resettlement and indigenous people. An Office of Facilitation has also recently been formed to handle claims that Bank projects have damaged people's interests.
2. Disasters resulting as a consequence of natural hazard events. See Section 1.5 for further discussion.

can cast doubts on their legitimacy, particularly if figures involve some valuation of non-tangibles. Of course, financial analysis of loss and the cost of investments needed to avoid loss may not be sufficient to ensure greater attention to natural hazard risk, as demonstrated from experience elsewhere (for instance, in relation to disease, water pollution and illiteracy). But proof of net financial benefits is almost undoubtedly a first, very necessary step in making a case for the importance of analysing hazard-related risks.

Meanwhile, monitoring and evaluation of risk reduction tends to be short term, tied to project cycles and focused on the outputs of initiatives (e.g., numbers trained in disaster planning, area sown with drought-resistant seeds), rather than their impact (the extent to which lives, assets and livelihoods are better protected during disasters) (see Chapter 8).

In the absence of concrete information on net economic or social benefits and faced with limited budgetary resources, many policy-makers have been reluctant to commit significant funds to risk reduction, although happy to continue pumping considerable funds into high-profile, post-disaster response. Instead, stories of development projects damaged by disaster abound every time a disaster occurs. The Inter-American Committee for Natural Disaster Reduction (IACNDR), for instance, states that:

> *…development organizations together with the countries decide for the long term where the investment should be carried out in order to facilitate sustainable development and competitiveness of the countries in the region. Many of these investments are lost in case of disasters due mainly to a lack of inclusion of prevention and mitigation in planning and execution of these projects.*
>
> *(IACNDR 2003:10)*

Had related risks been considered in the first place then different standards and forms of design might have been applied and damages reduced.[3] Different development paths may even have been considered. The United Nations Development Programme (UNDP 2004: 15) makes the important point that although 'natural disasters destroy development gains… development processes themselves play a role in driving disaster risk'.

Disaster proofing individual structures may not even cost much, a point strongly argued by those trying to increase investment in risk reduction (e.g., Federal Emergency Management Agency (FEMA) 1998; IACNDR 2003). Although figures vary,[4] FEMA (1998), for instance, estimates that mitigation measures increase construction costs for new facilities by as little as 1 to 5 per cent. It is also frequently pointed out that it is considerably cheaper to include mitigation measures in initial project design rather than subsequently modifying a structure to strengthen its resistance to natural hazards (e.g., Organization of American States (OAS) 1987). But even these figures do not seem convincing enough in the absence of data on the benefits and the costs of mitigation and in the face of ever-pressing demands on aid and other public resources.

Poor evidence on the benefits of mitigation in turn relates in part to problems with data on the impact of disasters, which, it is believed, considerably under-report losses (see Box 1.1). The World Meteorological Organization (WMO 2003: Chapter 2, item 12), for example, recently called for the establishment of an international database that would track the social and economic impacts of tropical cyclones and the costs of forecasting, information services and mitigation methods as 'this information could then be used to justify additional resources for tropical cyclone forecasting and disaster mitigation'. Although potential future losses cannot be predicated on the basis of past losses alone, as forms and levels of vulnerability are constantly shifting and changing, past losses provide an important starting point in trying to understand the likely nature and scale of future ones.

This need for improvement in disaster statistics is recognised and efforts are being undertaken at various levels to improve data. For instance, a damage assessment methodology developed by the Economic Commission for Latin America and the Caribbean (ECLAC) is not only being applied in its region but is also being considered for adaptation for use elsewhere.

Meanwhile, two international databases on disaster losses, the US Agency for International Development's (USAID) Office of Foreign Disaster Assistance (OFDA) database and the Belgium-based Centre for the Epidemiology of Disasters' (CRED)

3. For example, a recently completed road across the interior of the Caribbean island of Dominica has already deteriorated significantly because the quality of the road was determined on the basis of the projected volume of traffic alone rather than on weather conditions as well, including intermittent hurricanes accompanied by heavy rainfall (Benson and Clay 2001).

4. As a further example, OAS (1996) cites a Barbados civil engineer who reported in 1995 that, after five years of involvement in designing and implementing structural vulnerability reduction measures (including retrofitting), he considered that many buildings could be made virtually invulnerable to Category 3 hurricanes at a cost equivalent to only one to two years' insurance premiums.
Also in the Caribbean, an OAS Caribbean Disaster Mitigation Project study (Wason 1998) of four infrastructure projects in the region, which had failed due to the impact of natural disasters, found that the additional costs required to mitigate the damage suffered by the four projects varied from less than 1 per cent to under 12 per cent of the original project cost.

Box 1.1 Disaster impact data

It is widely recognized that existing data on the impact of disasters are weak, presenting an incomplete and, in parts, highly inaccurate account of their impact. Poor data are a problem in both the developed and the developing worlds. Commenting on the situation in the United States, for instance, Changnon (2003: 1231) states that 'assessment of losses has long been a very challenging problem for several reasons. Primary among these is the lack of systematic collection of loss data'. Changnon continues to state that 'major problems result from a lack of reliable data on the economic impacts of extremes and a lack of knowledge of the data limitations' (ibid.: 1232), including that it hampers informed decision-making and makes it difficult to assess potential future losses. He cites an example of 20-year losses from tornadoes in the US, estimated at between US$ 5.8bn and US$ 58bn, arguing that 'such ill-defined loss information limits informed decision making about the seriousness of each weather hazard and related research priorities' (ibid.: 1223).

Reported evidence on the impact of disasters typically focuses on levels of direct physical losses alone, based on damage assessments undertaken in the immediate aftermath of individual disasters, with additional information provided by the insurance industry. Even these data may be associated with a number of difficulties, including:

- Many countries lack standard, comprehensive guidelines for use in estimating the costs of disasters. Even within a particular country, there may be discrepancies between different disasters in terms of the scope of coverage of assessments and the way in which losses are valued.
- Coverage of assessments is typically partial, with involved government, donor and civil society groupings only covering areas where they may be able to provide relief and rehabilitation assistance. Damage to the private sector may be largely ignored.
- Additional data on private losses are provided by the insurance industry, as already indicated, but only cover insured losses. In many developing countries, only a small proportion of private losses may be insured.
- Damage assessments are commonly undertaken by officials and volunteers on the ground, often with little prior specialist training.
- Damage assessments are typically finalised very rapidly, often only a few months after a disaster, before the full impacts of a disaster can be ascertained (Benson 2003).

There are few attempts to measure indirect and secondary impacts, a number of which can only be gauged 12 months or more after an event. Direct costs relate to the physical damage to capital assets, including social infrastructure – that is, stock losses. However, the potential impacts of a hazard event go beyond direct ones to include many flow or knock-on effects, commonly categorised as either indirect or secondary (e.g., Otero and Marti 1995). Indirect costs relate to the knock-on disruption to the flow of goods and services, including, for instance, reduced output, loss of earnings and job losses. Secondary, or macroeconomic, effects concern both the short- and the long-term impacts of a hazard event on the overall economy and socio-economic conditions, such as on fiscal and monetary performance, levels of indebtedness, the distribution of income, and scale and incidence of poverty.

Direct losses are stock losses while indirect costs and secondary effects constitute flow losses. They are not additive and any attempt to aggregate them entails double counting. Nevertheless, one cannot simply focus on direct losses, as the flow implications of particular stock losses are highly context specific, relating to factors such as the relative importance of different sectors, the policy environment and so forth. Thus, the implications of different stock losses will vary both across countries and inter-temporally.

Emergency Management Disaster Events database, were merged in 1999 in an effort to improve coverage. An ongoing dialogue has also been established between CRED and reinsurance companies Munich Re and Swiss Re, the owners of the other two global disaster databases. There are also a number of initiatives at the national level to improve disaster data.

Somewhat surprisingly, there is also weak information available on the total amounts spent on post-disaster response. This in part reflects the fact that some public and external resources are reallocated after a disaster but these reallocations are in general not well documented (see Benson and Clay 2004). Even organizations such as the World Bank and IDB are unable to report the full amounts spent on post-disaster rehabilitation because unrecorded reallocations from ongoing development activities finance a substantial part of their response. There are additional problems relating to the fact the rehabilitation projects themselves are not necessarily clearly identified as such in records of activities, be they financed by government or the international community (see, for instance, Benson and Clay 2002). This, too, contributes to difficulties in aggregating total post-disaster expenditure. If the full extent of public resources spent on post-disaster

response was known – and the opportunity costs of reallocations, in terms of development opportunities forgone, calculated – then this, too, could help fuel the argument for greater investment in ex ante risk reduction.

Limited efforts to reduce vulnerability also appear to be linked to the fact that disasters are often viewed as one-off events to be dealt with by emergency specialists, rather than repeated episodes with potential consequences for long-term development. Yet, as Weichselgartner and Obersteiner (2002) state, 'risks of disasters arise out of the combination of natural hazards and human vulnerability and… by divorcing the natural disaster debate from the development debate, half of this disaster equation is ignored'. Those working in development need to be made aware that development activities can change the nature of magnitude of vulnerability to natural hazards – be it negatively or positively, physically or socio-economically – sometimes with tragic consequences (e.g., IFRC 2002). Such impacts and the mechanisms via which they occur require careful examination. Development workers also need to be encouraged to explore the impacts that a disaster could have on their work.

Various other factors have also contributed to reluctance to address risks emanating from natural hazards. Perceptions of the magnitude of risk may be incorrectly low, reducing any sense of the need for action. There may be more immediate problems requiring attention – for instance, the provision of adequate sanitation or education. Responding to such needs is more likely to secure political votes and ensure that any aid agencies seeking to provide funding will find government partner agencies willing to cooperate and finance ministries willing to take on any related loans. Donors and governments also like to be seen on the scene of a disaster, again – if ironically – gaining public support.

1.3.2 Mainstreaming risk

This project is aimed at identifying and developing guidelines and related tools for assessing and measuring risk and incorporating risk concerns into the design of projects. Its success depends, of course, on demand for such tools, as well as effective dissemination and uptake. This is by no means assured, as just discussed – indeed, in the case of some donor agencies it would require a quantum leap in thinking. Parallel initiatives are therefore required to create increased awareness of the need to incorporate risks emanating from disasters into the design of projects. Indeed, the two sets of initiatives are mutually complementary. Political will and assignment and acceptance of responsibilities are critical in ensuring that the tools will be used whilst development of tools is essential in enabling individual country/project officers to implement that political will and meet their responsibilities.

As part of this process, it is necessary to ensure that appropriate policies and strategies are in place. The identification and design of projects does not occur in isolation. Instead, it is influenced by the broad policies, objectives and priorities of an aid agency and its underlying ideology. Since around the late 1990s there has, in fact, been increasing recognition of this need to 'mainstream' risk – that is, to consider and address risks emanating from natural hazards in medium-term strategic frameworks, in country and sectoral strategies and policies, and in the design of individual projects in disaster-prone countries. ISDR (2003: 3), for instance, states that 'disaster reduction should be an integral component of the development process, as both a goal of development and a mechanism for its advancement'. The German Federal Ministry for Economic Cooperation and Development (*Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung* (BMZ)) similarly asserts that 'assistance in disasters and conflicts and the related preventative measures (development-orientated emergency aid) cannot properly be treated as an isolated field of activity; it must be assimilated into development cooperation as an integral component' (BMZ 1997: 4). It is hoped that such statements will ultimately be reflected in practice, following the path that environmental concerns have already undertaken relatively successively. Many donors already integrate good environmental management into their operations and programmes, and support client countries in doing likewise, although even this has not been entirely successful (see Chapter 2).

However, the concept of mainstreaming risk is by no means new. For at least 17 years, the OAS has consistently insisted that 'natural hazards assessment and mitigation should be routinely included in development planning' (OAS 1987: 2). In 1991 it even produced a lengthy primer, running to over 400 pages, on integrating natural hazard management into regional development planning. This book stated that:

> *The design of individual investment projects should, but in current practice ordinarily does not, incorporate the following types of natural hazard information:*
> - *Incidence of hazard risks in the project area*
> - *Incidence of hazard risks in the project's market areas and commercialization routes*
> - *Vulnerability of the supply and/or cost of production inputs (e.g., raw materials, equipment, energy resources) to natural hazard events*

- *Vulnerability of the project's output prices to natural hazard events*
- *Vulnerability of physical structures and production processes to natural hazard events*
- *Existence of current and/or proposed legislation that establishes guidelines for natural hazard risk mitigation in project design*
- *Effectiveness and cost of alternative natural hazard mitigation measures.*

(OAS 1991: 2-12–2-13)

The primer included information on how to incorporate natural hazards into planning and decision-making in the public sector and into the economic analysis of investment projects as well as covering tools and techniques for natural hazard assessment and assessment of specific natural hazards. However, until the late 1990s, OAS was somewhat of a lone voice.

Several factors have contributed to the more recent increase in interest in mainstreaming risk. First, there has been a gradual upward rise in reported disaster losses primarily, it is believed, due to growing economic and social vulnerability (e.g., ISDR 2003). Perceptions of rising costs have been reinforced by a rapid succession of catastrophic events causing substantial human and economic losses – notably Hurricanes Mitch and Georges in 1998, the 1998 Bangladesh floods, the Orissa cyclone in 1999, the Mozambique floods in 2000, the Gujarat earthquake in 2001 and the Iran earthquake in 2003.

The rising importance attached to poverty reduction has also thrust disaster management up the agenda. During the 1990s international commitments were made to reduce poverty, a process initiated in response to disappointing achievements over earlier decades (Benson and Clay 2004). Eradication of extreme poverty and hunger became the first of the Millennium Development Goals (MDGs) agreed by world leaders at the Millennium Summit in September 2000. The new emphasis by many donors on poverty reduction as their core long-term objective precipitated a rewriting of policies and guidelines to ensure that all opportunities to achieve this goal were achieved. As part of this process, the vulnerability of the poor to various types of risk, including those emanating from natural hazards, has been highlighted (e.g., World Bank 2000b). Exposure to risk and income shocks, including those emanating from natural hazards, is also identified as one of the four basic dimensions of poverty in the World Bank's Poverty Reduction Strategy Paper (PRSP) handbook (Klugman 2002). However, poverty alleviation initiatives do not necessarily reduce vulnerability to natural hazards. Consequences for vulnerability will depend on the form and nature of the initiative. It is, therefore, important that issues of risk are considered explicitly in designing poverty programmes, exploring sources of vulnerability and options for risk reduction.

Greater emphasis on sustainable development, again as part of the MDGs,[5] may also be playing a role in raising concerns about natural hazards as awareness grows that disasters are typically not one-off, temporary interruptions but are repeat events with implications for long-term growth. Disasters are increasingly recognised as unmanaged development risks and unresolved problems of development.

Against this backdrop, a number of agencies have begun efforts to mainstream risk, undertaking various institutional, policy and procedure changes to support this initiative. In terms of institutional changes, in 1997, for instance, responsibility for mitigation within the UN system was transferred from the Office for the Coordination of Humanitarian Affairs, whose work primarily involves post-disaster response, to the UN's development agency, UNDP. In 1998 the World Bank established a Disaster Management Facility (renamed the Hazard Management Unit (HMU) in February 2004) to improve its disaster prevention and mitigation practices and emergency response. The HMU's objective is to mainstream disaster prevention and mitigation considerations into all World Bank activities. In 2000, IDB established disaster management focal points at both headquarters and country office levels, with one focal point in each country office and 14 in Washington DC. A new ADB disaster and emergency policy (see below) has similarly created an 'anchor position for emergency assistance activities', possibly supported by a secondment programme from external partner agencies; 'emergency operation' focal points in each of the five regional departments; and emergency contact points in each resident mission (ADB 2004).

As regards policy changes, existing disaster policies often already cover mitigation and preparedness as well as response but are not necessarily explicitly followed in this regard. The IDB's Operational Policy on Natural and Unexpected Disasters (OP–704), for instance, provides for support for 'disaster prevention, mitigation and preparedness efforts before disaster strikes', but does not coherently follow through on this seemingly even-handed approach, focusing 'on addressing disaster events rather than risk management'.

5. Integration of the principles of sustainable development into country policies and programmes is one of the targets under the MDG of environmental sustainability. The six other MDGs are: to achieve universal primary education; to promote gender equality and empower women; to reduce child mortality; to improve maternal health; to combat HIV/AIDS, malaria and other diseases; and to develop a global partnership for development.

In 2000, to update OP–704 and in preparation for a related seminar at that year's IDB annual meeting, the Bank prepared an action plan on natural disasters, outlining a shift to a more holistic approach placing considerable emphasis on disaster management and the mainstreaming of risk. The plan identifies six strategic areas where the Bank should focus its risk reduction efforts: building national systems; building a culture of prevention; reducing the vulnerability of the poor; involving the private sector; supplying risk information for making decisions; and fostering leadership and cooperation in the region. It also includes a strategy for mainstreaming risk reduction in IDB operations (IDB 2000). The following year, IDB launched a Disaster Prevention Sector Facility, which finances up to US$ 5 million for risk identification and forecasting, mitigation and preparedness actions, risk transfer and national systems for risk reduction. In support of strategic objectives of the action plan, IDB is currently – as of 2003 and 2004 – in the process of developing a series of checklists for use in project design (see Box 1.2). It has also just completed an evaluation of its disaster-related policies and practices which calls for a revision to OP–704 'to reflect the approach to disaster risk management that is posited in the Action Plan' (IDB 2004: ii).

The World Bank is similarly currently undertaking an evaluation of its disaster portfolio, including mitigation, and it is envisaged that this process, too, could lead to a revision of its disaster policy. ADB has already recently approved a new disaster and emergency assistance policy. The new policy 'shifts the emphasis from only responding after disaster strikes to also supporting activities that anticipate and mitigate the likely impact of disasters that might occur' (ADB 2004: 20). Underlying principles include 'mainstreaming disaster risk management as an integral part of the development process' (ibid.: 20). The new policy also suggests that risk and vulnerability assessments should be conducted to complement the environmental and social assessments in the country strategy papers (ibid.: 24), although it has yet to be determined what form these might take.

Various bilateral agencies are also assessing their policies and practices with regard to disaster management. The Swedish International Development Agency (SIDA), for instance, is reported to be examining departmental experiences in the field of disaster reduction as a basis for producing guidelines on how it should be addressed (La Trobe and Venton 2003). The Canadian International Development Agency (CIDA) is 'working to integrate disaster risk management at the policy and programme levels' (ibid.: 27). The German government's international cooperation organisation, *Deutsche Gesellschaft für Technische Zusammenarbeit* (GTZ), is exploring how to mainstream risk in particular in sectoral and other programmes that are either 'heavily affected by disasters and their consequences and/or strive to

Box 1.2 IDB's risk management checklist initiative

The Inter-American Development Bank is currently developing a series of checklists to support analysis and assessment of natural hazards and related risks at each stage of its project cycle. A general checklist is being drawn up, with possible additional sector-specific annexes for ten key sectors (education, health, housing, transport, micro and small enterprise, agriculture and natural resources, environment, water and sanitation, energy and modernisation of the state).

The checklists pose a series of questions relating to background information on probabilities of occurrence of natural hazards in the project area; on the political and institutional framework pertaining to disaster management in the country; on structural and non-structural vulnerability of the project and associated mitigation measures; on disaster management-related responsibilities and mechanisms in project execution; and on the natural hazard-related risks associated with the project, including implied institutional, financial and economic viability.

The checklists will have to be applied before projects can be approved, in theory ensuring that risks will be identified and projects adapted accordingly to manage them. At a meeting to discuss the checklists in Ecuador in February 2004, it was agreed that to apply them effectively, training should be carried out among IDB staff and focal points, as well as national counterparts preparing projects especially in highly vulnerable countries. The checklists and an accompanying reference note should be finalised later in 2004.

The IDB checklist initiative has apparently been well received within the Bank. People interviewed for the purposes of this study from other aid agencies generally indicated, however, that they thought a similar process was unlikely to be well received in their own organisations because the project appraisal process is already extremely lengthy and costly. Some, nevertheless, felt that checklists might be an appropriate mechanism for assessing risk in the most disaster-prone countries. Several interviewees also commented that it was important to ensure that the checklists were effective in assessing risk and adjusting projects accordingly.

reduce the vulnerability of the population with the aim of promoting sustainable development' (GTZ 2002: 14).[6] In the wake of Hurricane Mitch, all USAID country strategy papers in the Latin American and Caribbean region have to include disaster management as one of their strategic objectives in programming assistance.

Some NGOs are making a similar shift. Tearfund, for instance, 'is determined to integrate risk management into all its relief and development structures and processes and is undertaking measures to achieve this', as well as trying to urge others to follow suit (La Trobe and Venton 2003: 2).

Governments have also committed to various mandates to incorporate disaster reduction into development. For instance, the IACNDR (2003) reports that OAS member states have taken on collectively, as regional groups or individually, over 30 acquired commitments, many of which include this approach.

There has been some recent related interest in the development of frameworks for assessing how far agencies and also certain countries have got in mainstreaming risk reduction, and for encouraging and facilitating further progress in this regard by highlighting potential opportunities as well as roles and responsibilities (e.g., ISDR/UNDP 2003; Mitchell 2003; World Bank 2002) (see Chapters 2 and 9). In a similar vein, there has been considerable interest in the development of national comparative indicators of vulnerability (see Box 1.3).

However, institutional and policy change alone – even if supported by appropriate methodological tools and guidelines – does not trigger a cultural shift within an organisation. Sadly, La Trobe and Venton (2003: 5) conclude, based on a series of discussions with donors, that risk reduction 'remains a relatively low priority within donors' relief and development plans, processes and practical implementation'. In fairness, some are more advanced than others but this general sentiment rings true. Although any organisation is likely to contain some individuals championing risk reduction, they are almost always in a small minority. Progress at the country level in integrating risk concerns into country and sectoral strategies, PRSPs and individual projects is thus generally limited to date. For instance, according to the World Bank HMU's web site, only nine PRSPs have incorporated 'hazard risk management'.[7] [8]

Meanwhile, only two of the 24 current IDB country papers mention disaster risk management in discussing the relevant country's development strategy (IDB 2004). There has also been very limited interest in borrowing under the IDB's Disaster Prevention Sector Facility, created in 2001, with only two loans extended to date (IDB 2004).

Developing country governments themselves also need to be convinced of the need for mitigation. Governments often seem to operate on the assumption that in the event of a disaster they will receive considerable support from the international community and so should focus scarce public resources on areas other than mitigation (see Chapter 6). In reality, post-disaster assistance may involve very little additional funding (Benson and Clay 2004). IACNDR (2003: 5), for instance, reports that 'history demonstrates that the international community covers less than 20 per cent of the affected country's requested rehabilitation and reconstruction assistance'.

1.4 Concepts and definitions[9]

It is widely acknowledged within the disaster community that there is no coherent understanding of terminology. This reflects the fact that disasters are an area of multidisciplinary research and policy analysis and involve practitioners from a wide range of fields. It is, therefore, important to define how key disaster and disaster management terms are used in this report.

A *natural hazard* is a geophysical, atmospheric or hydrological event that has a potential to cause harm or loss. Hazards can be natural (such as earthquakes and droughts) or induced by human processes (such as industrial accidents).

Vulnerability is the potential to suffer harm or loss (related to capacity to anticipate a hazard, cope with it, resist it and recover from its impact). Determinants of vulnerability include social, economic, political, cultural and institutional factors as well as physical factors.

Risk is the likelihood of a specific hazard of specific magnitude occurring in a specific location and its probable consequences for people and property.

A *disaster* is the occurrence of an abnormal or infrequent hazard that impacts on vulnerable communities or geographical areas, causing

6. Particularly relevant sectors are listed as 'rural development/environmental and resource management, decentralization/community development, health, housing and education' (GTZ 2002: 31).

7. http://www.worldbank.org/hazards/policy/prsp.htm, visited April 2004.

8. The HMU is currently undertaking a review of country assistance strategies to see how many of these incorporate it and in what way.

9. This section draws in part on Twigg 2004: 11–14.

Box 1.3 Indicators of vulnerability

There has recently been a flurry of interest in the development of indicators of national, regional and urban vulnerability to natural hazards. This interest has been motivated by a desire to be able to readily identify those countries most at risk, providing a broad-brush first marker of the extent to which natural hazards present a potential threat and thus to what extent they need to be addressed.

The notion of country vulnerability indicators has, in fact, been around for almost a decade. Briguglio (1995), for example, included a measure of 'proneness to natural disasters' in a study of the relative vulnerability of small island and larger economies to a range of variables. Proneness to natural disasters was 'measured' by total damage from significant disaster events (defined as exceeding 1 per cent of gross national product) occurring over the period from 1970 to 1989, drawing on earlier disaster analysis by UNDRO (1990). The Commonwealth Secretariat also included 'vulnerability to natural disasters' as one of four variables in a composite vulnerability index (Atkins et al. 2000), in this case measuring vulnerability to natural disasters according to the percentage of the population affected by natural disasters over the period from 1970 to 1996.

More recent initiatives have taken a somewhat more sophisticated approach. These initiatives include UNDP's development of a 'vulnerability index', as presented in its recently published *Reducing Disaster Risk: A Challenge for Development* (UNDP 2004). This index is based on a best-fit estimation of numbers of deaths for cross-country datasets over the period from 1980 to 2000 calculated by testing the explanatory power of 25 socio-economic factors that could contribute to vulnerability. These factors cover economic, environmental, demographic, health and sanitation, early warning, education and overall development issues. The resulting equations each involve only two or three independent variables, one of which relates in some way to physical exposure to the relevant hazard. As part of the UNDP initiative, considerable geographical and spatial information was compiled for major types of hazard.

The European Commission has also developed a 'disaster risk index'. ECHO (European Community Humanitarian Aid Office) uses the index to determine the priority country focus for its disaster reduction activities (De Haulleville et al. 2003). It combines information on natural hazards and vulnerability (as defined in terms of population density, the UNDP's Human Development Index, the Human Poverty Index and the Corruption Perception Index). Where available, information on national coping capacity is also incorporated.

Other ongoing initiatives include:

- An IDB-funded exercise, being undertaken by a team from the Universidad Nacional de Colombia, Manizales, on the development of indicators of comparative natural hazard-related risks for countries in Latin America and the Caribbean, taking into account both socio-economic and physical contributing factors. Sub-national and national indicators may be generated by the project. The indicators will then be used to identify highly vulnerable countries for enhanced programming exercises in disaster risk management between these countries and the IDB (IDB 2004). (See http://idea.unalmzl.edu.co)
- A ProVention hotspots project, being undertaken on a collaborative basis by a number of organisations to support global-scale prioritisation of international risk identification and disaster reduction efforts through quantitative identification of geographic areas of highest risk potential. (See http://www.proventionconsortium.org/projects/identification.htm)

These initiatives each create some perception of levels of risk in different countries. But how accurate are those perceptions? Most indicators are also based on historical impact rather than future vulnerability. Moreover, resulting rankings of countries are necessarily dependent on how risk is defined. Unsurprisingly, small island economies tend to dominate tables based on physical damage relative to economic size. In contrast, medium-sized countries that have experienced devastating catastrophes top UNDP's index based on fatalities. The EC's more complicated approach achieves a more balanced ranking, at least in the sense that the top-ranking countries include a few smaller countries, but detailed examination of country rankings still indicates some strange anomalies.

substantial damage, disruption and possible casualties and leaving the affected communities unable to function normally and requiring outside assistance.

Risk assessment is 'the integrated analysis of the risks inherent in a product, system or plant and their significance in an appropriate context' (Royal Society 1992: 4).

Risk management is 'a range of related activities for coping with risk, including how risks are identified and assessed and how social interventions to deal with (and reduce) risk are monitored and evaluated'

(Jones and Hood 1996: 7). Practitioners conventionally divide risk management activities into mitigation, preparedness, relief, and rehabilitation and reconstruction measures.

Mitigation is any action taken to minimise the extent of a disaster or potential disaster. Mitigation can take place before, during or after a disaster. Mitigation measures are both physical or structural (such as flood defences or strengthening buildings) and non-structural (such as training in disaster management, regulating land use and public education).

Preparedness is specific measures taken before disasters strike, usually to forecast or warn against them, take precautions when they threaten and arrange for the appropriate response (such as organising evacuation and stockpiling food supplies). Preparedness falls within the broader field of mitigation.

Relief is activities undertaken in the immediate aftermath of a disaster to save lives and address immediate humanitarian needs, including the provisional restoration of essential services.

Rehabilitation is the measures applied over a period of six to 24 months after a disaster, which are necessary to restore normal activities in affected areas, communities and economic sectors (ECLAC/IDNDR 1999).

Reconstruction is longer-term activities required to restore physical infrastructure and services.

The more general term *disaster reduction* or *disaster risk reduction* is often used to mean the broad development and application of policies, strategies and practices to minimise vulnerabilities throughout society via mitigation and preparedness.

1.5 Outline of the report

This report presents the findings of Phase 1. It provides a review of agency project documentation and related guidelines and procedures, organised around the different stages of the project cycle to see how risks emanating from natural hazards are currently handled. Chapter 2 sets the scene, outlining the basic project cycle followed by aid agencies and the broader process of programming within which country priorities are determined and individual projects identified and scoped. The nature and level of consideration paid to risks emanating from natural hazards in the three basic forms of appraisal that a project may undergo – economic, environmental and social – are discussed in Chapters 3, 4 and 5. These chapters consider the potential and actual use of tools in examining both the vulnerability of projects to natural hazards and the impact that particular projects, in turn, could have on physical and social forms of vulnerability. Chapter 6 considers forms of risk assessment that may be undertaken as part of project appraisal, pertaining both to natural hazards and more generally. It also reviews basic natural hazard risk assessment tools applied by the insurance industry. Chapter 7 discusses potential and actual use of logframe analysis in ensuring that natural hazard-related risks are incorporated into both project design and also monitoring and evaluation. The report moves on to consider tools and methodologies for evaluating risk reduction initiatives in Chapter 8, a necessarily challenging task involving assessment of the benefits of something that did not happen (that is, disaster losses averted). Chapter 9 considers methodologies for appraising and evaluating structures, systems and organisations from a disaster management perspective. The report concludes with a discussion of key policy findings and recommendations for Phase 2.

Chapters 3, 4, 5, 6 and 7 focus primarily on assessing vulnerability to natural hazards and incorporating appropriate risk reduction measures in designing mainstream development projects. In contrast, Chapter 8 focuses specifically on the evaluation of risk reduction measures.

Phase 1 is a scoping exercise. It is beyond the scope of this initial study to demonstrate that mitigation pays. Instead, the study and related report focus on the extent to which and how hazard risks are currently considered in project design and evaluation, and the scope and need for an improvement in practices.

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Chapter 2

Projects and programmes

2.1 Introduction

A project may be defined as: 'A series of activities with set objectives, designed to produce a specific outcome within a limited time frame' (EC 2001: 43). This simple definition covers an enormous variety of project types, in terms of size, aims, focus and methods. Nevertheless, there are basic similarities, expressed in the notion of the 'project cycle' (Section 2.2) around which this study is structured.

Projects are not prepared in isolation. Some sort of country or sectoral approach sets the framework within which they can be designed (Chang et al. 1999: 93–4). This is true for national governments, international donor agencies and many NGOs. Such national- or regional-level programming is beyond the scope of this study but is discussed briefly below (Section 2.3).

2.2 Project cycle management

Most agencies adopt a 'project cycle management' approach: a sequence of actions to develop, implement and evaluate projects that leads in turn into new projects. The precise formulation of the cycle and its phases varies from one agency to another, but in general they are very similar (see Figure 2.1).

The basic components of a standard project management cycle can be explained as follows (EC 2001: 3–4):

- *Programming*. The establishment of general guidelines and principles for cooperation, agreement of sectoral and thematic focus, and outlining of broad ideas for projects and programmes.
- *Identification*. Within the programme framework, problems, needs and interests of possible stakeholders are analysed; ideas for projects and other actions are identified and screened. The outcome is a decision on whether or not the options developed should be studied in more detail.
- *Appraisal*. All significant aspects of the idea are studied, taking into account stakeholders' views, relevance to problems, feasibility and other issues. Logical frameworks, activity and implementation schedules are developed, and the required inputs are calculated. The outcome is a decision on whether to take the project forward.
- *Financing*. A decision is taken by the relevant parties about whether or not to fund the project, based on the appraisal.
- *Implementation*. The agreed resources are used to carry out the planned activities and achieve objectives. Progress is assessed through monitoring to enable adjustment to changing circumstances. At the end of implementation, a decision should be made about whether to close or extend the project.
- *Evaluation*. This assessment of the project's achievements and impact should examine the relevance and fulfilment of objectives, efficiency, effectiveness, impact and sustainability. It should lead to a decision to continue, change or stop a project, and its conclusions should be taken into account when planning and implementing similar projects.

Figure 2.1 The project cycle

OECD	European Commission	World Bank
Country or sectoral strategy/ programme	Programming	Country Assistance Strategy
Project identification	Identification	Identification
Project preparation	Appraisal	Preparation
Project design or appraisal	Financing	Appraisal
[Inter-governmental] Agreement	Implementation	Negotiation and Board approval
Procurement or tendering	Evaluation	Implementation and supervision
Implementation		Implementation and completion
Project completion, phasing out or handing over		Evaluation
Evaluation		
Post-project assistance		

Source: Chang et al. 1999: 93–4; EC 2001: 3–4; World Bank 2004

Project cycle management guidelines assume explicitly that there will be a thorough appraisal stage, involving: full stakeholder analysis (which seeks the views of all who might be affected by a project, positively and negatively, and ascertains how they could be affected); problem analysis (identifying the negative aspects of an existing situation and establishing causal relationships between the problems that exist); analysis of project objectives (identifying achievable solutions to the problems); and analysis of the strategies to be used for attaining the objectives (EC 2001: 10–16). This is the stage at which tools, such as CBA, EIA, social analysis, SIA, vulnerability analysis or risk assessment, are likely to be deployed most extensively.

Each agency has its own specific procedures in place for ensuring that particular issues are addressed (e.g., World Bank 2001, 2004) and most agency operational guidelines are explicitly holistic, assuming that all relevant aspects of a project will be considered. However, it would be unrealistic to assume that in practice equal weight is given to the different appraisal tools in every context. Their significance within the overall approach to appraisal clearly varies widely according to the nature and scale of the project being undertaken, as well as the type of agency involved and its resources. In addition, it should not be assumed that staff automatically follow their agencies' guidelines properly: there may also be wide variations in the quality of appraisal within individual organisations (see also Chapter 10).

Surprisingly little work has been done on more integrated approaches to mainstreaming such issues into project planning methodologies. Most progress has been in Latin America. The Inter-American Development Bank's new disaster risk management checklists are discussed in Box 1.3 above. The World Bank's *Unidad Regional de Asistencia Técnica* (RUTA) guidelines for incorporating risk management into rural development projects, with a more field-level focus, also identify key entry points in the project cycle and supply relevant questions to be asked at different stages of project development, in the form of simple matrices (Kiesel 2001). It would be useful to examine how these guidelines are being applied.

The following chapters of this report discuss how a number of standard appraisal and evaluation tools are used during the project cycle to cover risk and vulnerability relating to natural hazards. It should be noted that the study does not consider engineering design (see Box 2.1).

Box 2.1 Engineering design

Engineering design is a central component of many projects. This issue was not addressed in the current study, however, because although aid agencies expect appropriate standards to be used, they do not have their own guidelines on engineering standards and practices.

In reality, engineering design and hazard proofing is something of a grey area. The extent of agency involvement in the details of design of any project varies. Some agencies take a hands-on approach, becoming directly involved in technical design. Others may base their level of involvement on perceived levels of competence in partner agencies, funding consultancy services where capacity is considered weak but otherwise leaving local counterparts to undertake this and then reviewing their work. And aid agencies have no involvement at all in the design of structures funded under contributions to social investment funds, which finance construction of schools and other social infrastructure (see Chapter 3).

Even where involvement in engineering design is greater, the majority of multilateral and, it is believed, bilateral agencies accepts local building standards for most structures. However, in many countries public infrastructure does not have to conform to building codes. Instead, agencies simply have to follow 'best local practice', which, in the words of one person interviewed for the purposes of this study, "can mean anything". Even local building codes, where applied, can vary considerably in terms of quality and standards. In some countries they are inadequate from a hazard perspective, setting insufficiently high standards of proofing and even failing entirely to take into account some types of hazard faced (e.g., earthquakes). Multi-hazard environments pose particular challenges, in part because there has been very little work anywhere on engineering structures in regions exposed to more than one hazard (e.g., floods and earthquakes). There can also be considerable problems of enforcement of building codes.

During interviews with aid agencies for the purpose of this study, several incidents were openly discussed where structures funded by the organisations concerned were not adequately hazard proofed. It was indicated that this reflected choices on the part of governments (see Chapter 3). It was also pointed out that such structures were no more likely to collapse than any other structure in a hazard event, implying that it would be deemed that the system, rather than the agency, was 'at fault' in the event of structural failure. The risk to the agency would be largely reputational.

2.3 Programming

For international donors, the primary focus of attention is at national or regional level. The programmes or strategies developed here supply the framework within which individual projects are selected and designed. For staff in donor agencies, these plans may be the key to mainstreaming disaster issues into development programming, as they are the main instruments of development cooperation.

At a higher level, donor policies and strategies supply a framework within which programmes are formulated. A number of internal and external factors – ideological, financial, political and institutional – shape these. Among the major donors there is a growing tendency towards greater coherence of key objectives (e.g., the Millennium Development Goals (see Chapter 1)) and common principles/standards of good practice in development assistance (Chang et al. 1999). Conformity with overall agency policies and strategies is usually discussed explicitly in an individual plan. But the policies of a bilateral or multilateral aid agency, whilst expressing overall priorities (e.g., geographical, sectoral), are usually sufficiently broad to give country- and regional-level programmers considerable flexibility in addressing particular needs.

Country and regional plans are known by many different names by their originating institutions, for example country/regional strategy papers (C/RSPs), country assistance programmes (CAPs), country assistance strategies (CASs) and poverty reduction strategy programmes (PRSPs). The scope, level of detail and emphasis vary between agencies but in broad terms they are similar. A typical plan might be structured as follows:

- Description and analysis of the current situation (political, economic, social) and challenges, identifying the main causal factors.
- Assessment of how these challenges are currently being dealt with, and the problems faced in doing so.
- Experience of the donor in that country/region and lessons learnt from its previous initiatives there.
- The activities of other international donor/lender agencies.
- The donor/lending organisation's strategy for the country or region: areas of focus.
- The proposed approach (in general: detailed activities are usually spelt out through individual project documents generated as a result of the strategy).
- Resources/inputs allocated to the work.
- Expected outputs/outcomes.

Time frames for such plans are typically three to five years, giving them strategic significance. It is also important to remember that in many cases, an individual plan is one in a long-term series of plans for that country or region whose priorities and approaches shift over time, enabling previously neglected issues to be picked up and new problems to be identified and addressed.

Country and regional plans are developed through a long process of research and consultation. Elements of this process that are significant for those wishing to promote incorporation of a vulnerability/hazards perspective include the following:

- *Evidence/data*. Planning may include primary research but in many cases there will be heavy reliance on secondary sources and analyses by governments and international agencies. Commonly used data sources include: the World Bank's World Development Indicators; UNDP's Human Development Index; reports on a country or region by international or regional agencies; national poverty assessments and living conditions surveys; and other donors'/lenders' country and regional strategy papers.
- *Priorities for intervention*. Donors seek significant impact by focusing on a small number of key areas for intervention. Given the range of problems facing many developing countries, it is therefore unlikely that disasters will feature among the priorities.[1] Even where disaster reduction does feature, the approach may be defined by other priorities. As an example, the EC's RSP for the Caribbean includes support to disaster management among its non-focal (i.e., lower-priority) sectors, but the approach centres on strengthening a comprehensive regional disaster strategy in line with the focus of the EC's support for the region, which is intensification of regional integration (EC 2003: 1, 16, 18–19, 24). Donor agency staff do not necessarily see failure to prioritise a particular issue as a problem, especially if this is a cross-cutting issue such as the environment: for them, it is more important to ensure that this issue is addressed in all sectors and projects.
- *What other donors/lenders are doing.* Donors look closely at what others are doing and try to avoid duplication. For example, the EC's current Guyana CSP identifies the World

1. This might shift after a major event: e.g., DFID's post-Hurricane Mitch strategy for Central America, which put 5 per cent of the programme's budget towards mitigation and preparedness (Twigg et al. 2000: 108).

Bank's PRSP and other donors' activities as two of the four elements in its framework for selecting areas of concentration (the other two being the medium-term challenges facing the country and the EC's past experiences there). The fact that both the IDB and the Caribbean Development Bank were not planning further work on sea defences was clearly an important factor in the EC's decision to continue its support to this area (EC 2002: 17, Annex II). There is likely to be discussion with regional agencies and donors about this. A particular sector or issue may, therefore, be left to another donor to tackle.

- *Local priorities.* The extent to which developing countries are involved in informing donor priorities or are compelled to accept donor conditions is hotly debated. In practice it varies, in part depending on the economic strength and quality of governance in the recipient country. The final decisions clearly lie with the donors but stakeholder discussion of some kind is part of most planning processes, formal partner country approval is required and genuine national government support for the programme is essential to success. It appears that national governments rarely identify natural disasters as a development priority. If they were to do so, it is not clear how much influence this would have on donor assistance strategies. This issue requires further research.

Little work has been done to assess the extent to which natural hazards/disasters and associated vulnerability are included in country and regional plans, or to analyse the nature of that coverage and any proposed remedial efforts. Of the major donors, we know most about DFID's performance in this area. Internal reviews in 1997 and 1998 found that there was room for improvement in CSPs' coverage of response strategies and disaster preparedness. An independent study in 2000 examined 18 of DFID's most recently revised CSPs and RSPs for countries and regions prone to major natural hazards. Eleven recognised hazards or disasters as factors of some importance in their contextual analysis but only five had disaster risk reduction activity in any form as a significant component of their plans and only one had a line in its budget specifically for such work. A review by the UK government's National Audit Office in 2003 confirmed these earlier findings (NAO 2003: 28–30; Twigg et al. 2000: 108). The World Bank has carried out internal studies of coverage of disaster risk management issues in its CASs and PRSPs: these have not been made public but it is believed that the findings are similar (see also Chapter 1).[2] There is no reason to believe that studies of other donors would come to significantly different conclusions.

The subject needs more systematic investigation, similar to the EC's 2002 review of how environmental issues were mainstreamed into 60 country and seven regional strategy papers, which found considerable variations between countries and regions but a relatively poor level of integration overall (Dávalos 2002). An investigation should also look into the reasons behind the level of priority given to disasters in individual regions or countries.

There are examples of good practice. DFID's 1998 Bangladesh CSP had sustainable improvement in livelihoods for the poor and those vulnerable to poverty as one of its six priority themes. Its approach specifically included reducing the vulnerability of those on the margins of poverty to external shocks, including natural disasters, that might make them poorer. It was also stated that, where appropriate, projects would take account of the regular incidence of natural disasters and their impact on the poor (DFID 1998: 11). The EC's current RSP for Latin America allocates 20 per cent of expenditure to natural disaster preparedness, prevention and reconstruction (Dávalos 2002: 21) and several other CSPs identify linkages between vulnerability and environmental hazards (ibid.: 27). Approximately half of the funds for the work programme proposed in the 2002–7 Guyana CSP are allocated to sea defences and related coastal strategies (EC 2002: 2, 18, 22, 25).

Where country and regional plans refer to hazards/disasters among the causes of poverty/vulnerability, this does not necessarily mean that the influence of natural hazards/disasters is assessed (it may be only mentioned in passing) or that steps will be taken to address the problem: lack of real commitment or other factors may affect plan development (e.g., NAO 2003: 30). Use of the term 'vulnerability' does seem to be on the increase in plans, but precise definitions of this are often lacking and it may be used quite broadly.

This admittedly preliminary exploration of the subject suggests a few potential methods or tools that might assist incorporation of hazards/disasters into country and regional programmes.

Vulnerability/risk indices and indicators

A number of environmental or socio-economic vulnerability indicators have been developed, particularly by international organisations such as the World Bank, the OECD and UN agencies; some of these have been in use for some time (see Box 1.3). National disaster data sets are also available, such as

2. Only nine PRSPs are listed on the World Bank Hazard Management Unit's web site as having incorporated 'hazard risk management' (http://www.worldbank.org/hazards/policy/prsp.htm).

CRED's EM-DAT database, Munich Re's data on disasters' 'economic' impact and the DesInventar database for Latin America (CRED 2003; Munich Re 2002; DesInventar 2003). Integration of relevant data sets into a more integrated index of disaster vulnerability is a very recent development: during the period of this study, ECHO and UNDP have published models (de Haulleville et al. 2003; UNDP 2004). Whatever the methodological limitations of indices of this kind (see Chapter 1), they do provide concrete data of a sort, which is essential in donor agency decision-making. The Disaster Risk Index (DRI) developed for ECHO in 2003 has already been used to inform internal decisions about allocation of resources between disaster-prone countries and has begun to stimulate debate about priorities. Its potential value in decision-making is also recognised by some EC development staff. Agencies may wish to use disaster vulnerability indices in conjunction with other established indicators of socio-economic vulnerability, building up their own composite indicator sets. There may also be mileage in linking them to those expressing countries' vulnerability to climate change, which some donor agencies are now developing (e.g., EC 2003b: 20, 29–34).

Disaster/vulnerability profiles

The UNDP has experimented with disaster profiles of the least developed countries (LDCs): these were only single-page summaries of key socio-economic and disaster data (UNDP 2001), but there is potential for expansion into something more substantial. The EC's Country Environmental Profiles (CEPs) are perhaps a model for the size and scope of such a profile (see also Chapter 4). These cover: key environmental trends and issues; government response to environmental pressures (institutional, financial and legislative); integration of environmental concerns into other economic sectors; donor activity; and EC cooperation with the country on the issue (EC 2000). They are not very detailed documents but present a comprehensive and factual summary taken from more substantial sources (e.g., EC 1999). Alternatively, hazards/disasters could be incorporated formally into such environmental profiles.

Mainstreaming criteria and monitoring

Also needed are clear criteria showing how well hazard/disaster issues are being mainstreamed into plans. This would allow progress to be monitored (see also the discussion of evaluating national-level systems and institutional mainstreaming in Chapter 9). There is still too much reliance on anecdotal evidence of success or failure. An example of how such monitoring could be done is the EU's 2002 environmental review, which scored CSPs and RSPs against a series of criteria including: inclusion of a country environmental profile; analysis and measures at national level; measures at EC level; multilateral environmental agreements; other donors' responses to the issue; strategic environment assessment; and environmental-poverty linkages (Dávalos 2002). Evidence of difficulty in mainstreaming environmental issues (e.g., Dávalos 2002) indicates the extent of the challenge.

Manuals and guidelines

Guidance on how to mainstream disaster risk reduction into higher-level programming is scarce, reflecting the lack of interest in this issue until very recently. The RUTA guidelines referred to above (Section 2.2), though designed principally for project managers, contain some advice on programme-level aspects (Kiesel 2001); but for the moment one has to rely on guidance produced in other sectors. For instance, the EC has developed an online manual for integrating the environment into development policy, programming and projects. This gives detailed practical guidance, directly related to the full range of relevant EC instruments and procedures (EC 2000). However, it recognises that this needs to be supplemented by technical support and is therefore about to establish a three-person helpdesk in the EuropeAid Cooperation Office. The Joint UN Programme on HIV/AIDS (UNAIDS) and the World Bank have produced a toolkit to enable country officials and their partners to prepare and negotiate the inclusion of scaled-up HIV/AIDS programmes in PRSPs and the instruments of debt relief under the Highly Indebted Poor Countries (HIPC) initiative. It shows how to make a case for HIV/AIDS in poverty reduction and to present plans for addressing the problem (UNAIDS/World Bank 2001). Similar guidelines specific to disaster reduction would be a valuable resource, especially since many bilateral donors now base their country strategies on PRSPs.

Some of the donor agency staff interviewed for this study believed firmly that the way to promote incorporation of issues such as disaster risk reduction was through better use of existing inter-departmental consultation and networking mechanisms, rather than introducing new resources or procedures. Research into NGOs' engagement with disaster mitigation and preparedness has also identified the key roles that individuals can play within organisations by virtue of their position, experience, contacts and enthusiasm (Twigg and Steiner 2002). However, there is still much work to be done to establish the relative importance of structures and people in such contexts.

New policy issues

Growing recognition of the impact of climate change on development may lead to a higher profile for disaster risk reduction. Donor agencies are giving attention to how climate change adaptation (including disaster preparedness and reduction) can be mainstreamed into national and regional plans (e.g., EC 2003b: 15–17, 21–8).

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Chapter 3

Economic appraisal

3.1 Purpose of economic appraisal

As part of the project cycle, the costs of a project must be estimated and a detailed budget drawn up. Government and aid expenditure carries an opportunity cost and thus needs to be considered in the broader context of potential other uses of that funding. In an ideal world, the marginal benefit of the last dollar of public spending should equal the marginal disutility of raising another dollar through taxation, while the marginal benefits of each sector of public spending should also be equal (Toye 2000).[1] Even if governments (and others) lack the expertise – as Toye argues many do – to apply this principle, individual projects should at least be economically justifiable in their own right. Strengthening an infrastructure project against natural hazards, for instance, may reduce expenditure over the project's life.

Donor agencies and NGOs concur that, as a basic principle, a project must be at least cost-effective – that is, that project goals and objectives should be achieved at least possible cost. However, as the Asian Development Bank comments:

> *…a scrutiny of recent literature published by bilateral agencies such as Danish International Development Assistance (DANIDA), Danish Cooperation on Environment and Development (DANCED), AUSAid (Australian), GTZ (German), and FINNIDA (Finland) regarding preparation of project or sector loans reveals very little about general guidelines for economic analysis (in the sense of quantitative cost-benefit techniques), or risk analysis in particular. One reason for this is obviously that such agencies are (by and large) disbursing grant or extremely soft funds, often in relatively small amounts and do not have the same fiduciary accountability requirements as a bank such as ADB. It is also the case that operations by such agencies are increasingly in sectors where monetized costs and benefits are less obvious than historically may have been the case. The prevailing view among bilateral grant-based aid agencies, as reflected in the available documented techniques for project preparation is that projects are assessed primarily in qualitative terms, with a focus on institutional and sustainability issues, rather than on estimation of economic returns per se.*
>
> *(ADB 2002: 38)*

Nevertheless, multilateral lending agencies do undertake more rigorous economic analysis as a key element of their appraisal process. Governments should also undertake them. It is, therefore, relevant to consider how economic appraisals can and do take into account issues relating to risk reduction and indicate net financial benefits of mitigation.

There are also various tools for estimating likely future economic impacts of natural hazards at a macroeconomic level, such as growth models, input-output matrices and computer general equilibrium models (see, for instance, Benson 2003b for a discussion of these). These may be relevant in designing donor policies and programmes but are typically less useful at the project level.

3.2 Basic steps in undertaking an economic appraisal

Multilateral lending agency policies are fairly standard in their approach to economic appraisal, following recognised good economic and financial practice. The basic approach is concisely summed up as follows in the ADB's *Operations Manual*:

> *The economic analysis of projects is carried out prior to their financing and when necessary throughout the project cycle. Economic analysis seeks to promote the best use of a country's resources, consistent with national and sector development goals. The rationale for a project in terms of market or government failure and the country's national and sector development goals needs to be stated. Where possible, the costs and benefits of the best project alternative,*

1. In other words, the change in total benefits resulting from the last dollar of public spending should equal the fall in the total utility (satisfaction, pleasure or need-fulfilment) of consumption by tax payers, while the total benefits resulting from the last dollar of public spending in each sector should be equal.

defined and valued from the perspective of the national economy, are compared to assess economic efficiency. If benefits cannot be valued, economic costs are assessed against project objectives with a view to minimizing the cost of achieving them. An assessment of project risks, producer incentives, and fiscal impact is made for improving the sustainability of project activities. Environmental costs and benefits are included as far as possible. A statement should be provided of the main project benefits and beneficiaries.

(ADB 1997a: 1)

Cost-benefit and related project appraisal approaches are applied in seeking to secure the highest return to investment; to ensure that investment decisions are accountable; to facilitate a rational comparison of available options; and a rational allocation of public resources. They are potentially useful not only in quantifying the net benefits of particular projects but also, as Penning-Rowsell et al. (1992) note, in identifying and clarifying the issues involved in a particular decision.

Cost-benefit analysis (CBA) in its most basic form is a framework for the economic assessment of individual investment projects, under which the present value of future streams of benefits and costs are compared. Costs and benefits associated with a project are estimated by comparing the situation that would hold with and without the project and then expressed in monetary terms. External effects on consumers or other producers, such as environmental costs and benefits, are included in an economic analysis. The discounted or present value of future costs and benefits is then calculated. If a project yields net benefits (that is, if gross benefits exceed gross costs) then an investment is considered worthwhile. The approach considers the returns of a project to the whole of society and, as such, its scope is broader than that of financial analysis, which only considers those impacts that entail income and expenditure implications specifically for the economic agent concerned.

There are some notable flaws with CBA, in particular that results of the analysis will depend on how one defines and values different benefits and costs and on the level of discount rate used.[2] Indeed, if allowed sufficient manoeuvre to determine the breadth of benefits and costs considered, to what extent non-monetary costs are taken into account, how monetary costs are valued (using some form of inputted prices) and the discount rate, it is possible to manipulate the analysis to produce any result wanted. However, CBA is a mainstream project appraisal tool and likely to remain so. As such, it is important to consider how it could be adapted to take better account of natural hazards in more hazard-prone countries. Indeed, one of the existing biases in the application of cost-benefit analysis and related methodologies is precisely that it often ignores risks emanating from natural hazards.

3.3 Incorporating natural hazard concerns into economic appraisal

Economic appraisal techniques can be used to assess the cost efficiency of proposed disaster mitigation measures. They can also be used more generally to ensure that risks emanating from natural hazards are adequately explored, relative to prevailing probabilities, in planning and designing other projects. There are three particular aspects of economic appraisal where natural hazards may be a significant factor influencing the outcome of analysis and should therefore be considered as a matter of course.

3.3.1 Sensitivity and risk analysis

First and foremost, manuals on the economic analysis of projects include a section on sensitivity and risk analysis, outlining techniques for use in assessing the implications of uncertainty for the choice between project alternatives or for project viability.

Sensitivity analysis

Particular emphasis is placed on sensitivity analysis as the primary methodology for assessing uncertainty. As the World Bank states:

Economic analysis of projects is necessarily based on uncertain future events and involves implicit or explicit probability judgments… It is desirable, therefore, to take into consideration the range of possible variations in the values of

2. The discount rate converts the future value of costs and benefits into their present value. This conversion is required because money received today is worth more than an equivalent amount received at some point in the future because money received today can earn interest in the interim. Assuming, say, a 10 per cent rate of interest, US$ 100 today is US$ 110 in a year's time and US$ 121 in two years' time. Thus, an individual is indifferent between receiving US$ 100 today and US$ 110 in a year's time or US$ 121 in two years' time.
As the World Bank (1998: 152) states, 'the discount rate used should reflect not only the likely returns of funds in their best relevant alternative use (i.e., the opportunity cost of capital or "investment rate of interest"), but also the marginal rate at which savers are willing to save in the country (i.e., the rate at which the value of consumption falls over time, or "consumption rate of interest").' In practice, the World Bank normally uses a 10 to 12 per cent notional figure for evaluating Bank-financed projects, basically as a rationing device for World Bank funds (ibid.). ADB also tends to use a figure of 10 to 12 per cent.

the basic elements and to reflect clearly the extent of the uncertainties attaching to the outcomes. At the very least, economic analysis should identify the critical variables that determine the outcome of the project, that is, the values that increase (decrease) the likelihood that the project will have the expected positive net development impact... The analysis should also identify and reflect the likelihood that these variables may deviate significantly from their expected values, as well as the major factors affecting these deviations. The analysis should assess how likely such deviations are, singly and in combination, and identify the factors that are likely to create the greatest risks for the project. Finally, it should be explicit about actions taken to reduce these risks.

(World Bank 1998: 7)

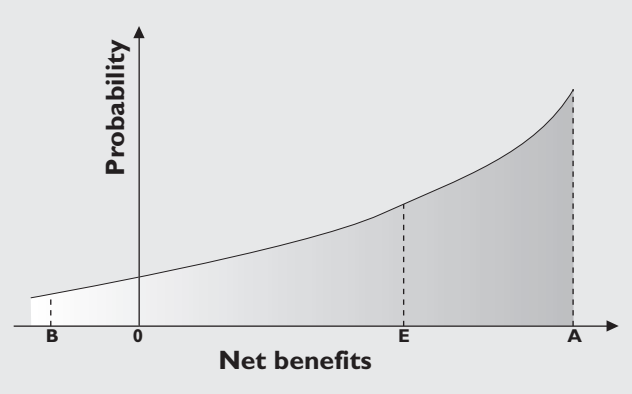
In other words, sensitivity analysis identifies parameters that are uncertain and that could have a significant impact on the project outcome. Sensitivity indicators are calculated summarising the impact of a change in each variable on the project's net present value (NPV), a higher indicator implying greater sensitivity. A switching value should also be calculated, showing the percentage change in key variables that would be required for the NPV of a project to become zero. Any variables with a low switching value could represent a significant risk to the project outcome. If sensitivity and risk analysis reveals that the project outcome is dependent on one or two major variables that are uncertain, then project design should be improved to include mitigating actions (ADB 1997b; World Bank 1998). For large projects and those with NPVs close to zero, a quantitative risk analysis incorporating different ranges for key variables and the likelihood of their occurring simultaneously is recommended (ADB 1997b).

Natural hazards are potentially one such source of uncertainty, where historical records and scientific investigation are limited and implications of climate change unclear (see Chapter 6). However, they are not necessarily explicitly recognised as such in donor guidelines on sensitivity analysis. For instance, the ADB manual (ADB 1997b) outlines a number of variables to which a project may be sensitive – but does not mention natural hazards. Despite this, Parker et al. (1987) state that sensitivity analysis is the preferred method of coping with uncertainty in flood protection benefit-cost analyses whilst Kramer (1995) notes that it is also perhaps the most widely used method to consider the impacts of uncertainty in CBA more generally. However, as Kramer (ibid.) reports, this approach does not generate any information about the relative risk of alternative investments.

Probability-based approaches (akin to quantitative risk analysis)

These approaches offer a more rigorous analysis that can be undertaken in cases where probabilistic distributions of the key variables are available – that is, where there is no uncertainty. Projects can then be selected on various bases such as their mean NPV; using a mean-variance analysis, which takes into account the degree of dispersion around the mean; using a safety-first analysis, which seeks to maximise the expected NPV conditional on the fact that it does not fall below a certain level; or using stochastic dominance analysis, under which probability distributions are ranked for different classes of risk averters. Consider, for instance, a proposed infrastructure project in an area subject to windstorms and cyclones. (Assume for the sake of simplicity that all other risks to the project are negligible.) Assume further that there are good scientific records on the frequency of incidence of events and that the probability distribution of windstorms and cyclones, including related wind speeds and wave heights in the vicinity of the proposed facility, can be obtained. Their related impacts on the costs and benefits of the project should then be calculated, generating a probability distribution of the project outcomes or net benefits as shown in Figure 3.1.

Figure 3.1 Probability distribution of project outcomes



Source: After Mechler (2002)

Let A be the projected net benefits before risk from windstorms and cyclones was considered. E is the expected or average outcome as derived from the probability distribution. Actual outcomes may lie anywhere between A and B, the worst-case scenario indicating negative net benefits in the event of the occurrence of more severe cyclones. The project evaluators may consider the probability of costs exceeding benefits as being too great in which case they could examine the net implications of strengthening the facility to various degrees. Strengthening would increase the initial investment cost but reduce potential damage, altering the probability distribution of project outcomes.

Kramer (1995) notes that although probability-based analysis had not, as of 1995, been used to examine the potential impacts of natural hazards on development projects (and research for this study revealed no such cases in the past eight years), it held considerable potential as a rigorous method for ranking projects exposed to risk or different mitigation options.

Other tools and methodologies

A series of other tools and methodologies has been developed to incorporate risk in cases where project benefits and costs are uncertain (e.g., Little and Mirrlees 1974). These are not generally mentioned in donor handbooks on economic appraisal. However, they have been advanced for specific use in the appraisal of mitigation projects (e.g., OAS 1990 and 1991; Kramer 1995) and may warrant greater attention by donors. Each has its particular advantages and limitations and the relative appropriateness of the various approaches depends on the amount of hazard information available and the particular nature of the project being assessed.

The approaches include application of a **pay-off** or **cut-off period**, whereby projects are assessed on the basis of whether they will generate sufficient net benefits over a specified period of time, with shorter time spans applied to higher-risk projects. OAS (1990) notes that for projects at high risk of flooding or landslides, the cut-off period might be set as low as two or three years. This method allows one simply to ignore costs and benefits beyond the cut-off period and is appropriate when there is high uncertainty about levels of risk but the magnitude of hazard events is potentially great. However, as Kramer (1995: 63) notes, a natural hazard may still occur before the chosen cut-off date and, as such, this method 'is deficient since it does not deal with uncertainty in a systematic way and should only be used when a meager amount of information is available'.

Another approach, sometimes referred to as **discount-rate adjustment**, involves the application of risk premiums to the discount rate, with less weight given to increasingly uncertain future benefits and costs. However, some caution against this technique, in part because a uniform discount rate is applied to all benefit and cost streams whilst differences in levels of uncertainty between different components of a project are ignored (e.g., Kramer 1995; Parker et al. 1987). Some prefer game-theory approaches, following either 'maximum-gain' or 'minimax-regret' strategies. Under the former, the project alternative that gives the highest return in the worst-case scenario is selected. The latter involves selection of the project giving the smallest sum of possible losses.

3.3.2 Environmental impact

It is now widely accepted that economic analysis should take into account a project's environmental impact. For instance, the World Bank's *Handbook on Economic Analysis of Investment Operations* states in its opening chapter that 'the effects of the project on the environment, both negative (costs) and positive (benefits), should be taken into account and, if possible, quantified and assigned a monetary value' (World Bank 1998: 6). ADB's guidelines on environmental impact assessment make a similar point (ADB 1997c). However, although a project can alter the impact of natural hazards via its environmental impact, the manual contains no specific mention of the impact a project may have on, say, the frequency of flooding. Similarly the World Bank document makes no reference to natural hazards in this regard. Donor agencies should be encouraged to consider the cost implications that a project's environmental impact may have for determining the consequences of natural hazard events. The issue of environmental impact is discussed in further detail in Chapter 4.

3.3.3 Sustainability

Another economic criterion on which a potential project is considered is its sustainability – that is, whether net benefits endure throughout the life of the project and beyond at a level sufficient to meet the economic viability criteria (ADB 1997a). Natural hazards can threaten sustainability both by damaging project infrastructure and by undermining financial sustainability (for instance, by reducing availability of government funding to the project as resources are reallocated to rehabilitation purposes). As such, they should also be considered as part of this analysis.

3.4 Complicating factors[3]

There are a number of difficulties in applying economic appraisal methods in cases where risks emanating from natural hazards exist or, more directly, to mitigation and preparedness projects. These difficulties are outlined below. A number are not unique to this area and, as such, many of the approaches developed to address similar assessment difficulties in other areas are pertinent to the appraisal of risk reduction measures. Other difficulties appear less easily surmountable.

Another factor limiting analysis of natural hazard-related risk in designing and approving projects relates to attitudes to it. This is dealt with separately (see Section 3.6).

3. This section draws heavily on Benson (2003a).

Non-monetary benefits

Risk reduction measures can entail substantial non-monetary benefits. Various methodologies have been developed to evaluate such difficulties (e.g., Abelson 1996). For example, under **cost-effectiveness analysis**, project inputs are valued in monetary units and outputs in physical units, with the least-costly method of achieving a particular objective then chosen. However, this methodology is really only appropriate in cases where a decision has already been made to proceed with a particular project. If the benefits consist of improvements in several dimensions then weighted cost-effectiveness analysis is appropriate, under which different benefits are weighted (a subjective judgement) and reduced to a single measure (World Bank 1998).

Alternatively, under the **standards approach**, targets and criteria are set which the project has to meet – such as protection against floods up to a 'one-in-100-year' event. A third approach, **multi-criteria analysis**, involves the application of weights to various criteria or impacts, some of which may be in measured in volume rather than value terms. Stakeholders participate in establishing objectives and attributes and in weighting them. Another method, which was explored in the context of the Bangladesh Flood Action Plan, involves the application of appropriately estimated **corrective factors** to the directly quantifiable benefits of a project in order to take implicit account of unquantifiable benefits. In other words, the direct benefits of a project are adjusted upwards to reflect the project's overall developmental benefits. However, the value of this corrective factor needs to be adjusted in accordance with specific country circumstances as well as the type of hazard being considered.

Various techniques have also been developed for estimating the value of non-monetised goods for use in methodologies that require monetary values. These include:

- The **travel cost method**, for use in evaluating recreational benefits, which could be applied to substitute sites to measure the economic losses associated with destruction of a particular recreation site.
- The **hedonic price method**, for use in assessing amenity gains and losses on house prices, which has been used to gauge the effects of floods.
- The **contingent valuation method**, under which respondents to a survey are asked how much they would be willing to pay for a clearly specified change, such as the additional protection offered by a particular structural mitigation investment.
- **Land price analysis**, under which the role of risks emanating from natural hazards in determining land prices can be calculated, thus providing a measure of people's willingness to pay to avoid risk.
- **Productivity analysis**, under which a biological production function is used to measure the effects of environmental change on the productivity of a resource, such as the benefits for fish of wetlands habitat destroyed by hurricanes.
- **Opportunity cost analysis**, under which environmental resources are valued based on the cost of replacing the services provided by a destroyed resource.

Valuation of human life

Natural hazard events can result in injury and loss of life. However, the valuation of loss of human life is one of the most contentious areas of economics, involving as it does both ethical and technical difficulties. There is a natural aversion to placing a cost on human lives as they are far more than simply a form of productive capital. People would typically place a near infinite value on the lives of their loved ones. However, the reality is that in order to make certain decisions and choices between uses of resources, lives do have to be valued. In the past, human life was most commonly valued on the basis of an individual's foregone earning capacity, by estimating the future income – expressed in NPV – that an individual would be expected to generate over the remaining duration of his or her potential working life. This approach had many shortcomings, including that it implies that higher earners are worth more (World Bank 1998). More recently, the willingness-to-pay approach has been regarded as a better valuation tool (Smith 1996). This measures the value individuals place directly on reducing their own and others' risk of death and injury, summed across all those that might be affected by a particular event. Willingness-to-pay measures reflect the whole range of costs associated with premature death, including loss of production, suffering and losses imposed on other family members and society.

Availability of information on the impact of past disasters

Data on the impact of past disasters – which can offer a useful starting point for estimating the likely impacts of future events – are often incomplete and inaccurate, in part reflecting inadequacies in post-disaster damage assessments. To help overcome such difficulties, a unit-loss approach has been developed in the United Kingdom under which floodplain land uses are coded under a standard system which also takes account of the ground-floor height of each building (e.g., Penning Rowsell and Chatterton 1977; Parker et al. 1987). Total direct and indirect losses are then computed by applying

annually revised, carefully synthesised or average damage data sets on unit losses relating specifically to the various property codes. Indeed, Parker et al. (1987: 9) advocate this method over the use of assessments of actual losses in recent flood events as the latter approach 'is fraught with difficulties where indirect flood losses are concerned'. However, the unit-loss approach requires considerable information and resources to set up a database and ensure that it is regularly updated, making this method less relevant to developing countries.

Particular complexities in appraising risk reduction measures

In undertaking CBA, with-without comparisons have to be made. Most risk reduction measures tend to alter the outcome of a hazard event by changing the pattern or level of loss, rather than entirely preventing it. There is, therefore, a need to distinguish between avoidable and unavoidable losses. This is a potentially complex task. Mitigation measures can also create new risks by altering behaviour. As the Royal Society (1992) notes, it can be difficult to show clear links between resources committed and risk outcomes because people may adjust their behaviour to changes in the inherent safety of their environment, with some of the expected safety gain traded for gains in performance of other values. For example, coastal and floodplain protection can have the effect of increasing investment and settlement in vulnerable areas, despite the fact that structures can be overtopped or breached by floods exceeding their design level, as happened in the Midwest (United States) prior to the 1993 floods (FEMA 1998). Mitigation measures can also transfer risk to another area, most literally in the case of the diversion of floodwaters.

Public perceptions of risk

Although they may differ substantially from 'scientific' assessments, public perceptions should be taken into account. In particular, Handmer and Thompson (1997) point to the fact that confidence is much lower for low-probability events. Thus, it may be considered socially desirable to protect against low-probability, high-magnitude events even though it is not justified on the basis of annual average losses.

Realisation of economic benefits

One needs to consider the extent to which economic benefits will be realised. Measurement difficulties can be particularly pronounced in cases where accruement of the full benefits of a project are dependent on public compliance – for example, as with a warning system (see also Chapter 10).

3.5 Application

Unsurprisingly, the extent to which the above difficulties arise varies between types of hazard as well as the precise nature of the project being appraised. Handmer and Thompson (1997) explore the relative ease of economic assessment of various types of hazard in terms of risk definition (as determined by the ease of mapping the hazard area, the ease of undertaking probability estimates and the existence of past records); their impact (as determined by locational factors, hazard characteristics and building parameters, past loss records and the frequency of various hazard events); and mitigation opportunities (defined in terms of the scope for prevention or exclusion, longer-term individual loss reduction and short-term loss reduction). They conclude that, at present, flood mitigation is relatively more amenable to detailed benefit-cost analysis although there is considerable scope for the application of similar methods to other types of hazard, such as earthquakes, cyclones and bushfires.

The validity of this conclusion is seemingly confirmed by the relative balance of available literature on economic appraisals of mitigation and preparedness activities by type of hazard. The published literature on applications primarily relates to structural flood protection measures. Similarly, a significant proportion of published guidelines and manuals on assessment techniques relate to methods for estimating various forms of benefits and loss of flood protection and coastal management schemes (e.g., Bangladesh Flood Plan Coordination Organization 1992; Parker et al. 1987; Penning-Rowsell and Chatterton 1977; Penning-Rowsell et al. 1992; US Water Resources Council 1983).

However, there are some exceptions. In the United States, FEMA and state emergency management agencies have together produced a software module for conducting a benefit-cost analysis of mitigation measures against all major types of hazard (FEMA 1999: 3) (see Box 3.1). GTZ has also recently commissioned a study to produce guidelines for CBA of mitigation and risk transfer measures, focusing on the local level.[4] There are some additional guidelines and applications in the related area of global warming, principally pertaining to the costs and benefits of reducing greenhouse gas emissions (e.g., Munasinghe et al. 1995).

Even within the body of work relating to floods, current pre-investment appraisals of mitigation and preparedness measures typically adopt a very narrow approach. For example, at least in a United Kingdom

4. Personal communication with Mario Donga, 17 March 2004.

BOX 3.1 FEMA's Mitigation Benefit-Cost Analysis (BCA) Toolkit

The United States' Federal Emergency Management Agency (FEMA) has developed a 'Mitigation BCA Toolkit', which is available on CD-Rom. This toolkit includes software 'modules' written in Excel for each of the major hazards, including flood, hurricane wind, earthquake, tornado and wildland/urban interface fires. These essentially provide templates to structure and guide the BCA and ensure that mathematical aspects of the analysis are correct. However, FEMA stresses that all of the modules require users to enter project-specific data and that any BCA is only as accurate and valid as the input data. Many of the BCA modules have an accompanying technical manual, providing a definition of terms and a detailed line-by-line breakdown of the module. A hotline service is also available for technical enquiries.

There are two basic types of BCA software modules: a 'limited data' and 'full data' module. The 'limited data' or frequency-damage method module uses historical data and engineering judgement to develop frequency damage relationships both before and after mitigation. This analysis may be appropriate for small, low-cost projects, or as an initial screening of larger projects to assess whether more detailed analysis is warranted. The 'full data' or engineering method module uses engineering data on the probability and severity of hazards to estimate damages and losses (before and after mitigation) versus a quantitative measure of the hazard severity (e.g., flood depth, wind speed or level of earthquake ground shaking). This more detailed analysis is appropriate for large, high-cost projects, projects that are politically sensitive, or projects where initial screening indicates that benefit-cost ratios are close to one.

The CD-Rom also includes further practical assistance in the form of worked case studies; guidance on data derivation, including how to overcome data deficiencies; and guidance on determining and valuing benefits. Accompanying training courses are also provided, including a riverine basic course, a riverine intermediate course and a seismic course. Each of these courses covers basic BCA principles, data gathering and running of the very limited, limited and full data modules as well as providing additional worked examples of the methodology and exercises for students.

Source: FEMA 2003

context, the focus has been mainly on measuring the cost of physical capital damage whilst methods for measuring intangible direct impacts and indirect and secondary effects have received less attention (Penning-Rowsell 1999).

Exercises to document economic benefits of risk reduction with regard to other types of hazard appear to have been based on even cruder analysis. There is a body of work comparing costs of mitigation with losses from a single event without taking into account the probability of occurrence of a particular hazard and quantifying just one sort of benefit, in the form of direct physical damage averted. FEMA, for instance, has documented evidence in the context of the United States to increase awareness of the benefits of mitigation from an economic perspective (FEMA 1997; 1998), comparing data on costs of mitigation and losses from an actual disaster or likely losses from a large single event.[5] It reports, for instance, the case of Andritz, Inc., a Pennsylvania-based manufacturer of specialized capital equipment for the paper and feed industrial market. The company suffered losses totalling US$ 3.4 million as a consequence of Hurricane Agnes in 1972. Between 1972 and 1975 it therefore implemented mitigation measures costing US$ 30,000–40,000 (in 1979 dollars). These efforts contributed to over US$ 3m in cost savings from damages after Hurricane Eloise in 1975, with further benefits expected in subsequent years. Mitigation activities of Seafirst Bank, a division of Bank of America NT&SA and operator of the largest consumer-banking network in the state of Washington, are also discussed. Seafirst Bank invested less than US$ 1m in non-structural mitigation for its administrative building (anchoring building contents and so forth), equivalent to only 4–5 per cent of the estimated replacement cost excluding installation – dramatic figures yet focusing merely on direct physical damage. Indeed, FEMA itself acknowledges that many of the examples it reports underestimate benefits by focusing purely on physical damage, at least identifying other potential benefits from a business perspective:

- *increased life safety for employees and customers,*
- *reduced down-time in production,*
- *reduced damage to inventory or supplies,*
- *protected information systems,*
- *reduced damages to facilities and nonstructural components,*
- *reduced damages to vital equipment, and*
- *enhanced insurance coverage or reduced insurance deductibles.*

(FEMA 1998: 2)

A further limitation of the published literature relates to the fact that it largely pertains to appraisals in developed countries. One of the few frequently cited

5. Within these organisations, more detailed analysis may have been conducted but this was not reported.

examples of the economic benefits of mitigation in a developing country concerns a Red Cross project in Viet Nam. The Viet Nam Red Cross has supported a mangrove-planting programme, providing protection to coastal inhabitants from typhoons and storms. Planting and protection of 12,000 hectares of mangroves alongside 100km of dykes cost a total of US$ 1.1m over the period from 1994 to 2001, equivalent to an average US$ 0.13m per annum, reducing the annual cost of dyke maintenance by a substantive US$ 7.1m.[6] These figures – US$ 0.13m costs versus US$ 7.1m benefits, implying net benefits of almost US$ 7m each year – are widely quoted as illustrating that mitigation 'pays'. The true figure on net benefits would be even greater if additional indirect benefits were factored in. The programme has helped saved lives, protected livelihoods and even generated new livelihood opportunities in the form of sale of crabs, shrimps and molluscs which mangrove forests harbour (IFRC 2002).

Finally, pre-investment appraisals of other projects with potential indirect implications for levels and forms of vulnerability to natural hazards rarely seem to take account of related benefits and costs.[7] This appears to be in part because of lack of foresight and in part because of complexities of measurement. For example, the pre-investment appraisal for a power and communications project in the Philippines that would also result in improved cyclone-warning capabilities was unable to take account of the latter benefit because it could not be easily quantified (Benson 1997). Similarly, there is surprisingly little hard analysis of the costs and benefits relating to the incorporation of mitigation features into projects more generally.

3.6 Attitudes to risks emanating from natural hazards in public investment

It is frequently argued that governments with large project portfolios should be risk neutral, neither preferring nor averting risk but instead focusing on maximizing the NPV of projects. This case, first put forward in a classic paper by Arrow and Lind (1970), is based on concepts of risk pooling and risk spreading: with a large number of investments spread across all of society, the costs of any individual project failures can be absorbed within the project portfolio as a whole, with projects resulting in lower-than-expected NPVs counteracted by others resulting in higher-than-expected NPVs (ADB 2002; World Bank 1998). Thus, governments should be indifferent between high-risk and low-risk projects provided they have the same expected NPV (OAS 1991). Indeed, ADB (2002: 5) attributes the 'relative paucity of material on risk analysis' in its *Guidelines* (and *Financial Guidelines*) to this principle of risk neutrality. The same conclusion could be drawn about traditional aid agency approaches to risk more generally.

The World Bank (1998: 124) does qualify this by stating 'that risk-neutrality does not... imply that project designers should not attempt to minimize project risks'. Some exceptions are also made in the case of projects that are very large (implying that negative impacts might not cancel out), macroeconomically significant or 'affect particular groups in society such that these impacts could not be ignored' (ABD 2002: 23–25). Nevertheless, historically risk assessment of any form appears to have been relatively limited.

In practice, as OAS (1991) states, the above argument is only valid up to a point. In developing countries in particular, as already noted, availability of financial resources is often very limited relative to need. In such situations, 'governmental decisions should be based on the opportunity cost to society of the resources invested in the project and on the loss of economic assets, functions, and products' (OAS 1991: 2–15) and should not be risk neutral.

In the event of a natural hazard, the principle of risk spreading may not even apply, as a significant share of a country's economic assets could be damaged or destroyed – for instance, in the case of a major earthquake affecting a key city or of a typhoon striking a small island economy. Even those areas of a country that are not directly affected could suffer indirect impacts – for example, cutbacks in public expenditure, shortages of food and raw materials or temporary loss of markets.

Developing country governments themselves, whilst recognising that the principle of risk spreading may

6. In a workshop organised by the Hai Phong chapter of the Red Cross with the Dyke Management Department of Hai Phong province, it was calculated that the maintenance cost of 1 metre of dyke was reduced from 2.3 to 5 million Viet Nam dong (VND) to 1.2m VND per annum due to the protective effect of the mangroves planted by the Red Cross in Hai Phong province. This implied a minimum annual saving of 1.1m VND in maintenance expenditure per metre of dyke (i.e., 2.3m - 1.2m VND). Assuming an equivalent saving in the seven other provinces where the Red Cross has planted mangroves, benefits total 100km x 1,000m x 1.1m VND or US$ 7.1m per year in reduced maintenance costs, based on an exchange rate of US$ 1 = 15,500 VND. (Personal communication with Ian Wilderspin, 3 December 2003.)

7. An observation confirmed by Mechler's (2002: 50) comment that risks emanating from natural hazards are 'often… neglected in CBA assessments of individual projects'.

not hold, often take the view that in the event of a disaster, international assistance will be forthcoming, financing the replacement of lost assets. In reality, however, there are only finite levels of aid resources and disasters are placing increasing demands upon them. Preliminary investigations suggest that there may be little additionality in aid over the medium term, so that disaster assistance largely diverts funds from development (Benson and Clay 2004).

Meanwhile, lines around aid agency responsibilities appear to be ever more blurred as assistance is increasingly provided in the form of budgetary or programme support rather than for specific projects. Individual structures cannot be linked to particular donors, implicitly reducing pressures on aid agencies to consider issues of risk at least as pertaining to the design and siting of physical structures. Aid agency contributions to social investment funds, which in particular have been used to finance the construction of a large number of schools, similarly cannot be tracked to individual structures. Yet at least in Latin America, social investment funds are disbursed outside of the legislative framework of public practice and the funds assume no responsibility for the integrity of use of assets, including the vulnerability of structures built to natural hazards.

3.7 Conclusion

As Mechler (2002: 63) comments 'cost-efficiency as measured by CBA (cost-benefit analysis) should not be the sole criterion when planning and assessing development and risk management projects, but it provides important information for a more efficient and less risky allocation of scarce resources and thus can aid in bringing about more robust development'. To help ensure cost-benefit and related analysis does support appropriate project choices and design, however, it is essential to consider risks emanating from natural hazards as a matter of course in hazard-prone countries. Mitigating measures should then be introduced where required. The analysis is also useful in creating awareness of particular forms and levels of sensitivity to natural hazards and raising questions concerning responsibilities.

Clearly, more needs to be done, however, to increase awareness of the fact that tools do exist to take risks into account in economic appraisal of projects and to underline the importance of considering natural hazard-related risks for particular types of project in more hazard-prone countries. As part of this process, and as stated by FEMA (1999: 9), 'post disaster economic monitoring of mitigation projects is essential to demonstrate a quantifiable return on the initial investment and to provide communities justification to commit resources for mitigation measures'. There is also a strong case for developing brief guidelines on analysing risk, which could be inserted into existing donor agency handbooks on economic analysis. Such handbooks typically already include a series of 'special interest' appendices.

Finally, limited consideration of risks emanating from natural hazards should be placed in the context of possible broader weaknesses and inadequacies in the economic analysis of projects. ADB, for instance, reports that the quality of economic analysis varies considerably, that analysis of alternatives is often weak and that while proposals often include sensitivity tests, 'the analysis is generally limited to a mechanistic "plus 10% of costs", "minus 10% of benefits" or "1-year delay in implementation"' (ADB 2003: ix). Broader improvements, beyond consideration of potential risk to natural hazards, are clearly required in some cases.

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Chapter 4

Environmental appraisal

4.1 Purpose of appraisal

An environmental movement first began to emerge about 30 years ago, in the early 1970s. The initial focus was mainly on biophysical impacts, concerned with air and water pollution and the destructive use of natural resources (Steinemann 2000; UNDP n.d.). From the late 1980s emphasis gradually shifted towards the concept of sustainable development, defined in 1987 by the World Commission on Environment and Development as development that meets the needs of the present without limiting the potential to meet the needs of future generations. With this shift, the integration of environmental concerns into economic growth and development also became increasingly important (UNDP n.d.) and the scope of environmental concerns widened to include social, cultural and human health, as well as biophysical, impacts (Steinemann 2000).

Concurrent with increasing understanding and awareness of the importance of environmental factors, environmental review of projects and programmes has emerged as established good practice and most aid agencies now require that all projects be subject to some form of environmental review. An increasing number of partner countries also require 'an environmental examination of certain proposed policies, plans and programmes before agreement and implementation' (DFID 2003: 8). There are a number of international agreements committing signatories to promote environmental sustainability and to undertake environmental reviews of activities. Both the Rio Declaration and Agenda 21, for instance, emphasise the importance of using environmental impact assessments (EIAs) in development cooperation (SIDA 1998).

This report follows the World Bank's practice in using the term 'environmental review' to refer to the full process from screening at identification to evaluation after the last disbursement, or after implementation is complete (World Bank 1999). It may entail preparation of a full EIA, a more limited environmental analysis, or no further analysis at all beyond the initial screening. Some donors (for example, the European Commission) consider the socio-economic consequences of a project or programme as part of their environmental review. For the purposes of this report, social and economic impacts are dealt with separately, in Chapters 5 and 3 respectively.

4.2 Basic steps in undertaking an environmental review

The basic purpose of environmental review is:

> *…to examine the environmental consequences, both beneficial and adverse, of a proposed development project and to ensure that these consequences are taken into account in project design. The EIA evaluates the expected effects on human health, the natural environment and on property; it may also include social effects including gender-specific and special group needs, resettlement and impacts on indigenous people. The EIA should consider alternative project designs (including the "no-action" alternative), as well as mitigation measures or environmental safeguards that should be incorporated into the project design to offset adverse impacts. The assessment will be most useful if it is initiated at the earliest stage of project design to ensure from the outset that aid projects are environmentally sound and sustainable.*
>
> *(OECD 1992: 7)*[1]

The environmental review process typically starts with a screening session to determine whether a thorough EIA is required (OECD 1992).[2] Many donors apply some system of screening classification to determine what level of environmental review is required, based on various factors including 'the character of the receiving environment, project type and size, potential impact of the proposal, resilience of natural and human environments and coincidence of impact prediction' (EC 2000a: 126).[3] Initial screening is often

1. Note that OECD uses the term 'EIA' to cover all forms of environmental review rather than just the specific EIA process.
2. There is some variation in practice. SIDA, for instance, requires an EIA for all projects although 'EIAs for projects with minor environmental effects can be kept very brief' (SIDA 1998: 35). Thus no screening is required.
3. In the case of DFID, for instance, environmental screening is only compulsory for interventions with a value of GB£ 1 million or more. Below the GB£ 1m threshold screening is required where there are potential environmental impacts. DFID strongly recommends, however, that screening always be carried out, on the basis that it is difficult to decide whether there are potential impacts without screening (DFID 2003).

desk-based, except where major projects are concerned, and utilises a standard checklist (DFID 2003; SIDA 1998). Projects that are environmentally unacceptable can then be rejected at the earliest possible stage. The 'scoping' process then begins for projects that require a fuller EIA resulting in 'the identification of the most significant environmental issues (often including social issues) raised by the project, the timing and extent of analysis required, the sources of relevant expertise and suggestions for mitigating measures' (OECD 1992: 12). Scoping includes the collection of baseline information on physical, ecological, social, cultural, demographic and economic aspects of the project area, as well as on existing environmental legislation and other agreements (OECD 1992; SIDA 1998). Stakeholders should also be identified as part of the scoping process and a method for making their participation possible in the EIA process determined.

The EIA itself will include a prediction of environmental impacts of alternative project designs and the non-project or 'zero' alternative (that is, what would happen if the project did not take place) (EC 2000c: SIDA 1998). Again, predictions need to consider physical, biological, environmental, economic, health, socio-economic and cultural issues (EC 2000c). Predictions should include information on the nature or type of impact (including whether or not it is beneficial and reversible), the magnitude of impact, the location and geographical extent of impact, the timing and duration of impact and the likelihood of occurrence (EC 2000c). Impacts of the proposed project during construction, operation and decommissioning should all be defined (EC 2000a). Predictions should be good quality, objective and preferably quantitative. Qualitative predictions should be clearly defined and systematic (EC 2000c). EC (2000c) identifies three basic methods for impact prediction:

- Expert judgement – all methods will involve this to some degree but it can play a particularly important role when other methods are not possible.
- Mathematical and computer-based modelling – e.g., groundwater-flow simulation models, water runoff models, geographic information system (GIS).
- Physical models and experiments – e.g., to look at effects of a jetty on sediment transport.

The method selected will depend on various factors including the level of generality of a project (with more specific projects typically requiring more precise analysis) and the availability of time and resources.

The EIA should also include a risk assessment, examining 'the degree of uncertainty in the assessment of the different types of effects and risks' (SIDA 1998: 37) (see Chapter 6). Where required by regulatory regimes (e.g., in the EU for major industrial facilities), a safety case should be developed, integrating safety concerns at stages of design, construction and operation. In addition and where possible, an economic evaluation of environmental effects should be undertaken, particularly if they are expected to be substantial as 'a monetary valuation of the identified environmental effects facilitates the integration of the EIA in the final project assessment' (SIDA 1998: 37). Economic analysis also helps facilitate evaluation of possible alternatives and enables the most cost-effective instruments to be selected in overcoming environmental problems arising as a consequence of a project (SIDA 1998).

The EIA should then identify measures needed to enhance environmental benefits and minimise adverse environmental effects of the selected design (DFID 2003; SIDA 1998). Mitigation measures could include changes in project design, changes in technology or the addition of environmental protection measures (EC 2000a). An environmental management plan is next developed. This uses information and analysis generated by the environmental review to lay out 'procedures and plans to ensure that the mitigation measures and monitoring requirements approved during the environmental compliance review will actually be carried out in subsequent stages of the project' (ADB 2003: 52). In other words, the environmental review process considers what needs to be done and the environmental management plan lays out how to do it, including financing arrangements (UNDP n.d.). Stakeholders should again be involved in determining the environmental management plan. The plan should outline the specific mechanisms to be used in monitoring and evaluating the impact of the project on the environment (DFID 2003).

Donor guidelines emphasise the importance of beginning the EIA process as early as possible, which helps to ensure that environmental opportunities and risks can be fully integrated into the design process and adequately reflected in the project memorandum and logframe (e.g., DFID 2003). The environmental appraisal process should also be iterative, with appropriate action taken to address any new environmental issues that come to light during design and implementation (DFID 2003).

4.2.1 Strategic environmental assessment

Strategic environmental assessment (SEA) is a relatively new tool but is applied in some form by many multilateral and bilateral agencies. SEA is used to evaluate the environmental impacts (positive and

negative) of policies, plans and programmes, ensuring that environmental considerations are integrated into these higher, strategic levels of decision-making taken prior to the project stage. In other words, it 'helps streamline and strengthen EIAs by early identification of potential environmental impacts and reducing resources required to assess individual schemes' (EC 2000b: 136). As such, SEA responds to frequent criticism that 'project-level EIA occurs after questions related to whether, where and what type of development should take place have either been decided or largely pre-empted based on prior analyses that did not account for environmental concerns… Thus, compared to a project-level EIA, an SEA can consider a broader range of alternative proposals and mitigation measures' (ADB 2003: 97). SEA also facilitates 'systematic consideration of cumulative and broad scale (i.e. regional and global) environmental effects' (ADB 2003: 97) and has a broader temporal scale than project-level environmental review.

The EC lists possible forms of SEA:

- *SEA of policy proposals – usually comprising a very broad-brush high level analysis.*
- *Evaluation of regional environmental implications of multi-sectoral developments in a region over a certain time.*
- *SEA of sector investment programmes involving multiple sub-projects or sector policies.*
- *SEA during formulation of programmes to identify environmental impacts and opportunities and allow integration of mitigation measures into programme redesign.*
- *Evaluation of groups of actions related geographically or being of a similar project type, timing or technological character.*

(EC 2000b)

SEAs should be undertaken where there could be significant adverse environmental impacts. They should consider both direct and indirect environmental effects of a proposal and the cumulative environmental impact of the current proposal and other past, present and reasonably foreseeable future actions (ADB 2003). They should also make recommendations on capacity-building measures for environmentally sustainable development in the relevant sector or programme (SIDA 1998). Basic steps in undertaking an SEA are similar to those in undertaking EIA (see, for example, EC 2000b).

Strategic environmental analysis (SEAN) is a complementary tool sometimes confused with SEA. SEAN 'aims at early integration of environmental issues in planning processes, to define sustainable strategies, plans and interventions [while] SEA would assess in greater detail the impacts of a plan or strategy before a decision is… taken' (Kessler 2000: 299). SEAN focuses on interrelations between environmental and socio-economic development concerns, 'mainstream[ing] environmental issues into development planning processes by raising the level of knowledge on the environmental context and its interrelations with the other dimensions of sustainable development' (Kessler 2000: 296).

4.2.2 Country environmental analysis

Country environmental analysis (CEA) is another relatively new tool that a number of donor agencies (e.g., ADB, EC, IDB, UNDP, USAID and World Bank) are beginning to apply. It was developed in response to increasing focus on mainstreaming environmental issues and sustainable development, providing analysis that would influence country-level policy dialogue. CEA is typically undertaken as a background paper to the country strategy paper or advisory note, also providing useful information that can be drawn upon in undertaking the environmental review of individual projects, programmes and sectors. Indeed, OECD (1992) views country environmental surveys and strategies as critical documents in undertaking project environmental reviews, determining the utility and relevance of the reviews.

The new ADB environmental assessment guidelines, for instance, introduced the CEA as a requirement in the preparation of country strategies and programmes. The CEA will have the following purpose:

The CEA will provide the background information necessary for informed decision making on environmental constraints, needs, and opportunities in a developing member country (DMC), including those that impinge upon poverty partnership agreements, as appropriate. The CEA will outline environmental issues that are most important to a DMC's development strategy and describe ADB's role in helping remove the environmental constraints on the DMC's sustained development. The CEA is directed at the policy, program, and sector levels, although it may highlight important environment issues associated with projects in the pipeline.

(ADB 2003: 6)

The World Bank has similarly indicated its intention to begin CEA to strengthen the analytical foundation of

its environmental work at both the country and the sectoral level. According to the Bank, in the past 'diagnostic work on environmental issues has tended to be unsystematic and sporadic… plac[ing] constraints on the Bank's ability to more effectively integrate environmental issues into country programming, policy dialogue, programs and projects' (World Bank 2003b: 1). The Bank has therefore begun the development of appropriate methodological tools and pilot applications in selected countries, with a view to undertaking CEAs in advance of preparation of both CASs and PRSPs (World Bank 2003a). It envisages that a CEA would 'synthesize information about important environmental issues, highlight the environmental implications of key development policies, and evaluate the country's environmental management capacity' (World Bank 2003a: 4).

4.3 Incorporating natural hazard-related risks into environmental review

Natural hazards and the environment have a two-way relationship. The local natural environment can influence the physical impact of natural phenomena. Natural hazards, in turn, can potentially damage the environment.

In a number of countries, deforestation has disrupted watersheds, leading to more severe droughts and floods. Less water is being absorbed into the soil, resulting in increased water deficits and reduced dry-season flows, and exacerbating the effects of any temporary decline in rainfall. Deforestation has also contributed to increased run-off and thus to a higher incidence of flash flooding and landslides in the event of heavy rains. In addition, it has resulted in the siltation of river beds, reducing their carrying capacity and increasing the incidence of riverine flooding. Increased siltation of river deltas, bays and gulfs, together with the destruction of mangroves and other natural breakwaters, has increased the exposure to storm surges and seawater intrusion. In some countries, overgrazing and urbanisation have also contributed to increased run-off, whilst mining operations have played a role in increasing the incidence of landslides and flash floods. Thus, for instance, Heijmans (2001) points to evidence from the Philippines where local communities in the uplands say that they are increasingly vulnerable to typhoons and drought due to the government's logging policies, mining operations and the construction of dams for hydroelectricity purposes. Even normal annual monsoon rains can now trigger landslides and flash floods. In the view of community people, 'the conceptual difference between a typhoon … and monsoon rain… has become negligible, since effects at community level have become similar' (ibid.: 5).

Natural hazards, in turn, can have a range of environmental impacts. For instance, they can damage and destroy natural resources and natural habitat; flooding, forest fires and strong winds can cause soil erosion; forest fires can cause air pollution; and contaminated floodwaters can cause land pollution (Kelly 2003). Post-disaster relief and rehabilitation efforts can also have environmental consequences – for instance, the extraction of local resources for building purposes or firewood. However, the potential impact of natural hazards on the environment is of more tangential interest in undertaking environmental reviews of development projects, only relevant to the extent that they may exacerbate or reverse positive or negative impacts of a project.

4.3.1 Donor guidelines

Environmental guidelines – whether at the project, programme, sector or country level – vary considerably in the extent to which they consider natural hazards and related risk. Historically, there seems to have been relatively little attention to this issue. The ISDR, for instance, commented only two years ago that:

> *Although the inherent links between disaster reduction and environmental management are recognized, little research and policy work has been undertaken on this subject. The intriguing concept of using environmental tools for disaster reduction has not yet been widely applied by many practitioners.*
>
> *(ISDR 2002: 205)*

However, this gap is beginning to be recognised.[4] For example, the Caribbean Development Bank (CDB), in collaboration with CIDA through its Adapting to Climate Change in the Caribbean project, is currently undertaking an important initiative to develop guidelines for natural hazard impact assessment and their integration into its EIA procedures. Under the same initiative a sourcebook has just been finalised presenting a generic approach (see Box 4.1) on the integration of natural hazards within the environmental

4. Other donor guidelines, which could not be examined for the purposes of this study due to time constraints, may be similarly good. For example, according to GTZ (2002: 24), its environmental appraisal, which is obligatory for every project, also includes 'an assessment of natural disaster risk and caters for preventative measures'.

Box 4.1 Integrating hazard-related concerns into EIA: the CDB guidelines

The new CDB sourcebook systematically works through each stage of the EIA process outlining, at length, how natural hazard-related issues should be considered. In doing so, CDB makes the important comment that 'the consideration of natural hazards creates few additional requirements when undertaking any EIA, and does not require any structural change to the overall EIA process' (CDB 2004: 11). Key points are as follows:

Step 1: **Define project and alternatives:** include information on soils, geology, slopes and drainage, location relative to coasts and rivers, and hazard or damage history in the initial project description, which is used to frame the EIA investigation.

Step 2: **Preliminary hazard and vulnerability assessment:** undertake a preliminary identification of significant hazards and related vulnerability to inform EIA screening and scoping, including estimation of the frequency or probability of hazard events and severity of impact.

Step 3: **Screening:** include information from Step 2 in determining the level of environmental screening that a project requires. Projects should be assigned to Category A (full EIA report) if the anticipated short- to mid-term impacts from natural hazards are highly likely to result in significant adverse social, economic, structural or environmental impacts.

Step 4: **Scoping:** consider natural hazards in identifying critical issues to be addressed in the EIA. In instances where natural hazards are likely to result in significant impacts (i.e. Category A and B projects), they should be included amongst critical issues to be addressed in the EIA.

Step 5: **Assessment and evaluation:** consider potential effects of the project on the frequency and intensity of significant natural hazards in assessing and evaluating the impact of the project and project activities on the existing environment and social context; and the impact of significant hazards on the project and project activities. This step should include detailed hazard assessment and mapping of natural hazards that have been identified in the screening and scoping as having a potentially significant impact. It should also include a more detailed vulnerability assessment, extending the preliminary hazard and vulnerability assessment conducted in Step 2. Possible natural hazard risk reduction measures should be selected as necessary, to reduce identified risks to an acceptable level and the preferred project alternative identified. An economic assessment of management, mitigation and adaptation measures should be undertaken to consider the implications of related costs for project viability.

Step 6: **Develop environmental management and monitoring plans:** include development of management, mitigation and adaptation plans to address natural hazard vulnerabilities and identified risks and appropriate monitoring programmes to ensure the implementation and effectiveness of the hazard mitigation/climate change adaptation programme.

Step 7: **Prepare final report:** include management, mitigation and adaptation measures necessary to address natural hazard vulnerabilities and identified risks and an appropriate programme for monitoring project implementation and impacts.

Step 8: **Project appraisal:** in determining viability and acceptability of project against established criteria, confirm that:

- all potentially significant hazards, as identified in the EIA scoping, have been analysed using appropriate methodologies;
- appropriate and sufficient management, mitigation and/or adaptation measures have been identified and incorporated into project design for all potentially significant impacts identified in the detailed hazard and vulnerability assessments; and
- it is technically, financially and administratively feasible to implement the necessary natural hazard risk management measures in the proposed project.

Step 9: **Implement management, mitigation and adaptation measures:** ensure that the specified mitigation/adaptation and monitoring measures are implemented as part of the project and that the selected measures are appropriate.

Source: CDB 2004

review process. Both these and recently revised DFID guidelines (see Box 4.2) set good examples. The revised DFID guidelines look at both the risks and the opportunities to consider when incorporating environmental concerns into a project, exploring potential for beneficial as well as adverse impacts.

The World Bank's environmental policies and guidelines also cover natural hazards. However, they focus primarily on the vulnerability of projects to natural hazards rather than, as in the case of DFID, also considering the consequences of environmental impacts of projects for vulnerability.

Box 4.2 DFID's Environment Guide

DFID's new environmental guidelines, developed and published during a period when poverty reduction has been the central objective of its work, are very good in terms of the regard paid to natural hazards. Points made include the following:

- In discussing why the environment is important for the poor, DFID lists three principal reasons including that of vulnerability: '…the poor are often exposed to environmental hazards and environment-related conflict and are least capable of coping when they occur. In 1992 Hurricane Andrew hit the USA and resulted in 32 deaths. In 1991 a cyclone of similar force hit Bangladesh and killed over 139,000 people.' (page 6).
- In 'top tips for screening', it includes consideration of 'existing causes of environmental change' such as increased environmental hazards and how the intervention will contribute to or reduce these causes (p. 17).
- In considering environmental aspects of poverty reduction strategies, it lists the opportunity to address 'environmental drivers of poverty – such as loss of soil fertility, lack of clean water, and vulnerability due to natural hazards/disasters, climatic variation and long-term climate change' (p. 27).
- Also in considering environmental aspects of poverty reduction strategies, it lists the risk that 'national policies may fail to take into account environmental hazards/natural disasters' (p. 27).
- In considering environmental aspects of HIV/AIDS projects, it lists the fact that HIV/AIDS can 'render communities more vulnerable to environmental hazards, such as recurrent drought, as their coping strategies will already be stretched' (p. 35).
- In listing environmental aspects of forestry projects, it includes the risk that the value of forests as a source of, for instance, protection from landslips, may be overlooked (p. 45).
- In considering environmental aspects of urban development livelihood projects, it lists the risk that 'poor planning, construction and management of urban infrastructure can result in serious adverse direct or indirect environmental impacts including increased risk of environmental hazards (e.g. flooding)' (p. 48). The document goes on to state that 'major infrastructure projects require a more detailed environmental analysis or environmental impact assessment' (p. 48).
- In considering environmental aspects of forestry projects, it lists the opportunity 'to tackle global environmental problems such as climate change and biodiversity loss' (p. 45).
- In considering environmental aspects of health projects, it lists the opportunity that engagement with health ministries provides 'to consider more cost effective construction technology … include[ing] improving resilience of buildings to environmental hazards' (p. 34).
- In considering environmental aspects of infrastructure projects, it lists the opportunity to include environmentally beneficial improvements such as the design of infrastructure to incorporate mitigation measures to withstand natural hazards such as cyclones, earthquakes and floods (p. 46).
- In considering environmental aspects of education projects, it lists the risk that 'school location and construction may be chosen without due consideration of issues associated with the everyday running of the school such as water supply, energy requirements, ease of access, and local environmental hazards' (p. 36).
- In considering environmental aspects of reform of the financial sector and support to small and medium-sized enterprises, it lists the opportunity to support financial intermediaries 'in management of environmental aspects of their loans through provision of advice on environmental hazard-ranking, health and safety etc.' (p. 32).

Source: DFID 2003

The World Bank's guidelines Operational Directive 4.01 on environment assessment explicitly recommends that environmental assessments should examine whether a project could be affected by natural hazards and, if so, propose specific measures to address those concerns (World Bank 1989). Its Environmental Assessment Source Book lists some specific steps that should be undertaken in assessing natural hazard risk at, variously, the level of country, sector, programme and project environmental review:

> *a. Identify specific natural hazards, including natural hazard characteristics, distribution, intensities, qualities, and historical records to review frequency, and probability of occurrence and regional and local characteristics.*
> *b. Identify the critical sectors in the economy and natural resources that may be impacted by the identified hazards, analyse the constraints and conflicts that may be imposed by the natural hazards on each relevant sector and on natural resources and examine the possible structural and non-structural actions required to mitigate risks.*
> *c. For each sector/area at risk, evaluate its degree of vulnerability including facilities, infrastructure and population exposed and specify mechanisms that would help in reducing the identified vulnerabilities.*
> *d. For each sector/area at risk, examine standards, design criteria and maintenance practices that may foster vulnerability and make appropriate changes to help reduce it.*
> *e. Identify the location of facilities such as hydroelectric plants, oil storage plants, gas storage plants, nuclear facilities or industries that may be exposed to natural hazard risks.*
> *f. For the facilities/industries at risk, identify risk reduction strategies including alternate sites and analyze the cost and effectiveness of the different reduction alternatives.*
> *g. Examine the institutional capabilities for disaster prevention and mitigation at the national/regional/local levels, highlighting inter-institutional coordination mechanisms and the areas that may require strengthening.*
> *h. Analyze the role of the private sector (e.g., NGOs, insurance, banking, developers) both in promoting and in reducing vulnerability in the different sectors/regions under analysis.*
> *i. Identify the specific capabilities of local NGOs in vulnerability reduction activities, particularly concerning community involvement, education and training.*
> *j. Examine the existence and/or need for disaster prevention and mitigation policies and regulations both at the local and national levels.*
> *k. Analyze the development options in terms of their impact on natural hazards.*
>
> *(World Bank 1999: 2.34–2.35)*

The same document further states that:

> *In every case analyzed, the capacity of existing institutions to develop policy on natural hazards and to implement it through regulations (ordinances), economic incentives/disincentives (taxation, credit, subsidies), land use and building codes should be evaluated. Likewise, the institutional capacity to develop and implement education and training programs should be assessed. Appropriate recommendations for institutional strengthening and for training and education programs that facilitate the participation of the concerned agencies and communities in disaster mitigation program should be included in the plan.*
>
> *(World Bank 1999: 2.35)*

Chapter 8 of the Environmental Assessment Source Book also includes explicit sections on environmental review of flood protection projects (World Bank 1999: 8.29–8.34) and on dams and reservoirs, which are sometimes constructed for flood control purposes (ibid.: 8.19–8.23). In addition, in presenting guidelines for environmental assessment of different sectors, the document indicates potential natural hazard-related risks and steps in mitigating impacts at various points in the report. For instance, it recommends that siting of roads in locations where there are potential natural hazards should be avoided (ibid.: 8.56); and that standards of construction in steep areas should be sufficient to avoid slips and landslides (ibid.: 8.55).

In contrast, some other development agency guidelines pay much less attention to natural hazards. The OECD's general guidelines on environmental review (1992), for instance, identify categories of projects where EIA are generally required. This list includes those involving the exploitation of hydrological resources, projects that could have implications for vulnerability to rainfall shortfalls. It also states that 'special consideration should be given to the need for assessments of projects in very fragile environments' (OECD 1992: 8) but does not list highly hazard-prone areas amongst its examples. In discussing types of environmental impact, it lists 'effects on climate and atmosphere' (ibid.: 8) but not effects on vulnerability to natural hazard.

The SIDA guidelines include only one direct reference to natural hazards, in an appendix on framework

terms of reference for environmental assessment where flooding and drought are listed as examples of the basic developmental issue or problem being addressed by the proposed activity (SIDA 1998: 43).[5]

The recently revised 2003 ADB environmental guidelines also include few references to natural hazards and disasters, with the exception of floods. Disasters in general are only mentioned in the context of discussions about emergency or rehabilitation lending facilities as part of a section of the guidelines on ADB lending modalities; in terms of environmental assessment requirements for such loans; and in just one sentence, the need to include a 'contingency response plan for natural or other disasters' as part of the environmental management plan (ADB 2003: 151). Seismology and geology are also listed as items of information that should be gathered in undertaking the baseline survey for both initial environmental examination (applied to projects classified as likely to have minor or limited impacts) and full EIAs. Floods receive relatively more frequent reference, particularly in the context of rapid environmental assessment checklists by sector where they are mentioned with regard to irrigation, hydropower, urban development and sewage treatment.

However, both the ADB and the SIDA checklists cover a number of factors that would indirectly exacerbate the potential impact of natural hazards. Indeed, in discussing environmental risk assessment (ERA), ADB (1997: 5–5) explicitly notes that 'natural disasters are recognized as interacting with anthropogenic hazards (that is, hazards in, or transmitted by, the natural environment that accompany development projects) to sometimes increase the risk from the latter, but natural disasters are not usually the focus of ERA'.

For instance, in looking at agricultural projects, the SIDA checklists suggest that the following questions be posed under the sub-heading of 'land, water and air':

- *[Does the project] have an effect on land areas which are sensitive to drying up or erosion?*
- *[Does it] cause degradation as a result of forestry activities, other mechanical impacts, of overgrazing or movements of livestock, or reduce such degradation?*
- *[Does it] cause an increase or decrease in the availability of surface water or ground water, locally or regionally?*
- *[Does it] lead to greater surface run-off and less infiltration due to forestry activities, or counteract such effects?*
- *[Does it] lead to increased or decreased discharges of fossil carbon dioxide, methane or other greenhouse gases?*
- *[Does it] lead to increased or decreased discharges of ozone-depleting substances?*

(SIDA 1998: 13)

ADB includes a similar list of questions in relation to water-related activities, transport and communications, building, construction, waste disposal and mining, energy and, under education, school buildings and the production of school equipment. A couple of the queries are also raised in relation to humanitarian assistance; and a third question is raised in relation to support for the printing of educational textbooks and the production of teaching aids.

Environmental review of post-disaster response

Various development agency guidelines also include checklists on environmental assessment of disaster relief and humanitarian assistance operations (e.g., ADB, DFID, SIDA), although most waive normal environmental appraisal requirements in such circumstances. A fuller set of guidelines on rapid EIA in disasters was recently produced by Kelly (2003), on behalf of the Benfield Hazard Research Centre and CARE International. These guidelines are 'based on the concept that identifying and incorporating environmental issues into the early stages of a disaster response will make relief activities more effective and lay a foundation for a more comprehensive and speedy rehabilitation and recovery' (Kelly 2003: 4). They focus on assessment of 'the general context of the disaster; disaster related factors which may have an immediate impact on the environment; possible immediate environmental impacts of disaster agents; unmet basic needs of disaster survivors that could lead to adverse impact on the environment; and potential negative environmental consequences of relief operations' (Kelly 2003: v). They are based on qualitative assessment, drawing heavily on perceptions and often incomplete data.

Such guidelines and checklists are obviously important. However, there is a clear distinction between these – i.e., looking at environmental consequences of post-disaster response – and the focus of this chapter – the assessment of natural hazard-related risks from an environmental perspective. Of course there is some overlap to the extent that post-disaster response can have environmental consequences that, in turn, have implications for vulnerability to future hazard events. But they are not the same.

5. The same document also states that 'an EIA shall take into consideration direct or indirect effects on… land, water, air, climate and landscape' (SIDA 1998: 2).

4.3.2 Scope for improvement

Generic 'how to' guidelines produced by CDB (see Box 4.1) provide an extremely valuable resource for use in revising individual agency environmental review guidelines to incorporate natural hazard-related issues and concerns. A few additional points are made below.

Analysis of SEA and CEA

Both SEA and CEA are potentially useful tools in seeking to assess natural hazard-related risks and mainstream disaster reduction. Moreover, both are relatively new tools that are still being developed, implying that there is currently some opportunity to influence their scope and coverage of analysis. This opportunity should be exploited to ensure that disaster issues are adequately covered.

SEA allows an agency to 'consider more *alternative approaches* to an action rather than just *alternative designs'* (Steinemann 2000: 637, her emphasis). There is certainly scope in this regard for reducing vulnerability to natural hazards, as demonstrated, for instance, by a study of 1,804 farm plots in three Central American countries hit by Hurricane Mitch which demonstrated that farms using 'agro-ecological' methods to prevent soil and water run-off from hillsides lost far less topsoil as a consequence of the hurricane, retained more moisture and were much less vulnerable to surface erosion than plots farmed using more conventional methods (World Neighbors 2000).

CEA goes a stage further, considering alternative actions to a problem – for instance, emphasis on different industries or crops to promote productivity – again potentially reducing vulnerability to natural hazards. The World Bank (2003a: 8), for instance, envisages that its CEA 'will focus on providing a broad overview of the state of the environment and on the linkages of environmental issues with economic growth (cost of environmental damage; role of natural resources in the economy) and with poverty'. Disasters, too, can have consequences for long-term growth, causing both short-term economic dislocation and also potentially dampening the pace of long-term sustainable development (see Benson and Clay 2004). The World Bank also indicates that its CEA would explore the environmental implications of macroeconomic and sectoral policies. These, too, can have implications for vulnerability to natural hazards. For instance, in the case of Bangladesh there has been a structural change in the agricultural sector, primarily linked to trade liberalisation, that has facilitated rapid expansion of much lower-risk, dry winter season, irrigated rice and increased private imports during disaster years (Benson and Clay 2002). This change has reduced the economy's overall sensitivity to natural hazards. Conversely, Dominica's loss of guaranteed preferential access to the European market for its banana exports has left the island's agricultural sector more vulnerable to natural hazards as farmers have diversified out of banana production (Benson and Clay 2001). This sort of analysis can be used to enhance understanding of the implications of particular policies and programmes for long-term socio-economic vulnerability to hazards for a country as a whole, perhaps influencing the direction of development to balance potential risks against socio-economic benefits.

CEA can also play a potentially valuable role in reducing efforts required at the project level to collate and analyse information on natural hazards. In fact, this avoids potential duplication of effort and could also help ensure that related risks are, indeed, considered at the level of individual projects, rather than left out due to time and cost constraints (see below).[6]

Both SEA and CEA can also explore the cumulative consequences of a series of disaster events and also of a series of development initiatives. Again, such analysis can be valuable in understanding vulnerability to natural hazards, indicating longer-term trends that may offer important insights into mitigating losses. It also plays an important role in understanding the impact of a particular project as one of a series of like initiatives. As CDB (2004: 29) notes, 'the impact of the impact of any single development or natural hazard event may be considered insignificant when assessed in isolation, but may be significant when evaluated in the context of the combined effect of all reasonably foreseeable future development or natural hazard events that may impact on the project/activity in question'.

However, there is a danger that SEAs and CEAs will only highlight environmental aspects of natural hazard-related risk. It is important that a wider perspective is not lost and they are not viewed solely in terms of the identification of the level and nature of risk from an environmental perspective.

In addition, some sectors do not require an SEA, depending on the types of environmental impact a particular sector can have, the ecological state of a country and so forth. There is a case for arguing that exemptions should be reconsidered in highly disaster-prone areas.

6. The World Bank (2004) similarly suggests that some form of overarching country social analysis should take place (though not necessarily within the CEA), covering regional and sectoral issues and compiling information on topics such as inventories of cultural heritage, culturally relevant good practice, analysis of potential conflicts and institutional analysis. This, too, the World Bank states, would provide teams with necessary information and ensure that efforts to acquire such information are not duplicated across projects.

Consultation

Consultation with stakeholders should be used as an opportunity to gather information on natural hazards and on various groups' perceptions of risk, which in turn influence behaviour. Vulnerability even from a purely environmental perspective can often be highly localised and it is, therefore, important to seek the views of the local community. There may also have been significant recent shifts in vulnerability, a process that may be even be ongoing, as in the case of the Philippines cited above (Heijmans 2001). Such shifts could imply that risks are greater than historical records would indicate.

Classification of projects

Classification of projects according to the type of EIA required should be amended to indicate that a fuller EIA is required in areas of high risk to natural hazard, as stated in the CDB sourcebook (CDB 2004). Where agencies classify projects purely on a sectoral basis, these classifications may need to be revisited to check that they are appropriate in more hazard-prone countries, in particular bearing in mind that natural hazard events can have an impact on the project even if the project itself has little environmental impact.

4.4 Constraints

4.4.1 Hazard information

Environmental review, whether at the project, sectoral or country level, involves the collation of information on environmental conditions such as physical, ecological, economic, social and cultural resources. As such, it would seem the logical point to collate data on natural hazards, including probabilities of occurrence. CEA, in particular, should include collation of some basic hazard data at the national level. Indeed, some environmental reviews, whether at project, sectoral or programme level, should already do this according to some donor guidelines. UNDP environmental guidelines, for instance, indicate that country environmental reviews should include baseline data on rainfall, climate, temperatures, existence of seismic faults, cyclones and droughts. They should also identify the five most important environmental issues, considering topics such as natural hazards (UNDP n.d.).

However, this assumes that the relevant information exists. In reality, the quality and extent of information varies enormously across countries. Even where it does exist, it may be disparate, held by a range of different agencies. The World Bank, for instance, comments that:

> *Most of the information in disaster-prone countries that could be used for natural hazard impact reduction or for post disaster planning and management has not been collected specifically for that purpose. Thus, adaptation will be necessary for using such information from disparate sources in risk reduction.*
>
> *(World Bank 1999: 2.35)*

Environmental guidelines need to be extended to indicate the types of hazard information that could exist, where they might be held and particular factors to be aware of in assessing the quality of information (see Chapter 6). Careful attention also needs to be drawn to the fact that there can be highly localised variations in vulnerability to natural hazards, reflecting local environmental as well as socio-economic conditions. Thus, some information on site-specific circumstances is also required.

4.4.2 Timing

The environmental review process should begin at a very early stage of project design to ensure that it has the opportunity to influence project design, including incorporation of any disaster mitigation features. In practice, this does not always occur. The ADB reports that:

> *The biggest single constraint on the effectiveness of EIA is the timing of the assessment in the development project cycle. In spite of attempts to ensure that EIA information reaches decision makers early in the development planning cycle, many EIAs occur only after major decisions (for example, site selection and investment) have been made. As a result, any EIA findings that may result in delays, major project modification, or outright cancellation are difficult to accept.*
>
> *(ADB 1997: 13.1)*

4.4.3 Monitoring and enforcement

Strong, effective monitoring arrangements are important in ensuring that any required environmental management and mitigation measures specified in an EIA are implemented and that a project is neither highly vulnerable to natural hazards nor contributes to increased vulnerability in the project area. In higher-risk areas, environmental monitoring of projects should also keep track of any changes in vulnerability to hazards, allowing early identification of unexpected impacts and appropriate mitigation measures. In practice, however, monitoring and enforcement arrangements may sometimes be far from adequate. The ADB (1997: 13.7), for instance, writes that 'current

problems with the use of EIA for environmental planning have little to do with shortcomings in the planning approach and more to do with the reliance on monitoring and enforcement by governments to see that recommended mitigation/management measures are effectively implemented'.

4.4.4 Costs

Costs of undertaking an environmental review are, of course, relevant in considering their extension to include more comprehensive coverage of hazard-related issues. If hazard vulnerability is a secondary impact and time and resources available for an EIA are limited, it may be decided to exclude vulnerability analysis from the EIA. There is little hard, quantified evidence on returns to expenditure on such analysis, effectively implying little perceived value in undertaking it.

This reasoning would suggest that there is a strong case for collating data on beneficial impacts in terms of reduced vulnerability to natural hazards that could follow from more in-depth coverage in EIAs.

Increased undertaking of CEAs also offers an important development in this regard, potentially reducing time required for collation of information on natural hazards and its analysis in preparing individual projects. Hopefully, this, too, will increase the likelihood that risks emanating from natural hazards and opportunities for their mitigation are taken into account in the design of projects. CEAs could be undertaken jointly by donors, in the way that other types of analysis, such as public expenditure reviews, currently are, reducing costs even further.

4.5 Conclusion

The ADB writes that:

> *There is every reason to believe that the results of the EIA process will have increasing influence over development decision making. National governments and international assistance agencies (IAAs) are increasingly recognizing the environmental costs associated with failure to account for the environmental impacts of projects. EIA processes have been criticized for lack of effectiveness by many quarters. In most cases, the response has been to strengthen the legal, regulatory, and institutional capability of EIA agencies.*
>
> *(ADB 1997: 13.6)*

This opportunity to ensure that issues relating to natural hazards are also adequately covered, by making certain that they are considered as an integral part of the environmental review process, should be seized. The increasing application of SEA and CEA similarly offers potentially significant openings for mainstreaming natural hazard as well as environmental concerns more generally.

Many project-level environmental reviews already go some way in assessing the impact of projects on vulnerability to natural hazards, exploring potential consequences of a project for, for instance, natural resource depletion and soil erosion. Changing vulnerability can be an indirect consequence of such changes. Particular types of hazard – most notably, flooding – also receive some more direct coverage. However, most donor guidelines need to be adapted to include more explicit consideration of the impact that a project could have on vulnerability to natural hazards, particularly in highly hazard-prone areas. In such areas a change in vulnerability could have considerable consequences, not least leading to further environmental degradation via the destruction of natural resources as a consequence of an ensuing disaster. Greater attention is also required to the potential impact natural hazards can have on projects, at the very least extending development of safety cases, integrating safety concerns at stages of design, construction and operation, to all projects in high-risk areas.[7]

At the same time, it should be borne in mind that environmental review should not be the only stage at which natural hazards and related vulnerability are assessed. A number of those working to mainstream disaster management (e.g., OAS) view environmental review as the appropriate place in the project appraisal process to examine such issues. But certain aspects of vulnerability – for instance, economic, social or technical – may be better dealt with elsewhere.

7. Development of safety cases is already required in, for instance, the EU for major industrial facilities.

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Chapter 5

Vulnerability and social analysis

In recent times, previously separate discourses on disasters and development have begun to converge around the linked themes of vulnerability, social protection and livelihoods. This academic and policy-level trend has been accompanied at operational level by the development of a variety of methods for analysing situations and assessing the likely impact of project interventions. These include vulnerability analysis, social analysis, sustainable livelihoods approaches, social impact assessment and health impact assessment. There are many areas of overlap between the approaches, and within each of them a wide variety of specific tools can be used to collect and analyse data. The range of applications, in terms of scale, context and focus, is also varied, as is the range of users.

5.1 Vulnerability analysis

5.1.1 Introduction

Extensive research over the past 30 years has shown that, in general, it is the weaker groups in society that suffer worst from disasters: the poor (especially), the very young and the very old, women, the disabled and those who are marginalised by race or caste. Those who are already at an economic or social disadvantage tend to be more likely to suffer during disasters. This question of society's resilience and vulnerability is very important for understanding the impact of disasters, and making choices about how to intervene. The growth in interest in socio-economic vulnerability to disasters since the 1970s has generated a considerable amount of research and theory (Wisner et al. 2003).

Attempts to develop operational methods for identifying and analysing the different facets of human vulnerability and resilience or capacity began rather later. The key launch point was the capacities and vulnerabilities analysis (CVA) method, devised in the late 1980s as a practical and diagnostic tool for NGOs to use in planning and evaluating projects (Anderson and Woodrow 1998), from which many subsequent methods have been derived. Today, a wide range of vulnerability analysis or assessment (VA) methods are in use, by many different institutions and in a variety of disaster and development contexts, but particularly by NGOs in developing countries (Cannon et al. 2003: 50–63).

5.1.2 Scope of vulnerability analysis

VA considers the range of environmental, economic, social, cultural, institutional, political and even psychological factors that shape people's lives. Some aspects are readily apparent; for example, enhanced hazard risk caused by environmental degradation or occupation of flimsy housing in dangerous locations such as floodplains and unstable hillsides. Less immediately visible are underlying factors such as poverty, population growth, displacement due to economic development, migration to towns and cities, legal/political issues such as lack of land rights, discrimination, governments' macroeconomic and other policies, and the failure of governments and civil society institutions to protect citizens. The chain of causality, from root causes to local dangers, can be both long and complex (Wisner et al. 2003).

VA provides a framework for viewing vulnerability holistically. For example, the CVA method begins with a simple matrix for viewing people's vulnerabilities and capacities in three broad, interrelated areas: physical/material, social/organisational and motivational/attitudinal (see Figure 5.1).

Figure 5.1 Capacities and vulnerabilities analysis

	Vulner-abilities	Capacities
Physical/material What productive resources, skills and hazards exist?		
Social/ organisational What are the relations and organisation among people?		
Motivational/ attitudinal How does the community view its ability to create change?		

Source: Anderson and Woodrow 1998: 12

Each of the three areas covers a wide range of features:

- *Physical/material vulnerability and capacity.* The most visible area of vulnerability is physical/material. It includes land, climate, environment, health, skills and labour, infrastructure, housing, finance and technologies. Poor people suffer from crises more often than people who are richer because they have little or no savings, few income or production options, and limited resources. They are more vulnerable and recover more slowly. To understand physical/material vulnerabilities, one has to ask what made the people affected by disaster physically vulnerable: was it their economic activities (e.g., farmers cannot plant because of floods), geographic location (e.g., homes built in cyclone-prone areas) or poverty/lack of resources?
- *Social/organisational vulnerability and capacity.* How society is organised, its internal conflicts and how it manages them are just as important as the physical/material dimension of vulnerability, but less visible and less well understood. This aspect includes formal political structures and the informal systems through which people get things done. Poor societies that are well organised and cohesive can withstand or recover from disasters better than those where there is little or no organisation and communities are divided (e.g., by race, religion, class or caste). To explore this aspect, one has to ask what the social structure was before the disaster and how well it served the people when disaster struck; one can also ask what impact disasters have on social organisation.
- *Motivational/attitudinal vulnerability and capacity.* This area includes how people in society view themselves and their ability to affect their environment. Groups that share strong ideologies or belief systems, or have experience of cooperating successfully, may be better able to help each other at times of disaster than groups without such shared beliefs or those who feel fatalistic or dependent. Crises can stimulate communities to make extraordinary efforts. Questions to be asked here include what people's beliefs and motivations are, and how disasters affect them.

Other factors can be added to the matrix to make it reflect complex reality. These are: disaggregation by gender; disaggregation by other differences (e.g., economic status); changes over time; interaction between the categories; and different scales or levels of application (e.g., village or national levels) (Anderson and Woodrow 1998: 9–25).

Many subsequent VA frameworks have adopted similar approaches: for instance, the Disaster Mitigation Institute's victim security matrix – like CVA, an operational tool to support decision-making at field level – also links physical and material aspects of vulnerability with organisational and other factors. The matrix focuses on four key elements of vulnerability/security: food, water, habitat and work (Bhatt 1996). A number of VA methods build explicitly on the CVA framework: for example, the IFRC's vulnerability and capacity assessment (VCA) method (IFRC n.d.), which has been used in many countries, and the adaptation of CVA in the Philippines by the Citizens' Disaster Response Centre/Network (CDRC/N) as part of its Citizenry-Based and Development-Oriented Disaster Response (CBDO-DR) model (Heijmans and Victoria 2001).

5.1.3 Application and methods

VA can be carried out at different levels. Usually, it takes place locally. National-level analyses have sometimes been produced, for example by the Palestine Red Crescent, Gambia Red Cross and World Bank (Palestine Red Crescent Society 2000; Gambia Red Cross Society 1998; Tesliuc and Lindert 2002; Poupart et al. 2003). Which approach to take depends on the user and application, but the best ones, such as IFRC's VCA, supply a 'toolkit' of methods from which to choose (IFRC n.d.).

Data collection

VAs often draw upon existing sources of information that are publicly available (e.g., general social and economic surveys by governments and other agencies, including disaster data). Other commonly used data sources are drought and food security early warning systems, situation reports by operational agencies, the news media, analyses commissioned or carried out by international and bilateral donors, anthropological studies and case studies of recent disaster events (IFRC n.d.: 15–17).

At project level, agencies use such secondary sources for context or to cross-check information generated in the field, but base their understanding on local-level data, especially that generated by communities. Community-based approaches have more limited geographical and numerical coverage. Because the methods used and data collected will vary according to time and place, the results are not standardised and it can be difficult to compare findings. However, these drawbacks are outweighed by the advantages: the approach supplies far more detail and provides much better insights into the multiple pressures that communities face and the causal links between them, local needs and priorities, people's understanding of their own vulnerability, indigenous methods for dealing with risks and community capacity (actual and potential).

Most local-level VA will therefore be based on participatory techniques and tools, largely derived from participatory rural appraisal (PRA) and rapid rural appraisal (RRA) work, and include transect walks, mapping and modelling (physical and socio-economic), wealth and well-being ranking and other forms of social grouping, stories and oral histories, semi-structured interviews and focus groups, daily time charts and seasonal calendars, long-term timelines showing trends and change, problem trees and flow charts, direct observation, and Venn diagrams of institutional linkages (Heijmans and Victoria 2001: 25–44; IFRC n.d.: 19–42). Most VA practitioners regard participation as essential (e.g., Anderson and Woodrow 1998; Heijmans and Victoria 2001). Vulnerable people are usually well aware of the range of risks they face (e.g., Narayan et al. 1999) and, if given the opportunity, can communicate this knowledge effectively to outsiders (e.g., Bhatt 1998).

The designers of the CVA method argued from the outset against overemphasis on data collection. Experience suggests that VA tends to generate more information than is needed and identifies more issues than local agencies can address. Although some agencies are afraid of inadequate information, overdone data collection can be expensive, wasteful, ineffective and anti-developmental. The task of processing extensive information can put pressure on large and small organisations alike. This shows the importance of setting clear and realistic targets for a VA exercise. Agencies often fail to use information gathered, which is a waste of effort and expense. Information gathering sometimes becomes an end in itself, while the purpose – to promote effective programming – is forgotten (Anderson and Woodrow 1998: 44–8).

It was acknowledged when the CVA method was designed that it is difficult to know how much information is needed at each stage of project design and implementation – and for whom (e.g., headquarters and field staff have different information needs) (Anderson and Woodrow 1998: 44–8). On the other hand, the CDRC/N, which is a long-term practitioner of community-based VA, sees overlap of information as a way of cross-checking information. For CDRC/N, CVA in application is clearly a longer-term process. Understanding community-level situations starts with getting a general picture, followed by more detailed and focused analysis. Its guidelines are specific about the sequence in which data-gathering methods should be used. But CVA is only one of the approaches CDRC/N uses to build up community profiles through a series of 'snapshots of the community at particular moments' (Heijmans and Victoria 2001: 43). From a community perspective, the different approaches are integrated because people at risk make less distinction between the different phases of disaster management, and the findings of all the analyses are integrated into the counter-disaster plan.

Some project managers have suggested that a picture of vulnerability could usefully be built up gradually through a series of smaller assessment exercises, rather than a single intensive, complex VA (IFRC 2002). This would also enable an operational agency to fit its work around community activities, thereby causing minimal disruption. CARE has developed a rapid VA method for work in Central America (CARE 2003: IVb), the IFRC is considering how to develop similar methods, and other agencies may well be doing so.

Data analysis

Data analysis usually presents more problems than data collection. Vulnerability is highly complex and not easily captured: it is even possible to argue that it is too complicated to be captured by formal models and frameworks (Twigg 1998: 6–7). The IFRC's VCA method recognises the difficulty of assessing 'layers and layers of causes that build up the level of risk' (IFRC n.d.: 55).

VA is not intended to be prescriptive where methods for data collection are concerned. This flexibility can be seen as both a strength and a weakness. Its strength is in allowing different organisations to use it in a variety of contexts according to their needs and capacities. Its weakness is that the diversity of data sources and data sets makes comparison between projects very difficult and hence limits the potential for drawing more general lessons. Data sets contain a variety of evidence and indicators that are not easily triangulated, collated or analysed. Methodological guidelines have little to say on the subject of analysis (Cannon et al. 2003), although the IFRC has identified this as an issue requiring further work (IFRC 2002; Betts-Symonds 2003b).

VA frameworks are structured in such a way that it is easy to remember what sort of data to collect. They are comprehensive and cover the important variables. They allow equal consideration to different aspects of capacity and vulnerability. This approach is clearly advantageous in terms of ensuring that all relevant data are collected. Analysis of vulnerabilities and capacities, however, requires some kind of weighting to be given to these different factors. VA as generally practised experiences difficulty in weighing the many different aspects of vulnerability against one another, as they are not all equal in their nature or consequences. There are signs that this causes problems for many staff that have used VA, who find they need additional training and guidance.

Problems have arisen specifically over indicators of vulnerability. Here too, selection and weighting are

usually left to participants in the VA process. This makes sense as part of an open-minded, participatory approach but experience in the Philippines suggests that the lack of more detailed guidance on appropriate indicators can cause problems for field staff. Reviewing CDRC/N's experience, Heijmans and Victoria observe that 'The CVA matrix is useful as a guideline for data gathering, because it reminds you of the different aspects to look into. However, when you collect the data according to the three categories, the result is often more descriptive than analytical' (Heijmans and Victoria 2001: 42). There is clearly a risk that the projects that ensue from the CVA will draw on evidence that is over-subjective and too broad-based.

5.1.4 Value of VA in assessing hazard risk

For all their variety, VA approaches have much in common. In particular, they are holistic views that link disasters and development processes, and are flexible so that they can be adapted to circumstances, permitting the investigation and analysis of hazard risk within the wider vulnerability context.

Whichever VA approach is adopted, care must be taken to ensure that the significance of hazards and their impact is fully considered. This does not mean that there should be special emphasis on hazard risks, only that their relative importance within the vulnerability context should be properly assessed and kept in mind. Overemphasis on the purely socio-economic aspects of vulnerability can cause more directly hazard-related risk to be overlooked. This is due partly to the varied conceptual explanations of vulnerability, but perhaps especially to a blurring of the distinction between what can be seen as its two main components (IFRC n.d.: 5):

- Its external dimension – the risks, shocks and stresses to which a structure, individual, household, community or nation is subject.
- Its internal side – the lack of resources to cope.

In theory, this should not be a problem, since most VA frameworks explicitly cover natural and other hazards. For instance, the CVA method has physical and material vulnerability as one of the three main dimensions of vulnerability (see Figure 5.1 above).

The IFRC's guidance on its VCA method highlights the need to identify potential threats, including those related to natural hazards or resources; it also argues for separation of the different kinds and causes of vulnerability (IFRC n.d.: 44–6, 55–9). A recent review of 22 VCAs carried out by Red Cross Red Crescent societies provided instances of VCAs having led to identification of the range of significant hazards (at national level) and to increased hazard awareness (at community level) (Betts-Symonds 2003a). Recent Australian guidelines for assessing vulnerability and resilience set out a series of factors to be considered in assessing the potential severity of a hazard agent (predictability, speed of onset, destructiveness, duration, frequency, area or extent affected, number of people affected, need for assistance) and its impact (Buckle et al. 2001: 32–5). Box 5.1 is a recent example of a VA method that integrates hazard/natural resource issues within a broader understanding of vulnerability.

Box 5.1 VA and drought-proofing

The Kachhh Ecology Fund (KEF) was set up in 2001 to support long-term drought mitigation in rural districts of Gujarat, India. In collaboration with other agencies, KEF has developed a VA method – known as the drought-proofing planning (DPP) framework – for use at village level. The framework has three main components:

- Household VA studies. This also includes consideration of drought conditions and their impact on livelihood strategies, in order to identify threshold income levels that would enable households to cope with the prevailing drought conditions; and assessment of levels of dependency on the natural resource base.
- Natural resource mapping.
- Preparing drought-proofing action plans and training for implementing agencies.

The DPP was tested in four villages before being rolled out for wider use. Methods used for collecting data include consultations with villagers, household surveys, formal mapping (satellite images, field visits and studies), cost-benefit analysis and a range of PRA exercises (mapping of natural and household resources, seasonality diagrams, timelines, transect walks and wealth ranking).

Regarding hazards/natural resources, the method collects a variety of data. It includes: data on rainfall variations (from government irrigation department daily/hourly rainfall data sets); discussions with villagers relating rainfall variations to agricultural activities (timing, productivity); information on geology and soils, water resources, run-off and recharge, and biodiversity (collected through formal studies and mapping); data on natural and household resources (obtained through surveys and PRA); and evidence of the occurrence and impact of seasonal and longer-term trends or events (principally through PRA).

Source: Kachhh Ecology Fund n.d.

Specific hazard-focused VA techniques can also be developed. The CDRC/N has developed its own separate hazards, vulnerabilities and capacities assessment (HCVA) method, undertaken as an initial stage in counter-disaster planning. This is largely based on the agency's standard CVA approach but includes a more detailed analysis of hazards and their likely impact; it also tends to be carried out more rapidly than CVA (Heijmans and Victoria 2001: 27–34). Community mapping, which is a prominent component of participatory VA work, can generate detailed evidence of hazard threats at local level (see Box 5.2).

Moreover, by capturing vulnerable people's perceptions of risk and the priority accorded to it in their daily lives, VA often presents a different picture from that obtained by conventional hazard mapping and from operational agencies' perceptions (Heijmans 2001). For example the interviewees and focus groups consulted during the nationwide VCA carried out by the Palestine Red Crescent Society (PRCS) in 1999–2000 identified lack of water as their greatest priority in terms of hazards, with political events second. Road accidents, open sewers, pollution, fires, earthquakes and health came lower down the list. The significance given to water shortage surprised PRCS staff, who had expected political problems to be the dominant concern (Palestine Red Crescent Society 2000).

Older VA guidelines and some of those produced for developed countries may give greater prominence to external hazard risks and physical vulnerability compared to socio-economic vulnerability (e.g., Coburn et al. 1991; Directorate for Civil Defence and Emergency Planning, Norway 1995),[1] whereas internal vulnerability may feature more prominently in guidelines that are more strongly rooted in developing country experiences and livelihoods issues (e.g., Heijmans and Victoria 2001; Anderson and Woodrow 1998; IFRC n.d.). However, it is not clear how well hazard risks are covered and assessed by VA in practice overall. An extensive study would be required to establish this.

Although there is plenty of methodological guidance available, little VA experience has been written up. The limited evidence available to date gives some indications of the kinds of problems that might arise. For instance, it has been suggested that the CDRC/N's application of CVA and even HVCA does not necessarily relate capacities and vulnerabilities well to the many different kinds of hazard facing Filipino communities. With staff not often having sufficient expertise in hazards and risk to fill this gap, there is the possibility that some hazards' significance will be underestimated (Cannon et al. 2003: 15–16). Bellers (2000) found that the detail and accuracy of risk measurement provided by CVA and the other assessment methods used by CDRC/N was sparse: it was only when subsequent sectional plans were developed that more details on levels of comparative risk and need were articulated. In the IFRC, it is appreciated that natural hazards can be overlooked in participatory VCAs, because vulnerable communities

Box 5.2 Participatory mapping in VA

A study of disaster issues and coping strategies in a village in the Philippines tried to create a forum that would allow the most vulnerable residents of the village – typically the poor and least articulate – to explain their own situation and express their opinions. One of the methods used by the researchers was three-dimensional mapping. A map was made on a sheet of 8x4ft (2.5x1.2m) plywood (plywood is a popular building material, so it was easy to find a sheet). The village street plan was drawn first; then the surrounding hills that form the local watershed were modelled in dough (made from flour and water). The river and seasonal streams were marked and every house in the village was plotted on the map.

The map became the key reference point for all the other participatory work with the community, carried out over five days. More details were added day by day, until every household's physical, economic and social situation was mapped. The process gave rise to many arguments – for example, over whether a particular house was sufficiently well maintained to withstand the next typhoon, or whether people living near the river had somewhere dry to store their harvest.

The mapping led into workshop sessions that described how the situation had changed in recent years, and to explore 'what-if' scenarios. It seemed to give many people the chance to express concerns about their own vulnerability and it spelt out in a matter-of-fact, non-confrontational way the hidden structures of power and patronage (e.g., between landlords and tenants, landowners and wage labourers, and those in debt and those earning interest from others). Community members observed that the information was familiar to them, but the map had given them an overview that would be invaluable for preparing a disaster plan.

Source: Hall 1997

1. Yet VA is evolving rapidly and more recent models for developed countries place much more emphasis on socio-economic issues (e.g., Kuban and MacKenzie-Carey 2001; Buckle et al. 2001).

are more likely to focus on everyday problems. VCA task groups therefore need to be vigilant to ensure the exercise provides a balanced view of the sources of vulnerability, through primary and secondary data collection.

The problem can also be mitigated where VAs focus on particular hazards or locations. The Uganda Red Cross carried out a VCA in a single parish that identified and ranked several local hazards. Bubonic plague was ranked first in importance, followed by malaria and measles, because outside assistance was required to deal with these, whereas locally managed solutions could be found for other problems such as floods, pests and malnutrition. The plague problem was placed within a broader vulnerability context that identified causal factors, and the community identified a range of strategies and resources for reducing the threat from plague vectors: rats and fleas (Uganda Red Cross Society 2001).

Newer developments of VA may show greater awareness of the challenge of giving appropriate weight to external shocks such as hazards. Guidelines for programming in conditions of chronic vulnerability recently developed for CARE in East Africa place extra emphasis on identifying specific indicators for tracking the onset and impact of shocks. The approach used is essentially an adaptation of the organisation's standard household livelihood security (HLS) assessment method: not a new method per se but an attempt explicitly to ensure that all aspects are covered by linking existing programming methods and tools (CARE/TANGO 2003).

5.2 Sustainable livelihoods approaches

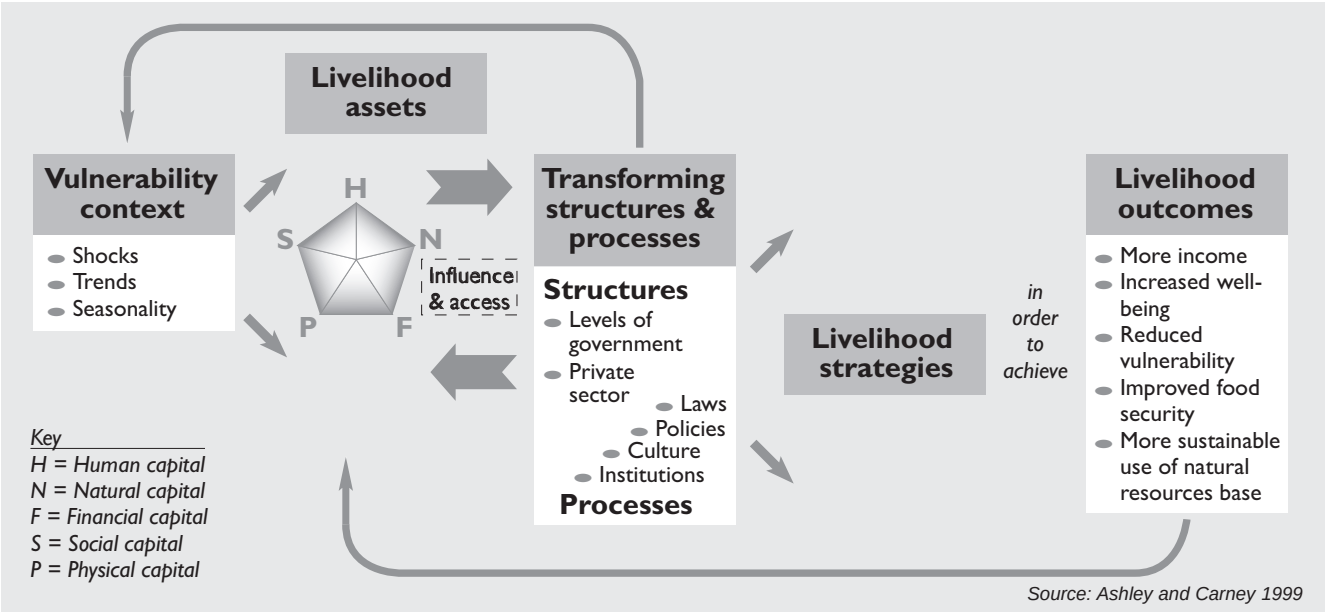
5.2.1 Outline and relevance

A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (DFID 1999–2003).

Sustainable livelihoods (SL) approaches have evolved out of shifts in thinking on poverty, sustainable development, participation and vulnerability since the early 1980s. By the late 1990s, these ideas had consolidated into a number of basically similar methods, used by a variety of institutions, underpinned by an 'asset-vulnerability approach' to understanding poverty (Brocklesby and Fisher 2003). SL approaches share some features with vulnerability and capacities analysis (Twigg 2001; Cannon et al. 2003) but are widely regarded as a distinct methodology.

In one of its best-known formulations, the SL framework starts with the vulnerability context in which people live their lives and the diverse *livelihood assets* (human, natural, financial, social and physical capital) that they possess. It then looks at how *transforming structures and processes* generate *livelihood strategies* that lead to *livelihood outcomes* (see Figure 5.2).

Figure 5.2 Sustainable livelihoods framework



Source: Ashley and Carney 1999

A central feature of an SL approach is that it views people as living and working within a context of vulnerability, which has a direct impact upon their assets and the livelihood options that are open to them. The framework in Figure 5.2 presents three main categories of vulnerability: trends, shocks and seasonality (DFID 1999–2003: 2.2).

Trends are long term and usually large scale. They include population trends, resource trends (including conflict over resources), economic trends (national and international), trends in governance and politics, and technological trends. They have a particularly important influence on rates of return from chosen livelihood strategies.

Shocks include human health shocks (e.g., epidemics), natural shocks (e.g., natural hazard-induced disasters), economic shocks (e.g., rapid changes in exchange rates), conflict and crop/livestock health shocks. They can destroy assets directly (e.g., in the case of floods or storms). They can also force people to dispose of assets as part of coping strategies. Resilience to external shocks and stresses is an important factor in livelihood sustainability.

Seasonality is expressed through seasonal shifts in prices, production, food availability, employment opportunities and health. These are one of the greatest and most enduring sources of hardship for poor people.

Understanding the vulnerability context is seen as a key step in SL analysis. Although the context often lies outside people's control, it can be managed by supporting poor people to build up their assets and thereby become more resilient (DFID 1999–2003: 2.2). This emphasis on vulnerability – from a developmental standpoint – has drawn disaster researchers and practitioners to SL as a potential model for integrating risk into development programming (Twigg 2001; Cannon et al. 2003).

Two core factors should be taken into account in considering the vulnerability context: the extent to which different groups are exposed to particular trends, shocks and seasonality; and the sensitivity of their livelihoods (i.e., their resilience) to these factors (DFID 1999–2003: 4.8). A variety of participatory and other techniques can be deployed to explore this, including transect walks and mapping (identifying physical and environmental features including hazards), environmental checklists (revealing the relationship between the poor and their environment), timelines (historical occurrence of hazards), seasonal calendars (rainfall, crop planting schedules, food levels), preference ranking (relative importance of the vulnerability context to different groups), secondary data collection (rainfall and temperature trends, morbidity and mortality), and other PRA techniques such as interviews, problem trees and workshops to identify differential vulnerability and adaptive behaviour (DFID 1999–2003: 4.3, 4.8; Drinkwater and Rusinow 1999: 11; CARE 2000: module 5; TANGO 2002; Brocklesby and ActionAid Bangladesh 2002; Alam et al. 2002a, 2002b).

5.2.2 Application of SL to hazards-induced vulnerability

SL thinking 'is essentially an integrating device, helping to form and bring together the perspectives which contribute to a people-centred SL approach' (Farrington et al. 1999). It has been applied in a variety of ways in project planning and review, and for research, often as a framework for structuring or rethinking perspectives and analysis. Many lessons have been learnt about application, and practical guidance is available on the general approach and specific methods (Ashley and Carney 1999; Carney et al. 1999; Pasteur 2001a, 2001b; DFID 1999–2003; Turton 2001; CARE/TANGO 2003; Frankenberger et al. 1999; Brocklesby and ActionAid Bangladesh 2002; Alam et al. 2002a, 2002b).

In principle, SL approaches and methods address the different risks within the vulnerability context, but SL thinking is emphatically holistic and the context is so multidimensional, involving physical, social and political elements (Nicol 2000: 15–16), that in practice comprehensive analysis is difficult, with a potentially very wide range of issues to be investigated (e.g., DFID 1999–2003: 2.2, 4.8; Ashley and Hussain 2000: 22–3). There is a risk that natural hazards' importance may be downplayed by such an approach, especially in the case of hazards that occur relatively infrequently. Some agencies have found that the breadth of the SL vision limits understanding of the links between environmental change and poverty (Carney et al. 1999: 11–13). Approaches that focus on the household level, such as CARE's HLS model, (Drinkwater and Rusinow 1999; Carney et al. 1999: 4–7) may be more sensitive to local hazard risks (the HLS approach also places more emphasis on identification of risk factors: TANGO 2000; cf. Cannon et al. 2003: 39–49).[2]

A further indication that natural hazards' significance may be undervalued is the assumption that, in the short to medium term and on an individual or small group basis, little can be done to alter the vulnerability

2. CARE's approach is also said to be distinctive in the way it treats the physical and natural environment, distinguishing between the resource base over which households have control and that regulated through membership in the larger community, i.e., common property assets (Drinkwater and Rusinow 1999: 3).

context directly. This is true in the sense that some hazards cannot be prevented, and the approach rightly emphasises the need to build people's resilience to shocks, but it could lead researchers and implementing agencies to undervalue the potentially beneficial impact of local- and higher-level disaster mitigation measures. SL analysis recognises that hazards can damage natural capital, but seems to place less emphasis on the magnification and creation of hazards by inappropriate resource use.

Applications of SL to project planning tend to use people's existing assets and strategies as the starting point (Pasteur 2001a: 4) – i.e., they put more emphasis on the experience and management of vulnerability than the external forces that contribute to it – which reflects the people-centredness of SL approaches. Similarly, discussion about assessment of the impact of SL approaches focuses on livelihood assets, processes and outcomes (Macqueen 2001; Pasteur 2001b; Ashley and Hussain 2000; Drinkwater and Rusinow 1999: 12–14; see also Hoon et al. 1997, Wanmali 1997, Farrington et al. 1999).

Despite these methodological problems, there is experience to show the value of SL approaches in risk reduction, particularly in food and water security, where it has led to projects broadening their focus from technical issues of natural resources, productivity or health to wider livelihood security assets and strategies. Community resilience and project sustainability are improved by placing the technical and environmental aspects within this wider context (DFID 1999–2003: 7.1; Pasteur 2001a; Turton 2000a, 2000b; Nicol 2000: 16–18; Carney et al. 1999: 5).

Recently, some agencies have begun adapting SL approaches to bring hazards back into focus. As already noted (Section 5.1.4), CARE East Africa has developed guidelines for livelihood support in conditions of 'chronic vulnerability',[3] building on the agency's HLS method and linking it to risk management thinking. This highlights the distinctions between the symptoms and causes of vulnerability; its analysis also distinguishes risk factors from the socio-political context. It puts greater emphasis on the need to identify, understand and mitigate the different causal factors, and on understanding the interaction between particular hazards and different dimensions of vulnerability. Mostly using standard PRA-type tools, livelihood assessments are carried out to understand household vulnerability, complemented by baseline vulnerability assessments that enhance understanding of the nature of risks and emergencies and community/households' capacity to cope (CARE/TANGO 2003).

ActionAid Bangladesh's diversity and livelihoods assessment approach is being piloted 'as a tool for including local people's views in the analysis of risk, vulnerability and allied livelihood strategies, and in the formulation of interventions to enhance the quality, diversity and sustainability of those strategies'. Conceptually, it is based on a social risk management framework, which classifies risk into different categories (including natural and environmental but also social, political, economic, lifecycle, health, etc.) and analyses different forms of risk management strategy. In this way it relates the management of risk and vulnerability to livelihood assets and strategies, social networks, rights and entitlements, and livelihood diversification (Brocklesby and ActionAid Bangladesh 2002; Alam et al. 2002a, 2002b).

The SL framework is very broad, but it does allow the many different factors of livelihood resilience to be put in context and balanced against each other. Many of its components are not new but the framework itself is innovative. Placing vulnerability and external shocks at the heart of livelihoods analysis is a big step forward from traditional development thinking. The CARE East Africa and ActionAid Bangladesh approaches reorientate SL analysis to give greater prominence to risk and demonstrate its potential for setting risk reduction and hazard vulnerability in the wider vulnerability and livelihoods context.

5.3 Social analysis

5.3.1 Introduction

Social analysis was adopted as an integral part of project appraisal in the World Bank in 1984 (World Bank 2002: 86–91). It is now generally regarded as a key element in designing development projects (e.g., EuropeAid 2001: 10–12; Lohani et al. 1997: I: chapter 7) and forms part of many major donor and lending agencies' operating procedures (e.g., ADB 1997: 44). Social impact assessment (see section 5.4) often forms part of a broader social analysis or appraisal, but has a more specific remit.

5.3.2 Application

Social analysis and social assessment are terms used to refer to 'a broad range of processes and procedures for incorporating social dimensions into development projects' (Lohani et al. 1997: I: 7.0). Social analysis is widely used in economic development and poverty

3. That is, 'in places where we have reason to think that, over the course of a three or five year planning horizon, some kind of shock or emergency is likely to happen that will put people's lives or livelihoods at risk' (CARE/TANGO 2003: 1).

alleviation initiatives, to assess if a project is likely to meet its social objectives and to recommend measures that will ensure these objectives are met. It can show if a project will contribute to equitable and sustainable development. It does so by:

- examining social opportunities, constraints and likely impacts;
- assessing the role of beneficiaries in project design and implementation; and
- helping the implementer or donor to identify and monitor expected social development outcomes and social risks.

It therefore complements other forms of analysis (e.g., economic, environmental). Good social analysis is multidimensional, looking at assets and livelihoods and the complex relationships between different groups. It reflects recent shifts in thinking among the major donors about the complexity of poverty (World Bank 2002: 1–7).

Applications can be at different levels, using different instruments. They might include:

- macro-social analysis of the socio-cultural, institutional, historical and political context, carried out as inputs into country-level strategies and programming, or to support policy formulation and sector strategies;
- sociological appraisal of the opportunities, constraints and likely impacts, carried out as part of project appraisal; and
- social assessment, where the views of stakeholders are obtained in order to improve project design and establish participatory processes for implementation and monitoring

All of these would normally be undertaken at an early stage in project or programme development, although further appraisals or assessments can be carried out at any time if required. The project cycle offers many entry points for using social analysis (World Bank 2002: 8–14, 47–61; Lohani et al. 1997: I: 7.1; ADB 2001a: I: 9–12).

The methods used in social analysis[4] can and should be diverse, ranging from large-scale formal studies to PRA. The selection of tools and methods must be made according to context and resources. Quantitative and qualitative data should be collected. An iterative analytical process is needed to identify, assess and formulate responses to risks, opportunities, constraints and likely impacts. Current good practice also recommends the systematic participation of relevant stakeholders (World Bank 2002: 63, 68–82; see also Krueger et al. 2001).

5.3.3 Social analysis, social protection and social risk management

Recent recognition of vulnerability as a factor in poverty has led a number of leading agencies to look more closely at risk – in the widest sense – in the form of 'social protection' approaches that guide pre-project social analysis. Social protection may be defined as 'the set of policies and programmes designed to reduce poverty and vulnerability by promoting efficient labour markets, diminishing people's exposure to risks, and enhancing their capacity to protect themselves against hazards and interruption/loss of income' (ADB 2001b: 1).[5]

The World Bank and the ADB have taken great interest in social risk and protection in recent years and their approaches to incorporating these issues in project design typify modern practice (for what follows, see World Bank 2002: 12–14, 33–40, 50–1, 80–2; ADB 2001a (I) 7–8; (II) 4–6; (III) Appendices 8.1, 8.2). The World Bank recommends five 'entry points' for social analysis, on account of its complexity:[6] social diversity and gender; institutions, rules and behaviour; stakeholders; participation; and social risks. Social risk analysis looks at what might go wrong for the project, the implementing agency or donor/lender, and vulnerable groups. Similarly, for the ADB, a risk and vulnerability profile is an integral part of a country poverty profile, and leads into a potentially wide range of measures to reduce risk, help the poor and vulnerable to manage risks themselves and strengthen formal arrangements for risk management.

The World Bank and ADB break social risks down into categories. The categorisations are different but both encompass natural hazards and disasters (see Table 5.1). In the World Bank's categorisation, the vulnerability category best addresses environmental hazard risks to a project *that can be managed* (exogenous risks are seen as macro factors beyond a project's control). The basic approach proposed for assessing this is to view it as a 'risk chain' with three components:

- The risk, or uncertain events.
- The options for managing risk.
- The outcome, in terms of welfare loss.

4. The term 'social assessment' tends to be applied more specifically to the action of carrying out a social analysis.

5. Social protection thinking recognises the importance of pre-disaster mitigation within a broader poverty/vulnerability reduction framework (e.g., Yodmani 2001).

6. These are seen as 'a set of lenses for examining related dimensions of social reality'.

Table 5.1 Social analysis and types of risk

World Bank	Asian Development Bank
Vulnerability: increased exposure or susceptibility, especially of the vulnerable and poor, to endemic risks or external shocks (the analysis should explore how to manage such risks).	**Life cycle:** risks to the individual, such as illness, injury, disability, old age.
Country risks: conflict and violence, political instability, ethnic and religious tension. These are beyond the control of project managers but must be considered during project appraisal.	**Social risks:** crime, violence, civil strife, war, lack of rights.
Political economy risks: those that might affect the project's intended beneficiaries as an indirect result of the project: e.g., capture of benefits, opposition or distortion of project by influential stakeholders and élites.	**Economic risks:** unemployment and other labour market risks, economic transition and restructuring, harvest failure.
Institutional risks: include poor governance, limited technical and administrative capacity, and design complexity.	**Environmental risks:** natural catastrophes and disasters.
Exogenous risks: for example, terms of trade, regional conflict, effects of climate.	**Development-induced risks:** involuntary displacement, loss of common property, loss of support networks, homelessness, marginalisation.

Sources: World Bank 2002: 33; ADB 2001a(I) 7-8; cf. World Bank 2003: 30; ADB 2001b: 3

The first element in the chain clearly addresses diverse sources of risk, and social analysts are advised to study the broad project context (e.g., historical patterns of rainfall and flooding, health statistics, the region's political economy). Consultation with poor people is strongly recommended, as they have a sophisticated understanding of the risks they face and their vulnerability to them. Analysis should consider the nature and root causes of vulnerability. It should also consider the project's effects on people's physical and other assets, coping strategies and the thresholds or limits within which groups can mitigate risk and withstand externally induced shocks.

The ADB's risk and vulnerability profile is also wide-ranging. It is designed to look at short- and long-term factors and includes three main elements:

- Major country risks comprising: those related to the individual life cycle such as hunger, illness, old age; economic risks such as unemployment or price changes; environmental risks such as floods and earthquakes; and social/governance-related risks such as corruption and discrimination.
- Incidence of risks by population group.
- Coverage gaps in managing or mitigating these risks and priorities to be addressed.

Key issues to be investigated include the range, severity and frequency of vulnerabilities affecting the population, the different types of difficulty faced by vulnerable groups, and the consequences of doing nothing.

Social risk analysis must lead to a corresponding risk management strategy in the project plan. Collating and analysing the assessments of all risk categories is a necessary but complicated element in developing the project. The World Bank recommends a conventional probability-impact matrix to identify risks that justify modifications to the project plan, followed by further planning using tools such as scenario analysis to raise the risk threshold of the target population. However, it accepts that risk analysis draws heavily on subjective understanding of complex issues. It also accepts that disputes between stakeholders consulted during the process can hinder analysis: findings must be validated as far as possible.

Further information on how a social risk assessment might be done in practice is given in the World Bank's *A User's Guide to Poverty and Social Impact Analysis* (2003: 75; see also Coudouel et al. 2001: 164–200). This suggests that information about risks is gathered from secondary literature;[7] discussions with Bank staff and other partners; existing agencies that assess country risks; questionnaires, in-depth interviews or focus groups with key informants from government

7. Available from, for example, 'country databases', international risk rating agencies (e.g., *Economist* Intelligence Unit country risk ratings, Transparency International corruption perception index, International Country Risk Guide ratings), 'social science research', implementing agencies and partners.

agencies, NGOs and companies; and that the information can be validated through triangulation and cross-checking. A whole social risk assessment can be carried out rapidly by social scientists (two-to-four person weeks in-country, depending on the complexity of the project). The scope of such an enquiry – across all five categories of social risk – and the relatively limited time and resources available may make it difficult to obtain a full understanding of individual types of risk or of complex issues such as vulnerability. The ADB's approach is similar: a broad-brush and relatively rapid exercise (by an economist), leading to a summary vulnerability and risk profile that identifies major causes of risk/vulnerability, ranks them according to impact and highlights gaps in project or programme coverage. In both cases, the method is better suited to programme- or country-level initiatives, where key data sets are more likely to be readily available, than at project level, where much of the data may have to be collected from scratch.

These methodological factors have clear implications regarding the coverage of risks emanating from natural hazards. Whether it is applied at project or (more usually) programme level, social risk analysis is intended to provide a wide-ranging assessment of all major risks to the poor. If done properly, considering all relevant factors, it should identify the presence of significant hazard risks. However, it is not an ideal tool for analysis of individual hazard risks because it is not designed for that level of detail: this must be done using a more specific methodology such as vulnerability analysis, social impact assessment, risk analysis, environmental impact assessment or health impact assessment.

5.4 Social impact assessment

5.4.1 Definition

Social impact assessment (SIA) can be defined in general terms as 'analysing, monitoring and managing the social consequences of development'. More specifically, it includes:

> *…the processes of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions*
>
> *(IAIA 2003)*

SIA helps to explain how a proposed action will change the lives of people in communities, and how alternative actions might mitigate harmful changes and implement beneficial ones. It is therefore a valuable tool in the planning and decision-making process (Burdge 2003).

5.4.2 Application

SIA as a systematic approach dates from the 1960s, originating as a socio-economic component of EIA. It has expanded and developed rapidly since then, particularly in developed countries, but it has been used increasingly in international development since the mid-1980s (Becker 1997: 22–51). SIA can be undertaken at different levels, although much of the literature focuses on project-level assessment. At project level, typical applications are to consider the likely impacts of new industrial activities, construction, land use or resource management practices (Interorganizational Committee 1994: 10–11).

Although it has a long history, SIA has not been as widely used in decision-making as other forms of assessment (economic, technical, environmental). Some proponents of SIAs have complained that a proper SIA is not often undertaken as a stand-alone exercise or as part of EIAs, and there are said to be few instances where SIA has made a significant difference in the final decision about a project's feasibility (Burdge and Vanclay 1995; Burdge 2003). This indicates the still weak integration of many social science perspectives into project design and implementation in operational agencies of all kinds, which is due to a variety of institutional factors (e.g., World Bank 2002: 41–62).

5.4.3 Methods and approaches

There is no single SIA method; rather, it should be seen as a collection of tools and approaches that have been developed and systematised over decades (Becker 1997). However, the *Guidelines and Principles for Social Impact Assessment* (Interorganizational Committee 1994) are widely accepted as a core methodological document (Burdge and Vanclay 1995: 31). These have recently been supplemented by the *Social Impact Assessment: International Principles* drawn up by the International Association for Impact Assessment (IAIA) (IAIA 2003).

To predict the probable impact of a particular development or policy change on a given community, SIA draws on the past behaviour of other individuals and communities affected by similar developments. It is therefore rooted in comparative analysis. SIAs can be carried out at different stages in project and policy development, from initial planning to operation and post-implementation.

There is a general consensus on the types of impact that need to be considered in a SIA. Studies in a variety of settings have consistently identified certain key social impact variables relating to:

- population characteristics and impacts (changes in number, density, distribution and composition);
- community and institutional structures (including size, structure and level of organisation of local government and changes in attitudes, values, local government and employment);
- political and social resources (distribution of power and alterations in power, interested and affected parties, leadership capacity);
- individual and family changes (factors that influence daily life including attitudes, values, perceptions, social relationships and networks);
- community resources (patterns of land use, community services, tax base); and
- social justice (equity, human rights, participation).

Practitioners have developed a series of qualitative and quantitative indicators against each (Burdge 2003).

A conventional SIA process is likely to include the following steps (Interorganizational Committee 1994: 14–22):

- Public involvement: developing an effective public plan to involve all potentially involved groups.
- Identification of alternatives to the proposed action or policy change.
- Baseline conditions: describing relevant human environment/area of influence.
- Scoping: identifying the range of possible social impacts.
- Projection of estimated effects and investigation of probable impacts.
- Predicting responses to impacts and determining significance of identified social impacts.
- Estimating subsequent and cumulative impacts.
- Recommending new or changed alternatives and estimating their consequences.
- Developing and implementing a plan for mitigating adverse impacts.
- Monitoring and evaluation.

A wide range of social science methods can be employed in carrying out a SIA, and a variety of data-gathering techniques would be used in most instances, depending on purpose and context (Becker 1997: 52–141). For some, the diversity of approaches, tools, units of analysis and data sets is problematic because it leads to inconsistency and lack of coherence (Burdge and Vanclay 1995: 43–7).

The main data sources are likely to be published social science literature, secondary data (e.g., census data, geographical data including maps, national and local government statistics, documentation from NGOs and community-based organisations (CBOs), local histories, newspapers) and primary data from the affected area (e.g., survey research, informant interviews, oral histories, PRA exercises) (Interorganizational Committee 1994: 27).

A good SIA should provide qualitative and quantitative indicators of social impacts that can be understood by decision-makers and citizens alike (Burdge 2003). Practitioners of SIA in developed countries are more likely to emphasise conventional, formal social survey methods than those working in developing countries, who put greater weight on PRA methods. There are probably two reasons for this. One is that experience in developing countries has taught researchers the value of triangulation of qualitative and quantitative data from different sources where comprehensive, reliable quantitative data sets are unavailable and there are insufficient resources to undertake formal surveys (Becker 1997: 192–211). The other is the growing recognition of PRA's effectiveness in revealing aspects of local conditions that are invisible to more conventional social survey methods (Chambers 1997). However, standard guidance is that 'It is more important to identify likely social impacts than to precisely quantify the more obvious social impacts… it is better to be roughly correct on important issues than to be precisely correct on unimportant issues' (Interorganizational Committee 1994: 28).

Good practice guidelines emphasise the importance of community participation, respect for human rights, transparency and accountability, social equity, socially sustainable development and focus on positive outcomes (IAIA 2003). The Interorganizational Committee's 1994 *Guidelines and Principles* identify nine principles for SIA, addressing both general approach and methodological good practice (see Box 5.3).

5.4.4 Value of SIA in assessing potential hazard risks

As a conceptual model, SIA is equipped to take hazard risk into account. It can be understood as an overarching framework that embodies evaluation of all impacts on humans and on all the ways in which people and communities interact with their socio-cultural, economic and biophysical surroundings (IAIA 2003).

Box 5.3 SIA principles

- *Involve the diverse public.* Identify and involve all potentially affected groups and individuals.
- *Analyse impact equity.* Clearly identify who will win and who will lose and emphasise vulnerability of under-represented groups.
- *Focus the assessment.* Deal with issues and public concerns that really count, not those that are just easy to count.
- *Identify methods and assumptions and define significance.* Describe how the SIA is conducted, what assumptions are used and how significance is determined.
- *Provide feedback on social impacts to project planners.* Identify problems that could be solved with changes to the proposed action or alternatives.
- *Use SIA practitioners.* Trained social scientists employing social science methods will provide the best results.
- *Establish monitoring and mitigation programmes.* Manage uncertainty by monitoring and mitigating adverse impacts.
- *Identify data sources.* Use published scientific literature, secondary data and primary data from the affected area.
- *Plan for gaps in data.* Evaluate the missing information and develop a strategy for proceeding.

Source: Interorganizational Committee 1994: 24

SIA should be multidimensional. It should view social impacts in very broad terms, encompassing people's way of life, culture, community, political systems, environment, health and well-being, personal and property rights, and fears and aspirations. Its coverage of environmental impact might include the quality of the air and water people use, the availability and quality of the food they eat, the level of hazard or risk, dust and noise they are exposed to, the adequacy of sanitation, their physical safety, and their access to and control over resources. In looking at health and well-being, it addresses physical, mental, social and spiritual well-being and not merely the absence of disease or infirmity. SIA theory accepts that social, economic and biophysical impacts are interconnected and that change in any one of these domains will lead to changes in the others. Seen in this way, SIA has clear overlaps with EIA, health impact assessment and other forms of ex-ante impact assessment, as well as with vulnerability analysis. The IAIA maintains that, while SIA is typically applied to the consequences of planned interventions, its techniques can also be used to consider the social impacts of other types of event such as disasters, demographic change and epidemics (IAIA 2003).

Guidance on SIA principles makes it clear that good practice is risk-averse. One of the six 'core values' in the IAIA's *International Principles* is: 'People have a right to live and work in an environment which is conducive to good health and to a good quality of life and which enables the development of human and social potential' (IAIA 2003). Other guiding principles endorsed in the document are the precautionary principle, the polluter-pays principle, the prevention principle ('It is generally preferable and cheaper in the long run to prevent negative social impacts and ecological damage from happening than having to restore or rectify damage after the event') and the protection and promotion of health and safety (ibid.).

Standard methodological guidance reinforces this conceptual position by identifying hazard- and risk-related issues to be addressed during the SIA process. The Interorganizational Committee (1994) includes dimensions of vulnerability and capacity in its SIA variables. Within the SIA variable category 'community resources', it identifies patterns of natural resource and land use, the availability of community services (including health, police, fire protection and sanitation facilities) as factors to be analysed. In its guidance on assessment of baseline conditions – the third step in its ten-step SIA process – it recommends exploration of the geographical and human environments including relationships with the biophysical environment (e.g., ecological setting, aspects of the environment seen as resources or problems, patterns of resource use) and culture, attitudes and social-psychological conditions (e.g., risk perception, psychological coping) (Interorganizational Committee 1994: 12, 15–16). Becker (1997: 148–51) also identifies clear links between risk assessment and SIA. Hazardous events and their risk or uncertainty should be included in baseline and trend analysis; scenario analysis must be supplemented by scenarios of the consequences of exposure to the hazards identified (using fault or event-tree procedures). Next, the risk has to be specified and risk mitigation strategies designed.

Whilst hazards and risk are important features of the SIA process, SIA is not in itself a method of analysing hazard risk generated by a project or external to it. It is assumed in the literature on SIA principles and methods that a risk or health impact analysis will be undertaken, either to complement the SIA or within a broader EIA of which the SIA is part.

5.4.5 Social interpretation of risk

SIA explicitly acknowledges the importance of the social construction of reality, in both affected communities and implementing agencies. The Interorganizational Committee's guidelines list 'perceptions of risk, health and safety' as one of 35 SIA variables to be studied (within the general category of 'individual and family changes', i.e., factors that influence the daily life of individuals and families, including attitudes, perceptions, family characteristics and friendship networks) (Interorganizational Committee 1994: 6, 12–13).

Wlodarczyk and Tennyson (2003) identify the importance of investigating people's perceptions of risk as part of a SIA. Here, risk is not seen as an objective fact but a subjective experience felt by everyone, and felt differently by different people. From this perspective, SIA is not a risk assessment per se but the next step in the process: understanding and measuring the human consequences of or human responses to risky or threatening situations. Wlodarczyk and Tennyson develop a 'source–pathway–receptor' model to show how social and economic effects may occur as the result of public attitudes towards risk. In their SIA of the potential consequences of reopening nuclear power reactors in Ontario, Canada, people's behavioural intentions (triangulated with other data) were seen as a key indicator of their likely response to the project.

Momtaz (2003) shows how SIA was used as part of an EIA for the Khulna-Jessore Drainage Rehabilitation Project in Bangladesh. Using RRA and similar participatory methods in 60 locations, the SIA made extensive use of local perceptions of likely changes including potential damage to property and crops from flooding and health impacts. The findings influenced the government's final choice of option for intervention.

5.5 Health impact assessment

5.5.1 Introduction

Health impact assessment (HIA) is a 'combination of procedures or methods by which a policy, program or project may be judged as to the effects it may have on the health of a population' (WHO Regional Office for Europe, cited in N&YPHO 2001: 2). It should be seen as 'a framework within which a wide range of health impacts of a specific project or policy can be assessed' (Kjellstrom et al. 2003: 451).

Although a relatively new approach undergoing rapid evolution, it is attracting considerable interest among policy-makers worldwide. Applications are wide-ranging, including construction and transport projects, local planning proposals, and assessment and review of socio-economic policies. Most practitioners believe that HIA should be used to improve policies and proposals and there are signs that findings can lead to changes in planning processes, although the long-term outcomes of adopting HIA recommendations are harder to assess (N&YPHO 2001; Taylor et al. 2003a, 2003c).

Ideally, it should be integrated with EIA and SIA, early in the planning cycle, while ensuring that the importance of health is not lost in the integration process. Integration does happen in some cases, but experience suggests that it is not easy, owing to several factors including limited resources, lack of political commitment, competition between organisations and sectors, and lack of expertise in using it (N&YPHO 2001).

5.5.2 Methods

Contemporary HIA has different origins: one strand derives from EIA, another from public health policy and the notions of determinants of health. It is also based on different disciplinary approaches: epidemiology and toxicology on one hand, and social sciences on the other. Because it remains relatively new, HIA is still largely unevaluated as a process; there are now many toolkits and guidelines but no standard, validated models. Relatively few assessments have been undertaken and these have used several approaches (Kemm 2003; Morgan 2003; N&YPHO 2001). However, some basic methodological aspects can be defined.

HIA is a multidisciplinary process viewing a range of evidence within a structured framework. It uses qualitative and quantitative measures (N&YPHO 2001). Health is seen as more than the absence of sickness and disease: it 'encompasses social, economic, cultural and psychological well-being, and the ability to adapt to the stresses of daily life' (Health Canada 1999: I: 1.2). HIA therefore addresses the underlying determinants of health, which might include income and social status, employment and working conditions, physical environments, education, healthy child development, biology and genetic endowment, health services, personal health practices and coping skills, and social support networks (Health Canada 1999: I: 1.2). Most HIA methods use checklists of the underlying determinants of health as markers for change in health risks (e.g., using employment levels as a marker for the status of community health). However, causal pathways are so complex that it is not often possible to say what the outcome will be (N&YPHO 2001).

Because there is considerable scope for projects to influence occupational and public health, HIA guidance recommends investigating a wide range of health factors, such as (Health Canada 1999: I: 2.7):

- hazardous agents (e.g., microbiological viruses, bacteria, chemicals, noise, dust, radiation, vibration);
- environmental factors (e.g., changes in the quality or availability of water, food, air, land and soil, waste management practices, physical safety and security, disease vectors);
- exposure conditions (human exposure pathways such as food, air and water, public exposure, occupational exposure, identification of high-risk groups);
- effects on physical health (mortality, morbidity from communicable and non-communicable diseases, injuries and accidents, effects on future generations, effects on high-risk groups, exacerbation of existing health conditions such as asthma, cumulative effects);
- effects on health-care services (incremental health-care needs, displacement of traditional health-care services); and
- effects on social well-being (effects on income, socio-economic status and employment, effects on municipal revenues and local industries, migration and resettlement, effects on social and community health including culture and way of life, effects on services such as education and social support networks, effects on psychological well-being, and beneficial effects on health).

The types of information collected and indicator used will depend on the type of project and its potential effects, but clearly there is a wide range of possibilities. For example, indicators of physical health among the general public might include respiratory effects, noise levels, effects of accidents and malfunctions, disease rates and fertility levels, while among workers they might include injuries, effects of accidents and malfunctions, days off work, disability, long-term limitations on activity, and respiratory and skin effects. Indicators of changes in socio-cultural well-being are likely to be still broader (e.g., Health Canada 1999: I: 3.2).

Different HIA models measure impact in different ways. The principal sources of evidence tend to be literature reviews and qualitative methods, because this evidence is easiest to obtain and is sometimes all that is available; but ideally a range of data sources (economic, epidemiological, quantitative and qualitative) should be taken into account. In practice, measurement of impacts is constrained by the need to strike a balance between resource availability and depth of analysis (N&YPHO 2001). HIAs therefore vary greatly in approach and data. For example, the health impact of atmospheric pollution in nine French towns was quantified through epidemiological surveillance using extensive quantitative data on pollutants, mortality and hospital admissions (INVS 2002), whereas qualitative data from a small stakeholder review workshop were used to assess the value of an air pollution helpline in London (Thompson 2001).

Health inequality should be a central issue in HIA (Taylor et al. 2003b). HIA approaches stress the importance of identifying the most vulnerable groups in society on the basis that they are likely to be more severely affected than others, with less access to resources and a lower level of political power to promote their own interests. Most guidelines stress the importance of involving the local community, both in obtaining relevant information and in devising mitigation measures that are socially acceptable; but community participation presents many practical challenges (N&YPHO 2001; Parry and Wright 2003).

5.5.3 Linkages/integration with other assessment models

The term ‘HIA’ is used to name a wide variety of activities, and its overlaps and linkages with other impact assessment and risk analysis methods are often not fully explored (Kemm 2003; Morgan 2003). Links to EIA and comparative risk assessment are particularly strong.

HIA has evolved partly out of EIA, particularly in international development, and most EIA programmes require consideration of human health impacts, although it seems that many address these inadequately (Steinemann 2000). The World Bank is said to have carried out many HIAs as part of environmental assessments (Mercier 2003). Its environment department has issued guidance on integrating health and safety concerns into EIA, with the following steps recommended (World Bank 1997):

- Early screening to identify potential health hazards (based on documents relating to similar projects elsewhere, opinions of specialists and community leaders, reference documents, maps and national health data). This should be systematic and comprehensive, even if not all hazards identified are subsequently addressed by the project. It should address the whole project cycle.
- Rapid health risk assessment by a health specialist (using secondary sources, key informant interviews, reconnaissance

missions). This will often be sufficient to eliminate many health hazards from further consideration, or identify appropriate risk management measures. It can also be used to develop terms of reference (TORs) for more detailed assessments.

- Detailed health risk assessments of specific hazards, if required (based on secondary sources, key informant interviews, focus group discussions and other participative methods, direct observation, random sampling, project documents; but not primary data collection, unless absolutely necessary). The assessment should put the human community first, recognising differential vulnerability. Health impacts should be quantified if possible, but for many hazards a simple risk ranking may be all that is possible. Assumptions of the analysis should be stated.
- Development of risk management or mitigation measures.

Although some advice on methods is given, this is not prescriptive. The main aim is to set out a process for incorporating HIA, and it is clear that this can be accomplished within standard EIA processes.

Little systematic research has been done on how comparative risk assessment (CRA) can contribute to HIA (Dora 2003; Kjellstrom et al. 2003). For some, CRA – defined by the WHO as the systematic evaluation of the changes in population health that result from modifying the population's exposure to a risk factor or group of risk factors (Kjellstrom et al. 2003: 451) – is a form of HIA (Kemm 2003). Both HIA and CRA draw on research from a range of disciplines and assimilate them into frameworks through which comparisons between different issues and information sources and judgements can be made. Both methods allow users to compare different sources of ill health in a population. A key difference is that CRA is a formal, quantitative approach that places different risk factors into a single measure incorporating mortality and morbidity (disability-adjusted life years or DALYS), whereas HIA looks at a wider range of indicators; it also places much more emphasis on stakeholder participation (Kjellstrom et al. 2003). A review of application of both methods to road transport policies sees considerable potential for synergy but emphasises the complexity of integration, especially given the absence of evidence of good practice (Kjellstrom et al. 2003).

5.6 Conclusion

The rising interest among development and disaster planners in risk, vulnerability, social protection and sustainable livelihoods has led to the development of a range of complementary and often overlapping approaches to analysis. This brief review of some of the main methods suggests that all are designed to take hazard-related risk and vulnerability into account, and capable of doing so, but that this has proved harder to achieve in practice, due to both methodological and operational constraints.

One of the biggest challenges is to achieve a balance between the breadth and depth of coverage. All the methods described seek a holistic view of the issues, but in the case of such complex, multidimensional subjects as human vulnerability and resilience, resources are rarely if ever sufficient to achieve this. In practice, it appears to be more normal either to aim for broad-brush coverage without detailed analysis of individual aspects (e.g., natural hazards) or to focus on particular elements (e.g., livelihood assets) and largely overlook others. The complexity of the issues also creates difficulties in data analysis, where very different types of evidence on different dimensions of vulnerability or social risk have to be weighed against each other.

There are signs that some agencies are now paying more attention to understanding the nature and impact of external shocks on vulnerable people, with a corresponding change in emphasis in their analytical approaches. This is not a radical shift, more a re-balancing of perspective. More generally, there is an interest in collecting and learning from experience, particularly in the case of newer methods, which deserves institutional encouragement. More dialogue between practitioners of the different approaches would be valuable in identifying their relative strengths and weaknesses, as well as facilitating greater harmonisation.

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Chapter 6

Risk assessment

6.1 Purpose of risk assessment

Risk assessment as a specialised field began as part of military operations' research during the Second World War and thereafter in the avoidance of chemical and nuclear plant failure. More recently, it has been extended to consider the control of major industrial hazards, including associated acute human health issues and, more recently again, to natural systems. The latter include assessment of risks to ecological resources and investigating the risks arising from natural hazards (World Bank 1997). Economic and financial risk analysis has been developed separately, if in parallel, to test sensitivity of net benefits to a project to changes in particular parameters (prices of inputs and outputs, rates of interest and so forth) (see Chapter 3). Organisations in both the public and the private sectors assess risk.

In the context of international aid, risk assessment essentially explores what could go wrong, the range and magnitude of potential impacts and the likelihood of adverse consequences (World Bank 1997). The success of a particular project or programme depends in part on the reasonableness of underlying explicit and implicit assumptions. It is, therefore, 'essential… to test the validity of the critical conditions deemed necessary for the achievement of program objectives' (CIDA 2000: 3).

In reality, aid agencies' interest in risk assessment has shifted over time. Historically, the focus seems to have been largely on economic and financial risks, with much greater concern on the part of lending banks than agencies disbursing grants (ADB 2002) (see Chapter 3). However, Harberger (1998)[1] argues that, even then, because there are sovereign guarantees of such loans and the banks' capital is not effectively at risk, international financial institutions (IFIs) tended to take a less serious view of risk than private investors, for example, would in similar circumstances.[2]

Increasing application of logframe analysis from the 1970s onwards stimulated some wider consideration of risk, exploring a range of factors that could prevent projects or programmes from delivering their outputs and meeting objectives, although the extent of detail of such analysis has varied considerably (see Chapter 7). Grant-making as well as lending agencies began to undertake these wider risk assessments.

More recently again, with increasing emphasis on sustainable development, there has been increasing interest in tools for risk assessment to explore issues of environmental, institutional and financial sustainability, the latter including availability of finances to sustain a project. CIDA (2000: 3), for instance, defines risk in terms of 'not meeting program objectives or that of program results not being sustainable'. Risks to effective and sustainable aid outcomes include partner stability, availability of funding to operate and maintain infrastructure, governance, macro factors in country, poverty reduction risks and environmental risks as well as project quality factors (AusAID 2000). ADB (2002) comments that the shift in emphasis of organisations such as the World Bank and DFID to a more participant-centred, 'pro-poor' driven, 'livelihoods' approach has also increased the attention paid to risk assessment in the context of the impact of projects on household vulnerability, although not from a quantitative perspective.

Risks to an aid agency's reputation and public standing also seem to have assumed more importance as greater emphasis has been placed on accountability and recourse to legal action becomes an ever-growing threat.

6.2 Risk assessment methodologies

Risk assessment basically entails assessing the types of risks that threaten an operation; reviewing existing and proposed facilities to determine vulnerability to these risks; developing loss estimates; identifying effective mitigation options and their costs; making decisions to address the vulnerability based on the potential costs and benefits; and implementing

1. Cited in ADB (2002).

2. Writing in 1991, OAS commented that the IFIs are 'generally more concerned with how macroeconomic and political factors may affect a government's overall repayment ability than with the effect of risk factors on cost recovery. As a result, loans are routinely made with little or no risk assessment. While this attitude makes sense for the bank because it grants loans against overall government credit worthiness and does not share the risk of any individual project, it does not necessarily make sense for borrowing nations' (OAS 1991: 2–16).

the risk management plan (FEMA 1998). Ideally, risk assessment should start at the beginning of the project cycle and should be continually monitored and periodically reassessed over the course of a project. A full risk assessment should be developed at the state of detailed project preparation (AusAID 2000). Stakeholders should be involved at all stages in the risk assessment process, offering insights and knowledge on the nature of local risks and their perceptions and attitudes to them.

There are many tools for estimating risk, ranging from qualitative exercises to sophisticated mathematical models estimating probabilistic-based estimates of project returns depending on the behaviour of key variables. ADB (2002: 60–3) identifies seven risk analysis techniques:

- Logical framework 'risks and assumptions' elaboration (see Chapter 7).
- Subjective construction of 3*3 (or more) cell matrices showing approximate probability of risk occurrence (high, medium, low) against seriousness of impact (high, medium, low) (see Chapter 7).
- Qualitative poverty and risk vulnerability assessment (see Chapter 5).
- Risk aversion/focus of loss estimation, based on quantification of the extent of target groups' attitudes to risk and possible losses of incomes based on interviews.
- Simplified probabilistic analysis, indicating the likelihood of a project's expected internal rate of return or expected net present value being acceptable, based on consideration of key variables as determinants of project performance (see Chapter 3).
- Use of standard spreadsheet functions to generate random numbers and counts of observations of key variables and thus produce distribution of project outcomes.
- 'Monte Carlo' simulation with continuous distributions.[3]

Analytical tools are becoming increasingly sophisticated with advances in science and computer modelling and as understanding of the natural hazards and their impacts improves (Schneider et al. 1999). Numerical measures of risk produced by such tools can be easier to build into broader economic and financial project and programme appraisals. However, they may capture only certain aspects of risk (see Box 6.1). A broad-based or 'generic' analysis is typically taken when risks are accumulated over many assets, while a detailed or 'site-specific' analysis is often more appropriate for high-valued or critical assets (ibid.).

Once risk has been assessed, a risk management plan should be drawn up. There are various options in deciding how to respond to risks. According to the Australian Agency for International Development (AusAID 2000), risks can be:

- accepted (appropriate where risks, or remaining risks after other measures are taken, are low);
- avoided (e.g., by not continuing with that activity or component of a project);
- reduced in likelihood (e.g., by selecting alternative proposals or designs);
- mitigated; and/or
- transferred (e.g., in the case of a donor agency contracting a third party).

Selection of one of these responses will involve trade-offs between the potential benefits and costs of implementing a particular response (AusAID 2000). The selection will also depend on levels of risk aversion. DFID (2003c: 4) refers to 'risk appetite' or the amount of risk that one is prepared to be exposed to before judging that action is necessary. The development agency needs to consider what level of risk it is appropriate for itself to accept, to suggest that partner government or other agencies accept and to impose on potential project beneficiaries (ADB 2002). However, 'whether quantified or not, ultimately a decision about whether to accept a project in the face of the simple known existence of a risk (or of a particular level of that risk), is a subjective decision for planners and policy-makers' (ADB 2002: 60).

Risks should then be continuously reassessed over the course of a project to ensure that the risk management plan remains appropriate, for instance in the face of changes in the external environment (AusAID 2000). The effectiveness of a risk management strategy should also be monitored. At the end of a project, the risk management plan and strategy should be evaluated and 'their overall efficiency in dealing with risk… measured against risks known to have occurred' (AusAID 2000: 3).

3. Values for individual variables are generated randomly according to their respective probability distributions, combined with other randomly generated values for the other variables, and an estimate of the project's net present value then calculated. This process is then normally repeated at least 1,000 times, equivalent to implementing the project again and again in different circumstances, and an average (expected) net present value is produced together with an associated probability distribution. Very large and complete datasets are not necessarily required to perform a Monte Carlo simulation. Instead, simplifying assumptions can be made about variable distributions. As a bare minimum, triangular distribution from three points (most likely, minimum possible and maximum possible) can be constructed based on best guesses of project preparation team members. Local knowledge can also be drawn upon, for instance using Delphi survey techniques (ADB 2002).

Box 6.1 Quantitative versus qualitative analysis

Risk assessment increases the level of information available to decision-makers but how can that information be used and is it even in a usable form? There is a strong case for quantifying risk, generating a cumulative probability distribution of project outcomes (see Chapter 3). As the United Kingdom's Royal Society (1992: 159), for instance, argues, 'any rational system of risk management must rest on systematic attempts to quantify risks and to assess them against a pre-set array of objectives by methods analogous to cost-benefit analysis'. Proponents of such arguments hold that rigorous quantification of risk promotes policy rationality and that there is no real alternative to quantitative risk analysis as the primary tool for promoting rational resource allocation in corporate and public management and exposing key policy questions.

However, as the Royal Society itself acknowledges, many would also recognise that it is important to understand the causes and characteristics of different types of risk and that quantitative risk analysis needs to be combined with other broader forms of information and analysis. Indeed, Hood and Jones (1996) state that more radical critics of more formal methods of quantitative risk analysis even argue that they are harmful as a tool for risk management because they define the way in which problems are perceived, focusing on those aspects of risk that can be most easily defined and directly addressed. Numerical estimates of risk can lose crucial issues of context. Quantitative information can ' "drive out" other information' while 'the regulator become(s) vulnerable to "number-hungry" analyses and critics' (Leape 1980).[4]

In the case of natural hazards, for example, there has often been a tendency to focus on technocratic, rather than socially engineered, solutions. Risk has also been measured primarily in terms of direct damage or cost of a future disaster to feed, in turn, into cost-benefit analysis of potential mitigation measures and the pricing of insurance premiums. As Schneider et al. (2003: 6) argue, 'research is needed to extend these estimates to include indirect effects (e.g., loss of income, quality of life) as well as other social, political, and economic factors that invariably play a role in decisions about risk treatment'.

Finally, it should be remembered that judgement is inherent even in quantified measures of risk: 'judgement can arise in the selection of a risk index, in the assessment of consequences and uncertainties, as well as in the initial structuring of a risk problem' (Royal Society 1992: 94).

In particular projects, a more focused form of risk assessment may also be required. The EC, for instance, mentions safety risk assessment, health risk assessment, contaminated land risk assessment and pollution risk assessment as well as 'natural disaster risk assessment' (EC 2000). Activities requiring one or other of these risk assessments include handling, storage or disposal of hazardous materials and wastes in quantities above a specified threshold level; the construction of dams; and major construction works in locations vulnerable to seismic activity or other potentially damaging natural events (ibid.). According to EU regulatory requirements, for instance, all major industrial facilities in the EU must include the development of a safety case as part of the environmental impact assessment, integrating safety concerns at stages of design, construction and operation (EEC 1982).

ADB (2002: 11) makes the important distinction between 'risk (unknown but quantified outcomes) and uncertainty (unknown and unquantified outcomes)'. Sensitivity analysis is the most widely applied technique for describing uncertainty, involving the changing of one or more selected variables and the resultant change in a project's net present value or internal rate of return (ADB 2002) (see Chapter 3). This leads to the identification of those variables to which a particular project design is particularly sensitive, leading to mitigation measures where considered necessary. The impact of disasters, if uncertain, would have to be calculated indirectly, via their impact on these project variables (e.g., on crop yields, prices, consumer utilisation rates). However, sensitivity analysis is a highly subjective technique, dependent on judgement rather than empirical evidence (ibid.).

6.3 Application of risk assessment

Basic project documents often indicate risks and assumptions, at least as identified in the context of logframes (see Chapter 7). Other forms of analysis – notably economic and environmental analysis – may also include some form of risk assessment (see Chapters 3 and 4) whilst, as already noted, particular specialised forms of risk assessment may be

4. Cited in Steinemann (2000).

conducted. For instance, the World Bank's *Guidelines for Completing the Project Appraisal* document advocates use of the risk matrix approach in assessing overall risks as part of the preparation of Bank projects, using logframe analysis to identify critical risks (World Bank n.d.). Risks are rated as:

- high (greater than 75 per cent probability of occurrence);
- substantial (50–75 per cent probability);
- modest (25–50 per cent probability); or
- low/negligible (less than 25 per cent probability).

The project appraisal document should then describe how risk mitigation would be addressed during project preparation. Finally, the overall level of project risk should be rated, either as high risk (a greater than 75 per cent probability that project development objectives will not be achieved), substantial risk (50–75 per cent probability), modest risk (25–50 per cent probability) or low or negligible risk (less than 25 per cent probability). In the more specific case of environmental risk, the World Bank's practice is that 'where uncertainties associated with Bank investments are large and important… a quantitative assessment of risks is appropriate' (World Bank 1997: 2). Meanwhile, AusAID specifically requires that a risk management plan be prepared and submitted as part of project approval procedures for all bilateral AusAID proposals (AusAID 2000).

However, aid agencies' efforts to analyse risk of any kind sometimes appear to have been rather cursory. A recent ABD report, for instance, found that 'actual applications of risk analysis in ADB operations have remained relatively limited since 1985, and have been concentrated in certain sectors, notably power' (ADB 2002: 6). ADB reviewed risk analysis practices as reported in 50 recent Reports and Recommendations to the President (RRPs) – the report presented for purposes of loan approval. This review found that the standard format of an RRP invariably includes a section qualitatively describing the risks that a project is expected to face, often including a description of measures to mitigate risk (such as provision of technical assistance or provision of counterpart funding). The project framework then places these risks in the context of the project's hierarchy of objectives. However, analysis of risk was found to be cursory. Sensitivity testing often simply entailed changing project aggregate 'base case' costs and benefits streams by 10 or 20 per cent and delaying benefits by one or two years. The project was then usually described in terms of its 'robustness' – i.e., that even 'in the "worst case" scenario (when cost changes are highest, benefits most reduced and/or delayed, etc.) its EIRR (expected internal rate of return) is still above 12 per cent' with the additional statement sometimes '(improbably) made that, given its ability to survive such adverse circumstances, "the project faces no risk" ' (ADB 2002: 32). The same ADB study also found that the financial and economic analysis section of an RRP often argues that 'conservative' or 'pessimistic' estimates have been used for forecasts of variables upon which benefits are estimated (e.g., crop prices and yields), again to reflect possible risk factors but without actually quantifying them.

The ADB study also reviewed project performance across all sectors, revealing that the main technical factors causing differences between anticipated and actual project outcomes could largely have been subjected to some form of risk analysis and related project redesign where required. ADB concluded that 'what emerges from the review of ADB and other agency experience is that, despite the extensive academic literature describing the techniques for more quantitative approaches to risk analysis and the increasing availability of computers with which to run probability-based simulations for values of key variables, actual examples of such practice are very rare' (ADB 2002: 44). ADB attributed this in part to difficulties in obtaining reliable data about key variables and having access to appropriate computer software capable of fitting probability distributions and generating expected values with associated measures of variance.

More positively, in an apparent effort to improve consideration of risk, various aid agencies, including ADB, have recently produced risk assessment procedures and guidelines. Some are specific to aid programmes. Others reflect wider government initiatives to promote risk management more broadly, as for instance by the UK Office of Government Commerce.[5]

CIDA, for instance, has recently introduced results-based management practices, as part of its efforts to limit exposure to risk. The emphasis is very much on potential risks to the success of CIDA's aid initiatives, principally in the form of programme aid, with political factors viewed as the primary threat (see Box 6.2).

DFID is also undertaking efforts to strengthen its risk management system. As part of this initiative, it has developed a corporate risk register listing the top risks to achieving its objectives. This tool provides DFID's Management Board with an overview of the main strategic, policy and operational risks facing the organisation and how they will be managed. Recently established 'Directors' Delivery Plans' also identify major risks to the delivery of objectives and targets,

5. See http://www.ogc.gov.uk/

Box 6.2 CIDA's risk assessment methodology

CIDA's risk assessment methodology is based on systems theory, which:

> *…views a society as a set of interacting roles and structures, all influenced by developments and trends both internal and external to the system. In this way, political, economic and social developments can be viewed as components of an interrelated system and instability seen as the result of a breakdown or malfunctioning in the system. Through this framework, analysis moves away from a focus on the symptoms of instability (whether riots, demonstrations, changes in government or adverse policy change) toward their structural preconditions.*
>
> *(CIDA 2000: 3–4)*

The approach is non-quantitative, with scenario development as the final output. The assessment begins with an analysis of the country's political, economic, social and institutional background and the risks posed to a particular CIDA strategy by these elements, guided by sets of questions and assumptions contained in six separate risk categories – political, institutional, economic, social/cultural, security and environmental risks. Political analysis focuses on the type of political regime in place and whether it promotes a predictable and stable operating environment for CIDA country programmes. Institutional analysis focuses on the variety and quality of institutions (including civil society), their policy positions and influence over policy- and decision-making. Economic analysis focuses on the country's economic structure, including vulnerability to shocks, and the effects of government economic policy, exploring both direct and indirect risks. For instance, economic shocks could lead to cutbacks in government spending on, say, education. Social and cultural analysis looks at the extent to which potential programmes could threaten local customs and culture. And, finally, security analysis considers the physical and psychological effects of security issues and their potential consequences for CIDA's ability to hire and retain Canadian and local partners.

The second part of the assessment entails the construction of particular scenarios postulating likely future developments under the various risk categories and the impact of such developments on CIDA's strategy. It is suggested that in most cases three scenarios should be developed. The guidelines indicate that scenarios should normally begin with political analysis and then explore the implications in each of the other five categories of risk. This effectively implies that natural hazard-related risks are unlikely to be explored because they do not flow as a consequence of political risks whilst there is unlikely to be an opportunity to run a disaster scenario.

The third and final part of the assessment involves drawing out the consequences of the scenario for CIDA's programme objective.

Source: CIDA 2000

while the new guidance on country assistance plans requires a detailed assessment of risks to the delivery of the poverty strategy and an explanation of how the risk assessment has informed choices of the nature and volume of DFID support (DFID 2002b). Key elements of DFID's risk policy include explicit encouragement of financial support of 'activities which have a high risk of not achieving their objectives, provided that the potential benefits of success (e.g. in contributing to the achievement of the Millennium Development Goals) are proportionately high and that the risks are managed sensibly' and enhancement of DFID's 'capacity to both rigorously assess and manage risks' (DFID 2002b: 1).

DFID already had in place a rigorous policy for assessing programme and project risks involving identification, assessment, management and review, but is also producing further guidance on assessing risks in projects to ensure greater consistency (DFID 2003a). DFID already requires the preparation of a risk annex as part of documentation supporting a new project (ADB 2002). For instance, the risk matrix for a recent DFID project in China (Yunnan Environmental Development Programme 2000) identified ten risks, including that of abnormal incidence of physical shocks such as earthquakes.[6] The risk matrix of a DFID chars livelihood programme in Bangladesh identified eight risks, the first of which was that 'environmental change or natural disasters may undermine programme progress'. The report stated that:

> *…although the probability associated with this risk is high, associated impact is judged as low, on the basis that previous floods have demonstrated that government, NGOs and development partners are relatively effective and efficient at mobilising resources to deal*

6. Cited in ADB 2002.

with the immediate crisis. It is likely that the agencies involved in disaster management would be the same agencies which are partnered with the programme, again reducing the likelihood that programme activities would be seriously disrupted.

In addition, the programme itself has a significant component concerned with improving disaster preparedness and disaster management… This is planned to begin from programme inception, and will itself contribute to improving the efficiency and effectiveness of disaster management operations should the need arise.

Despite the comfort that may be drawn from these factors, it remains true that if a disastrous flood were to occur in the first three years of the programme, it would constitute a severe setback to programme activities which would require reconsideration of the overall programme timetable.

(DFID 2002a: 5)

DFID (2003c) advocates the merits of facilitated risk assessment workshops in assessing risk. It suggests two alternative designs. The first basically entails construction of a risk assessment matrix, also known as a summary risk profile (see Chapter 7), brainstorming of all possible risks and then a ranking (low, medium or high impact) by how critical or dangerous they would be to the success of a project if they happened and their probability (low, medium or high). This approach appears to have been followed in the China and Bangladesh examples reported above. The second workshop design is based around a series of questions relating to the vertical logic of the logframe, considering risks to the achievement of activities, outputs and purpose (see Chapter 7).

6.4 Assessment of natural hazard-related risk

The above section relates to general assessments of risk. But do risks pertaining to natural hazards get marginalised in such assessments because they are somehow too nebulous – perhaps the selected 'wild card' thrown in for the sake of completeness, but not properly assessed due to various constraints, most notably limited resources for risk assessment and often high uncertainty (see below)?

Some aid agencies have developed checklists of potential risks that could arise, including mention of natural hazards (see Box 6.3). However, few agencies seem to have an explicit policy on measuring risks emanating from natural hazards and certainly no specific guidelines on how to go about this, other than in the context of environmental review (see Chapter 4).

An apparent exception, ADB's Operating Manual Section 25 (issued on 12 December 1995) *Rehabilitation Assistance After Disaster*, paragraph 16, states that:

…risk analysis and management of natural hazards should form an integral part of the appraisal process for all projects that may potentially be affected by disasters. Such analysis will help in evolving effective strategies to mitigate, or eliminate, the impact of hazards in general and the vulnerability of specific project elements or target groups in particular, and in selecting appropriate disaster responses well before disasters take place.

(ADB 1995)

However, ADB provides no guidelines on how to go about this analysis and apparently rarely, if ever, actually does it. Meanwhile, a World Bank update to its *Environmental Assessment Sourcebook* (World Bank 1997: 8) states that 'while the primary focus of risk assessment is the hazards and risks arising from human activities, the Bank is also concerned with risks arising from natural disasters such as floods, typhoons and earthquakes'. But, again, the document does not contain any information on how to conduct a hazard risk assessment.

There is also a possibility that even where natural hazard risk is considered, the view may be taken that there is little that can be reasonably done, at least within the confines of the project, to tackle it. A distinction is commonly made between internal and external sources of risk, with natural hazards categorised as an external risk. DFID (2003c: 3), for instance, defines external risk as 'a risk aris[ing] because of circumstances or events outside of the organization. The ability to exert control may be limited to planning for a contingency response'.

It is important to stress, however, that natural hazard risks *can* potentially be reduced if scientific information is carefully examined, sources of vulnerability identified and possible mitigation measures implemented. Assessment allows one to:

- predict the expected impact of natural hazards on the project, including the extent to which it will succeed in its objectives;
- identify appropriate risk management strategies;
- predict the impact a project would have on forms and levels of vulnerability in the wider community; and
- help derive national policy objectives, such as improved land use planning and building codes.

Box 6.3 Categories of risk

Some aid agencies have developed detailed guidelines to facilitate risk management, often including checklists of potential risks that could arise (e.g., AusAID 2000; CIDA 2000; DFID 2003c). Precise categorization and examples of sources of risk indicated vary but essentially cover the same ground including some mention of natural hazards.

DFID's *Tools for Development* (2003c), for instance, categorises risk as follows:

- Risks arising from factors actually or potentially under your control (e.g., poor design, ineffective management systems, poor performance by contractors).
- Risks arising from factors in the wider policy and institutional environment that are only controllable by decision-makers elsewhere (e.g., poor policy environment, institutional weaknesses; lack of political will).
- Risks that are essentially 'uncontrollable' (e.g., natural disasters, political instability, world prices, interest rates).

In listing specific types of risk, the same document uses a slightly different categorization, labelling risks as either external, financial, activity or human resources, but again includes 'Acts of God' under external risks.[7] AusAID (2000) lists examples of sources of risk according to stage in the project cycle, including 'environmental emergencies' at the planning and feasibility stages and 'natural events (landslip/subsidence; earthquake; fire; flood; lightning; wind; and weather)' at the project delivery stages.

The CIDA guidelines mention natural hazards in the context of economic analysis, where it is indicated that analysis should include consideration of the following question: 'how vulnerable is the economy to "natural shocks" – if the economy is largely dependent on agriculture, to what extent can a bad harvest, or the impact of natural disasters (floods, hurricanes etc.) cause serious setbacks in the economy?' (CIDA 2000: 17). Under environmental analysis, several possible questions also relating to natural hazards are also listed, including 'what is the propensity for and impact of natural disasters such as earthquakes, hurricanes, floods, droughts, etc.?' However, environmental analysis is optional – the only one of the six types of analysis that is. It is left to the discretion of the analyst to decide whether it is required, depending on whether or not environmental concerns are considered to pose serious risks.

Disasters can also be an underlying cause of a number of the other risks listed – for instance, infrastructure risks (by destroying infrastructure), budgetary risks (by causing reallocation of counterpart funding to post-disaster relief and rehabilitation operations), operational risks (by delaying projects and perhaps damaging progress to date) and personnel risks (by killing and maiming and diverting human resources into other activities). Again, however, there may be ways of limiting the impact of disasters on such variables, either by taking action within the confines of a specific project or through a broader policy or programme. For example, critical lifeline infrastructure can be hazard-proofed, leaving key transport routes open while financing for high-priority projects can be protected from reallocation.

A hazard risk assessment essentially involves hazard identification, including estimation of probabilities of occurrence of various hazards of different magnitudes; risk estimation, combining information on the magnitude and frequency of hazards with vulnerability to them; risk evaluation of the significance and acceptability or tolerance of risk, examining the balance between risks and benefits; and risk management, involving decisions on the acceptability of risks and implementation of mitigation measures to reduce or eliminate unacceptable risks and damage (EC 2000; World Bank 1997).

Hazard data is potentially available in various forms. Twigg (2004), for instance, cites:

- Geological hazard maps showing fault lines or unstable slopes liable to cause landslides.
- Hydrological maps of flood-prone areas.
- Wind, rainfall and sea-surface temperature data.
- Recordings of seismic activity from monitoring stations.
- Local rainfall and flood level records.

Modern technology has advanced hazard mapping and prediction of future events considerably through techniques such as geological mapping and satellite imagery, production of high-resolution maps and computer modelling. New geographic information system (GIS) mapping techniques, in particular, are revolutionising the potential capacity to analyse hazards, risks and vulnerability, and plan for disasters (Twigg 2004). A GIS is a software package used for information storage, situation analysis and modelling.

7. The DFID (2003b) risk register, which focuses on risks to DFID's overall operations, uses the same categorisation of risks but lists 'global warming caus[ing] increased natural disasters and economic damage to developing countries and poor people' under external risks rather than natural disasters themselves. It also includes conflict as an external risk.

The software works basically with spatial data and enables different kinds of data – for instance, contour lines, forests, watercourses and other geophysical phenomena, roads and other physical structures, demographic and social factors – to be overlaid in map form (Twigg 2004).

Estimation of losses has become extremely sophisticated thanks to the development of computer-based models, many of them produced by the insurance industry (see Box 6.4).[8] For example, there are now well-developed computational techniques for determining flood frequencies, including hydrodynamic modelling of river systems, and for mapping and estimating flood damages (Evans et al. 1999). Hurricane models can combine wind speed 'exceedance' probabilities with loss records from historical events, normalised to present-day values and adjusted to take account of inflation, population, housing stock and so forth (e.g., Murnane c.2003). Seasonal and inter-seasonal weather predictions can also be used to manage risk, informing production decisions (e.g., timing of planting of particular crops, choice of crop varieties, etc.) and trading decisions (importing additional or reduced volumes, hedging price movements via foreword buying on commodities

Box 6.4 Catastrophe insurance

The insurance and reinsurance industry is at the forefront of efforts to quantify natural hazard risks, focusing on the valuation of insured losses. Insurers need to know what risks they are covering in order to price premiums appropriately and ensure that they are sufficiently capitalised to bear potential claims. Indeed, insurance modelling has become increasingly sophisticated over the past decade, spurred both by substantial losses and by advancements in computer modelling techniques. Heavy insured losses of US$ 40 billion between 1991 and 1994 were attributed to the fact that the property insurance industry had 'no sound basis for setting rates' as it had not maintained records on losses for each weather peril and was unable to determine how changing conditions, whether related to changes in the weather or shifting vulnerability, could affect them (Changnon 2003).

Catastrophe insurance models contain hazard, damage and loss components (Murnane 2002). The hazard component generates probabilities on the pattern of physical disturbance (wind speeds, ground motions, etc.) associated with a hazard event, using scientific data on future locations, scales and rates of occurrence of events (Major 1999; Schneider et al. 1999). The calculation must take into account local factors, such as soil conditions in analysing earthquakes, and terrain and topography in assessing hurricanes (Schneider et al. 1999). It should also consider collateral effects, such as landslides, soil liquefaction and fires from earthquakes and storm surge, and flying debris from hurricanes (Schneider et al. 1999). Historical records are, however, often too short to provide reliable estimates for the most intense events, implying that either loss probabilities are based on averages or the effects of historical events are extrapolated to predict potentially catastrophic or probable maximum events (Murnane 2002; Schneider et al. 2003). The quality and availability of detailed information on geology, elevation and slope, and vegetation can also vary considerably. Calibration of the hazard component is further complicated by potential impacts of climate change, which also need to be taken into account.

The damage or engineering component calculates the damage that would be produced by a hazard (Murnane 2002). It applies data on physical intensity to site-specific structures and their contents and estimates damage and/or how particular factors would modify vulnerability (Major 1999; Schneider et al. 1999). In a generic evaluation, each structure is assigned to a particular class (e.g., unreinforced masonry) for which a general relationship has been established between each hazard intensity and expected damage (Schneider et al. 1999). Contents are similarly assigned to particular classes. Assessment of generic risk requires inventories of buildings and infrastructure.

Finally, the loss or insurance component totals the costs produced by the catastrophic event and estimates the losses to an insurer's portfolio. The total losses include the cost of repairing damaged buildings, payments for loss of business coverage, and the various deductibles and coverage limits associated with particular insurance policies (Murnane 2002).

Probable maximum loss (PML) curves then can be calculated showing the probabilities of occurrence and cumulative effects of hazard intensities, physical damage and restoration costs. The curve plots the probability of meeting or exceeding a level of loss in a given time period (that is, the one-in-ten-year loss, one-in-50-year loss, etc.) against the loss incurred (Schneider et al. 1999). Average or expected loss in any given year can also be calculated as the cumulative loss expected over all years (say, over a 100-year period) divided by the number of years. PMLs can be estimated and compared showing losses with and without a particular mitigation measure.

8. See Woo (1999) for in-depth coverage of natural hazard risk modelling.

markets, etc.). There have also been various initiatives to develop tools for measuring earthquake risk, particularly in urban areas (see Box 6.5).

However, there may be uncertainties pertaining to hazard parameters, in part reflecting limited historical records. For instance, hurricane records span only 100 years even for the United States (Major 1999) and historical data on hazard events and even on rainfall are very limited for many developing countries. Information on hazards with longer return periods, such as earthquakes and volcanic eruptions, is often particularly limited, with heavy reliance on scientific investigation of historical events and predictive modelling exercises. Hazard mapping may also have been only partially undertaken and high-

Box 6.5 Earthquake risk modelling: estimating existing risk

There has been a dramatic increase in efforts aimed at estimating the direct and indirect losses caused by earthquakes, spurred in part by the rising economic cost of disasters (Tierney et al. c.2000) and also by the fact that rapid urbanisation in developing countries has placed considerable numbers of people at risk from earthquakes. In 1950, slightly over 50 per cent of the urban population at risk from earthquakes lived in developing countries but this figure had increased to over 85 per cent by 2000 (GHI/UNCRD 2001). Most techniques and methodologies for earthquake modelling have been developed in the context of industrial countries, with the objective of generating highly accurate estimates of potential loss (GHI 2001). This box, however, provides some examples of those developed specifically for use in developing countries.

GeoHazards International (GHI), for instance, has developed a tool for estimating urban earthquake risk in developing countries, focusing on key, rather than all, factors contributing to risk and making the best possible use of existing information and local scientists' expertise and familiarity with a region. This methodology was later adopted by the UN International Decade for Natural Disaster Reduction's Risk Assessment Tools for Diagnosis of Urban Areas Against Seismic Disasters (RADIUS) project, which sought more generally to develop practical tools for urban risk management, including related plans, and promote risk reduction (GHI 2001).

GHI, together with the UN Centre for Regional Development (UNCRD), has also undertaken a Global Earthquake Safety Initiative Pilot Project to evaluate a methodology for assessing community earthquake safety by applying it to 21 cities (GHI/UNCRD 2001). The methodology focuses on loss. The role of five factors in contributing to life-threatening injuries and fatalities are considered:

- building fatality potential (in turn based on ground-shaking on firm and soft soils, the building stock, the quality of building design, construction and materials, the weight of the buildings and building occupancy rate);
- landslide fatality potential;
- search-and-rescue life-saving potential;
- fire fatality potential; and
- medical-care life-saving potential.

Fatalities are calculated based on the number of lives that would be lost if all parts of a city, as it exists today, experienced shaking at a level that has only a 10 per cent chance of being equalled or exceeded in ten years. The project concluded that the methodology produced useful results, including that it increased awareness of earthquake risk; identified sources of risk and their relative importance; and generated information that could be used to evaluate the effectiveness of mitigation options and relative costs and benefits and that could be used to set national and international funding priorities.

A not-dissimilar initiative has been undertaken by an international NGO working in central and south Asia to rank vulnerability of individual structures, although primarily from an engineering perspective. This methodology involves a rapid, non-invasive, assessment of individual structures, measuring seismic, physical and human vulnerability, the latter defined in safety terms. In relatively homogenous areas, assessments can be used to extrapolate statements about the vulnerability of the wider area. The methodology has been field-tested in Tajikistan and it is intended that further assessments will be undertaken elsewhere.

All of the above deal with the estimation of existing risk. As such, they are not directly relevant in designing new projects, where attention should focus on ensuring that appropriate seismic standards are applied in the first place. However, such models can generate useful background information, indicating the risk environment and potential indirect threats to the success of a project – or even a broader programme – relating, for instance, to the destruction of marketing outlets or disruption to the supply of essential services (electricity, water, telecommunications, etc.).

resolution maps, in particular, may not be available. Reliable, extensive and up-to-date data required for GIS may simply not be available.

Information also needs to be in a user-friendly form. In practice, hazard data is often in the form of a probability distribution, showing expected values with associated levels of variability – for instance, average rainfall and tails of distribution. Some training in statistics is required to understand and use it. Even maps can be difficult to interpret, particularly when a particular area faces a number of different hazards.

There are additional uncertainties relating to the impact of climate change on the frequency and severity of climatological events. These uncertainties should be identified 'as they can influence the scale of the consequences' (World Bank 1997: 4). Loss estimation introduces further uncertainties. In particular, damage estimates, whether determined qualitatively or quantitatively, necessarily involve some simplification as factors determining vulnerability are highly complex. The selected mathematical formulation of a model may not be correct (Major 1999).

At the same time it should be remembered that it is not always necessary to rely on sophisticated technologies and outside specialists: 'visual surveys by experienced people can identify areas at risk from landslides; simple stream gauges or flood marks can be used to monitor rising water and identify areas likely to be flooded; and local people's knowledge of hazards is often more accurate and extensive than outsiders appreciate' (Twigg 2004: 30).

6.5 Conclusion

Overall assessments of risk are typically very general and, by definition, qualitative as they seek to take a wide range of factors into account. By definition, consideration of natural hazard risk is therefore limited. Tools exist for undertaking more in-depth analysis, whether in the form of stand-alone assessments or as part of appraisal from, say, an environmental or social perspective (see Chapters 4 and 5). Very few stand-alone hazard risk assessments appear to be taken, however. Indeed, it is even not clear whether there is a case for undertaking separate analysis. Natural hazards can pose a wide variety of risks, threatening individual livelihoods, physical structures, macroeconomic performance, environmental resources and so forth. It is difficult to capture this eclectic grouping in a single form of analysis. As such, it seems better to assess and address risks emanating from natural hazards through other forms of risk assessment – economic, environmental, social, etc.

Having said that, certain specialist forms of risk assessment could be applied to consider particular aspects of natural hazard risk. In particular, there is a strong case for arguing that safety risk assessments (SRAs) should be undertaken in high-risk areas to ensure that all aid-funded structures are at least built to safety standards. Currently, SRA is primarily concerned with control of risk within the chemical and manufacturing or petroleum industries, including handling, storage and disposal of hazardous materials and wastes, focusing on safety of the workforce and adjacent communities (World Bank 1997).[9]

Extending the horizon of risk assessments beyond the project implementation phase could also enhance the attention paid to natural hazards. AusAID (2000: 11) recommends that 'risk management be broadened to incorporate risks to the sustainability of benefits as well as to project implementation', arguing that 'the significant difference between managing risk and sustainability is that sustainability makes us consider the long-term outcomes beyond the direct influence of project management, whereas risk analysis and management is about threats to implementation and the achievement of objectives within the defined period of the project' (ibid.: 11). This longer-term approach would increase the importance of external factors beyond the direct control of project management.

9. Most SRAs are qualitative or semi-quantitative, with risks typically expressed in terms of the numbers of additional deaths or injuries in a population over a specified time frame. Common methods for hazard identification include hazard and operability studies, failure mode and effect analysis, 'what-if' checklists and historical data on similar processes. The probability of occurrence of identified hazards is then estimated (World Bank 1997).

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Chapter 7

Logical frameworks

7.1 Purpose of the logical framework approach

The logical framework, or logframe, approach is a popular and widely-used tool for project design, integrating various interests and concerns. The tool, originally developed for military planning purposes, was introduced by USAID in the 1970s and is now an international standard planning tool for aid agencies. Many agencies now require preparation of logframes for planning, implementation and evaluation purposes of policies, programmes and projects.

The logframe approach provides 'a structured, logical approach to setting priorities and determining the intended results and activities of a project' (Jackson n.d.: 2). If used correctly, the logframe analysis can help 'achieve stakeholder consensus; organise thinking; relate activities and investment to expected results; set performance indicators; allocate responsibilities; [and] communicate concisely and unambiguously with all key stakeholders' (DFID c.2003: 1). It also provides a management tool.

The logframe analysis can be used as an iterative, dynamic tool throughout the project cycle, rather than as a one-off exercise. It can be used for identifying and assessing activities, preparing the project design, appraising project designs, implementing approved projects and monitoring, reviewing and evaluating project progress and performance (AusAID 2000). In the words of DFID (c.2003: 3), 'it is a living document: it should be reviewed regularly during programme and project implementation', as the project or programme itself develops and circumstances change. As such, it can be subject to change. It is also 'a "master tool" for creating other tools, such as the detailed budget, the breakdown of responsibilities, the implementation schedule and a monitoring plan' (EC 2001: 8).

For the sake of simplicity, the following text refers to the undertaking of logframe analysis in the context of projects. However, it could equally apply to analysis of sectoral programmes or to policies.

7.2 Basic steps in undertaking a logframe analysis

Donor agencies' manuals vary slightly in the order of steps prescribed in undertaking logframe analysis. Some, for instance, include stakeholder analysis as part of other stages rather than as a separate activity. However, the broad approach is the same, particularly given that the different steps are iterative, with, for instance, stakeholder analysis required at various stages.

The basic steps of a logframe analysis are as follows:

- *Problem analysis (or situational and cause-and-effect analysis)*. Identification of the central problem(s) and development of a problem tree, showing causes and effects of the central problem and linkages between them via the central problem. Problem analysis should be based on a thorough understanding of the current situation, including socio-economic, gender and biophysical characteristics; regulatory frameworks and how they are enforced; and major actors (UNDP 2003). Brainstorming techniques can be used to identify the main problems (Jackson n.d.).
- *Stakeholder analysis.* Ascertainment of perceptions of all the different actors who may have an influence on the intended project or are affected by it, and definition of their stakes in the problem, including roles and interests in addressing it and reaching solutions. Main purposes of stakeholder analysis are 'to better address distributional and social impacts of projects, programs and policies' and 'to identify existing or potential conflicts of interest, and factor appropriate mitigation strategies into activity design' (AusAID 2000: 6).
- *Objectives tree/analysis.* Translation of effects identified in the problems analysis into positive statements and then use of causes to determine means-end relationships. In its widest sense, objectives analysis is 'a procedure for systematically identifying, categorizing, specifying and – if required – balancing out objectives of all parties involved in a specific situation' (Jackson n.d.: 5). Some objectives may not be achievable and so will have to be addressed in other projects.

Others may be unrealistic and will have to be given up.

- *Analysis of alternative strategies.* Analysis of possible strategies that could help solve the problem against a series of pre-identified, weighted criteria (e.g., benefits to target groups; sustainability of benefits; technical, social, economic, financial, institutional, environmental and political feasibility and desirability). In selecting strategies, UNDP (2003) urges that risks associated with different strategies are also explored; opportunities are sought for mitigating negative effects; and trade-offs and opportunities between different strategies are understood. Objectives and priorities also have to be in line with funding resources available.

These first four steps basically answer a series of questions relating to the focus of the project: its aims; at what level and where, geographically, it will operate; the political, socio-economic, technological and biological environment in which the project will operate; major stakeholders; others doing related work and the particular niche of the proposed project; project implementers; intended duration of the project; anticipated level of funding; and funding source (Jackson n.d.).

A logframe matrix is then developed, providing a summary of why a project is being carried out, what it expects to achieve, how it will achieve its outputs or results, which external factors are crucial for its success, how the success can be assessed and means of its verification (Jackson n.d.). This requires further analysis relating to:

- specific outputs, activities and inputs;
- the identification of risks or assumptions, indicating conditions external to the project that could prevent or must be met in order for project objectives to be achieved and supporting monitoring of risks during project implementation. Assumptions should be realistic and complete, and risks acceptable (EC 2001). Risks and assumptions include those objectives identified in the objectives analysis that the project is not seeking to meet or that are not achievable. These may affect the project's implementation and long-term sustainability but lie outside the project's control; and
- identification of monitoring and evaluation indicators, using baseline information gathered as part of the problem analysis. DFID (c.2003), for instance, supports a 'Quality, Quantity, Time' maxim for constructing indicators, although noting that this maxim should not be applied rigidly and that appropriate qualitative indicators should also be developed. DFID (ibid.) also advises that indicators and means of verifications should be relevant, valid, reliable, measurable or verifiable and cost-effective or proportionate.[1]

The logframe matrix, in turn, is then used to develop a detailed workplan and project budget, based on the activities identified in it. Subsequently, the logframe matrix should be used as a basic management and monitoring tool.

7.2.1 Vertical and horizontal logic

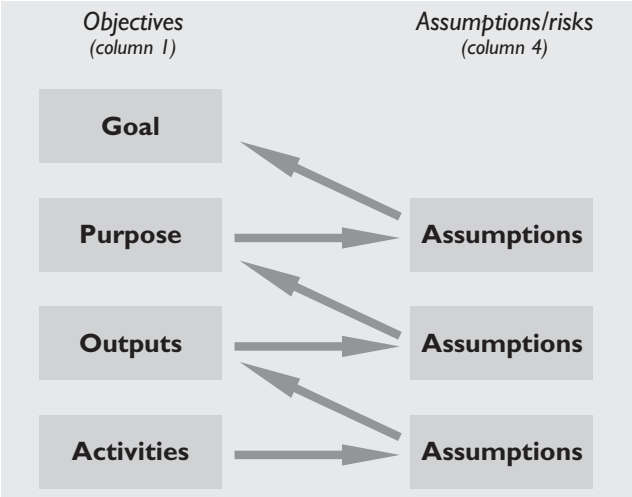
A logframe matrix typically has four (sometimes five) rows and four columns. Titles of columns and rows vary slightly between donor agencies but their basic meaning is the same (see Annex 7.1). Row headings relate to project goals, purpose, outputs, inputs and activities. Column headings relate to design summary, performance targets/indicators (specific tangible/quantifiable measures of achievement for each level in the design summary), monitoring and evaluation mechanisms and assumptions/risks.

The vertical logic provides a detailed breakdown of the chain of causality in the project design, with each level required in order for the one above to succeed. Projects are subject to external factors outside the direct control of project managers. These factors are highlighted in the fourth column of a logframe matrix, either as assumptions that have to be met in order for the project to stay on track or as risks that could threaten the project's course. Moving vertically up a logframe, if assumptions at each level are met then the next tier of objectives can be achieved. Thus, if inputs are provided and the assumptions hold, then activities can be undertaken; if activities are undertaken and the assumptions hold, then outputs will be produced; and so forth up to the top level where, if the project purpose is supported and assumptions hold, then this should contribute towards achievement of the overall goal (see Figure 7.1). As such, the vertical logic 'identifies what the project intends to do, clarifies the causal relationships, and specifies the important assumptions and uncertainties beyond the project manager's control' (AusAID 2000: 15). If the project 'has good causality, then the vertical logic should be correct and demonstrable' (Jackson n.d.: 10).

The horizontal logic helps establish the basis for monitoring and evaluation of a project (AusAID 2000). A project's activities, inputs and outputs need to be

1. DFID (c.2003) also suggests that in defining a logframe's objectives, SMARTER (specific, measurable, achievable, realistic, time-bound, enjoyable, rewarding) indicators are helpful and that SPICED (subjective, participatory, indirect, cross-checked, empowering, diverse) indicators are useful in defining a relevant and comprehensive set of objectively verifiable indicators. The EC (2001) similarly states that objectively verifiable indicators should be SMART.

Figure 7.1 Vertical logic – relationship between objectives and assumptions



Source: After AusAID (2000)

monitored; achievement of outputs, component objectives and purpose periodically measured and reviewed; achievement of purpose evaluated at the end of the project; and achievement of the goal evaluated ex post. Indicators for monitoring and evaluation therefore need to be determined.[2]

7.3 Potential for incorporating risks emanating from natural hazards into logframe analysis

Analysis of risks and assumptions is an integral part of logframe analysis. Moreover, logframe analysis naturally leads one into further risk assessment, stakeholder consultations on risk and the preparation of a risk management plan, as well as sustainability analysis and development of a sustainability strategy (AusAID 2000). As such, logframe analysis is a natural tool for considering potential risks emanating from natural hazards.

However, rather than considering the issue of natural hazards purely in terms of risk assessment, it is important to build it into other stages of the logframe analysis as well. First, in hazard-prone countries, impacts of past disasters and the behavioural influence of anticipated future ones (for instance on crop production decisions) should be considered in undertaking problem analysis. In areas that experience frequent hazard events, full involvement of target groups in stakeholder analysis – a potential benefit of the logframe approach, as it 'provides a valuable tool for encouraging substantive and meaningful participation of all key stakeholders in project design and implementation' (Saldanha and Whittle 1998: 54) – could help in this regard, giving local communities a voice to explain their living and working environments.

Second, in undertaking analysis of alternative strategies, the impact of a project on vulnerability to natural hazards and the feasibility of a project given the probability of natural hazard events and related risks could be introduced as additional criteria against which possible strategies are measured and compared. Risks emanating from natural hazards are indirectly covered by existing criteria (for instance, in assessing sustainability of benefits and economic and financial viability) but in all probability are unlikely actually to be considered.

Logframe analysis also encourages emphasis on the process as well as the products of an activity – that is, how something is done, not just what is done (DFID c.2003). This may help increase attention to risk reduction, by promoting exploration of alternative options that also mitigate against disaster. As DFID (c.2003: 5) states, 'focus on the processes will generally lead to better targeting at real problems and needs, better implementation and improved sustainability'.

Risks and assumptions must be considered at the various levels of a logframe matrix: in terms of project goals, purpose, outputs, activities and inputs. With a little imagination, natural hazards may pose a risk at any – perhaps all – levels of activity in a logframe matrix, i.e., they may:

- restrict inputs from leading to activities (e.g., if a disaster occurs and volunteers for a training programme are no longer able to attend a course);
- restrict activities from creating outputs (e.g., by destroying infrastructure built under a project); and/or
- restrict outputs from achieving the purpose or objective of a project (e.g., if there is post-disaster out-migration from an area in search of work, reducing the number of beneficiaries from a water supply project; or if there is a post-disaster withdrawal of children from a school to generate additional family income, limiting achievements of a project aimed at increasing literacy rates).

2. AusAID (2000: 25) cautions, however, that although the logframe matrix can be used as a framework for designing the monitoring and evaluation system, 'it is usually not appropriate to specify indicators for every activity… as this tends to clutter the matrix with too much detail. Activity and monitoring systems are often better defined and established during implementation by the management team'. AusAID (2000) also urges caution in specifying quantified targets in the logframe as this requires detailed assessment and agreement by all the implementing agencies.

Leading on from this, Saldanha and Whittle (1998: 44) list four options for dealing with risks (and assumptions) that are considered beyond the control of the project:

- *Do nothing.* If all risks and assumptions are of minor significance and unlikely to endanger achievement of project objectives then they can be ignored.
- *Change the project design.* Add outputs and/or inputs to address the assumption or risk (e.g., to provide additional water resources as a contingency resource to bridge short periods of drought in a project aimed at increasing rice production).
- *Add a new project.* This may be necessary to ensure that a key assumption is met. Indeed, increasing attention to risks emanating from natural hazards in logframe analysis could be a catalyst for implementing more disaster mitigation projects as well as ensuring that natural hazard-related risks are in general handled more appropriately.
- *Abandon the project.* This may be the wisest course of action if the risk is too great and measures to deal with it too expensive or difficult.

Finally, it should be remembered that logframe matrices are not fixed in stone. Instead, they should be adjusted post-disaster to reflect impacts in a project. In this sense, they offer a tool for systematically and logically thinking through the consequences of a disaster and adjusting projects to reflect perceived or actual changes in the form and nature of related risk.

7.4 Complicating factors

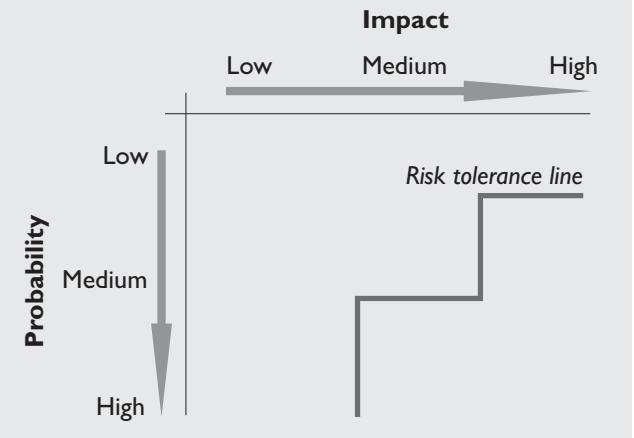
Logframe analysis has certain recognised limitations, which can restrict its potential use in ensuring that adequate consideration is paid to possible natural hazard-related risks and that appropriate mitigating steps are taken:

- Logframe analysis may not be applied in a very participatory fashion, even if stakeholder analysis is included. This may imply that risks emanating from natural hazards are ignored.
- Logframe matrices are often developed after a project has been designed, basically as a box-filling exercise to satisfy bureaucratic requirements, whether internal or of a potential funding body, rather than as a planning tool. This may imply that opportunities for adapting projects to mitigate the impacts of natural hazards are lost.
- Late, mechanistic preparation of logframe matrices can also result in the marginalisation of risk (AusAID 2000).
- Risks and assumptions are sometimes dealt with too superficially and no action is taken to address them (Saldanha and Whittle 1998).
- Logframe analysis does not readily enable the monitoring of unintended consequences (for instance, increasing vulnerability to natural hazards).
- It has become standard convention to exclude objectives that cannot be easily measured – such as risk reduction – from the logical framework matrix (Schiefer and Döbel 2001).
- Logframe analysis is often developed and used rigidly, stifling innovative thinking and adaptive management (Jackson n.d.).

The particular emphasis of a logframe analysis will also reflect priority aims and practices of the donor agency itself. In the absence of specific guidelines to consider disaster-related issues or revisions in policy to make risk reduction a primary goal of donor agencies, the degree of consideration of natural hazards will depend on background information on the project area, previous disaster exposure of the team undertaking the logframe analysis and the broader degree of success of an organisation to draw and utilise lessons from its previous experience.

The types of hazard that could occur will have an additional bearing on how and to what extent related risks are considered as part of the logframe analysis. In undertaking logframe analysis, the probability and significance of external assumptions being met and the seriousness and consequences of risk factors occurring should be estimated. Some assumptions and risks may be of only marginal importance but others could be critical. Risks are assessed in terms of the basic components of risk: probability of occurrence and scale of impact (see Figure 7.2). Risks falling to

Figure 7.2 Summary risk profile



the left of the risk tolerance line – that is, with lower probability and lower impact of failure – are discarded.

In the case of natural hazards, different types of hazard are associated with different probabilities of occurrence. Climatological hazards are most likely to be identified as posing both problems and risks in undertaking logframe analysis, reflecting both their shorter return periods (that is, the fact that there is a higher probability that they will occur over the life of a project) and the fact that, in the case of drought, they could threaten availability of a direct input to the project (rainfall). In contrast, risks emanating from earthquakes and volcanic hazards, with much longer return periods, may be discounted according to such analysis as probabilities of occurrence are low (ignoring projects in an area where there is ongoing volcanic activity).

However, this does not mean that seismic risks should be ignored. Instead, this observation underlines the point that risk-sensitive project appraisal and design practices are not sufficient in themselves. They need to be complemented by responsible policy documents, in the case of earthquakes ensuring that that there is an institutional responsibility to build to appropriate standards.

More general difficulties in quantifying natural hazard-related risks can also create problems (see Chapter 6). AusAID (2000) cautions that although the vertical logic of logframe analysis encourages examination of risk, it can also potentially encourage the downgrading of less quantified risks, such as those relating to natural hazards.

7.5 Practice

For the purposes of this study, five relatively detailed guidelines on logframe analysis were examined (produced by ADB, AusAID, DFID, EC and UNDP). Generic sample logframes were also available for IFRC and the World Bank.

Only the ADB guidelines (Saldanha and Whittle 1998) listed general types of risk (although some of the other donors list risks in companion risk analysis documents – see Chapter 6). Typical areas in which assumptions influence the outcomes of a project were listed as 'market conditions/prices; macroeconomic policies/conditions; political and social conditions; sector policies and conditions; environmental conditions; private sector capability; government administrative capability; community/NGO support; counterpart funding' (ibid.: 43). 'Natural' disasters were mentioned separately as an example of a risk to a project.[3]

Other guidelines (other than the EC (2001) document) contain a few other references to natural hazards. UNDP (2003) includes existence or risk of 'natural' disasters as a factor defining the programme environment that should be considered in understanding the current situation within which a project would occur. Rainfall is mentioned in the AusAID (2000) and ADB (Saldanha and Whittle 1998) guidelines; and 'climate data' in the DFID (c.2003) guidelines.

Unfortunately, in terms of examples of worked logframes, very few were available for review for the purposes of this study and it is not possible to extrapolate general comments from the very small number viewed. However, it is worth commenting that although natural hazards were mentioned in a few this appears to have been little more than lip service, with no explicit efforts indicated to reduce related risks.

It should also be remembered that logframes are developed by donor agencies both directly and in a third-party capacity, when seeking funding from another donor agency. This may affect how risks are presented, with a tendency to downplay risks where third-party funding is sought if it is felt that the risks indicated – so-called 'killer assumptions' that could wreck a project if the assumption turns out to be wrong – could jeopardise securing of funding. Some NGO staff have even admitted in discussion that, on occasion, they have not included natural hazards as a risk because they were concerned that it could put off potential funders (Twigg et al. 2000).

7.6 Conclusion

Analysis of risks and assumptions is an integral part of logframe analysis and thus a natural tool for considering risks emanating from natural hazards. It is important to consider the probability of natural hazard events and related vulnerability at all stages of a logframe analysis – for instance, in undertaking the problem analysis, consulting stakeholders, analysing alternative strategies and so forth. In order to maximise the potential value of logframe analysis in reducing risk, the analysis should also begin at a very early stage in project preparation. In practice, however, the potential usefulness of logframe analysis in analysing and addressing natural hazard-related risks appears to have gone largely unutilised.

3. 'Assumptions and Risks identify other conditions, which are external to the project but are needed to ensure that one level indeed causes the next level of performance to happen. Thus, given the level of inputs, outputs will be produced assuming project staff have the required technical skills (assumptions) – and outputs will give us the expected impacts – assuming no major natural disaster takes place (risks)' (Saldanha and Whittle 1998: 30).

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Annex 7.1 Sample logical framework matrix: ADB project design checklist

Design summary	Indicators and targets	Monitoring mechanisms	Assumptions and risks
Goal The long-term objective – i.e., project 'vision' – is stated; not something that the project will be expected to achieve alone during its lifetime.	*Indicators* are the preselected means to measure performance. A **target** is a predetermined success level for an indicator. The measurement unit for each indicator should be specified. The desired long-term sustainable impacts are stated. Goal impacts are usually only indirectly related – and partially attributable – to the project, and are likely to occur a considerable time after the project purpose has been attained.	Monitoring mechanisms are *either* established sources of data for the indicators and targets, *or* the means (and frequency) for collecting the data. Every indicator has at least one source of data, or means for collecting it. The source and/or means for collecting data is beyond the project, and is already institutionalised.	Only assumptions and risks beyond the control of the project – but essential to its success – are cited. Assumptions and risks at the goal level (if any) relate to the higher-level country strategy programme. **In general, leave this block blank.**
Purpose ● The improved situation for the target beneficiaries is summarised; i.e., after the project has satisfactorily completed (or delivered) the outputs to alleviate a perceived problem. *(I.e., the purpose is the immediate reason **why** the project is being undertaken: **not what** the project is going to do.)* ● The project has no more than **two** immediate objectives.	The desired improvement in the situation (i.e., the effect) as a result of the project is stated. *(Purpose indicators and targets reflect the changes in processes, results and/or behaviour by target beneficiaries that are expected shortly after the project outputs have been delivered.)*	The source and/or means for collecting data is beyond the project.	Assumptions and risks at the purpose level relate to the goal.
Outputs The key component categories are stated as **results** that can be produced/delivered during project implementation.	The outputs are all expected to be completed by the end of the project *(Outputs are deliverables and are all within the control of the project.)*	The source and/or means for collecting data is within the project control.	Assumptions and risks at the output level relate to the purpose.

Design summary	Indicators and targets	Monitoring mechanisms	Assumptions and risks
Activities The key tasks, steps, or stages to be undertaken by the project are listed.	The project implementation schedule andresponsibilities are identified. (*Use the following format:* · Start: (date) · Complete: (date) · Responsibility: (organisation or individual))	The source and/or means for collecting data is within the project control.	Assumptions and risks at the activity level relate to the outputs.
Inputs The various resource categories required to undertake the project are identified.	Indicators and targets are all expressed in terms of money and/or level of effort.	The source and/or means for collecting data is within the project control.	Assumptions and risks at the input level relate to the activities.

Source: ADB n.d.

Annex 7.2 Structure of logframe matrices

ADB	DFID	EC	IFRC	UNDP	World Bank
Row headings					
Goal	Goals	Overall objectives	Overall goal	Outcomes	Goal
Purpose	Purpose	Project purpose	Project objectives	Outputs	Purpose
Outputs	Outputs	Results	Expected results	Activities	Objective
Activities	Activities	Activities	Activities	Inputs	Output
Inputs					Project components subcomponents
Column headings					
1. Design summary	Summary – hierarchy of objectives	Intervention logic	Overall goal	Project summary/ description	Objectives
2. Indicators and targets	Objectively verifiable indicators	Objectively verifiable indicators	Indicators	Indicators	Indicators
3. Monitoring mechanisms	Means of verification	Sources of verification	Verification sources	Means of verification	Monitoring and evaluation
4. Assumptions and risks	Assumptions and risks	Assumptions	Assumptions	External factors (assumptions/ risks)	Critical assumptions

Sources: ADB n.d.; DFID c.2003; EC 2001; IFRC 2000; UNDP 2003; World Bank n.d.

Chapter 8

Monitoring and evaluation

8.1 Introduction

This chapter is a general survey of issues relating to the monitoring and evaluation (M&E) of disaster reduction initiatives, but focusing particularly on evaluation of impact. Owing to the shortage of guidance[1] and evidence, it is largely illustrative and its conclusions are tentative. Monitoring is covered in standard manuals (e.g., Gosling 2003: 92–107) and should be part of all agencies' systems. Good monitoring is essential to evaluation, since monitoring information is an important source for evaluators.

Some of the evidence cited in this chapter is not attributed because of agencies' sensitivity about confidentiality.

8.1.1 Definitions and terminology

The OECD DAC defines evaluation as follows:

> *An evaluation is an assessment, as systematic and objective as possible, of an on-going or completed project, programme or policy, its design, implementation and results. The aim is to determine the relevance and fulfilment of objectives, developmental efficiency, effectiveness, impact and sustainability. An evaluation should provide information that is credible and useful, enabling the incorporation of lessons learned into the decision-making process of both recipients and donors.*
>
> *(OECD DAC 1991)*

Monitoring is distinct from evaluation. It usually addresses inputs, activities and outputs. Most monitoring systems are designed to meet the ongoing information needs of project managers and provide information for donor reports. Evaluations focus on outputs and especially impact, and are intended for a wider internal and external audience. Monitoring is primarily descriptive whereas evaluation is more analytical. Impact assessment is mainly analytical, and concerned with longer-term outcomes. Monitoring should be frequent, throughout the project. Evaluation is infrequent. It can take place at many points in the project cycle.

Other terms sometimes used in this context are 'review' and 'audit'. Review comes somewhere between monitoring and evaluation. Reviews supplement regular monitoring, taking place less frequently and focusing more on activities and outputs than on impact. They usually form part of internal management systems, but reviews involving external stakeholders are not uncommon. Audits are normally associated with financial accountability and honesty but the term is sometimes used more broadly.

Assessment of a project or programme can focus on several different aspects:

- *Inputs*: The human, financial and technical resources deployed; their effectiveness, cost-effectiveness and appropriateness can be assessed.
- *Activities and processes*: The performance of tasks and factors affecting this.
- *Outputs*: The immediate results the project achieves (sometimes called 'deliverables').
- *Impact (or outcomes)*: 'Significant or lasting changes in people's lives, brought about by a given action or series of actions' (Roche 1999: 21).

8.1.2 Purpose and value of M&E

The OECD DAC (1991) identifies two main purposes of evaluation:

- To improve future aid policy, programmes and projects through feedback of lessons learned.
- To provide a basis for accountability, including the provision of information to the public.

More specifically, the value of evaluation is (Hallam 1998: 23–4):

- Evaluations are the key means by which agencies seek to learn lessons from their work and incorporate them into policy and practice.
- This organisational learning is a prerequisite for the transfer of knowledge between agencies.

1. The chapter draws on recent writing on M&E in development and humanitarian work (Dawson 1996; Roche 1999; Gosling 2003; Hallam 1998; Nagarajan and Vanheukelen 1997; OECD DAC 1991; Wood et al. 2001). Twigg 2004: 337–65 has general observations on M&E in disaster reduction.

- Evaluation is often the only consolidated source showing how a programme progressed.
- Evaluations provide a means for retaining and building institutional memory.
- They question and test basic assumptions.
- They create space for lesson learning.
- The generation of written reports contributes to transparency and accountability, and means lessons can be shared more easily.
- They provide a way of assessing the critical link between those on the ground and decision-makers.
- Learning from experience is of particular value at times of policy uncertainty.

8.1.3 Planning M&E

Evaluation must be an integral part of agency planning, from strategic to project levels. All agencies should have an evaluation policy, supported by relevant guidelines and methods.

M&E systems must be planned carefully: no two projects are identical. The purpose and methods of any monitoring exercise, review or evaluation should be clearly defined and agreed. Since it is almost never possible to assess everything, there must be some focus to the assessment and its objectives must be realistic. Thought should be given to diverse conceptual and operational issues – for example, indicators, units of assessment, sampling (size and methods), geographical coverage, use of existing information sources, composition of evaluation teams, the nature and extent of beneficiary participation, scheduling, tools and methods, resources and reporting back/accountability to stakeholders. Terms of reference (TOR) should reflect the main decisions that have been made on these issues. Clear TOR are vital: many problems with evaluations stem from failure to achieve this clarity and to reach agreement with stakeholders on TOR contents.

Even the best plans can break down when confronted with reality in the field, so flexibility is essential.

8.1.4 M&E in disaster reduction

The range of M&E approaches and methods in development and relief has grown considerably since the early 1990s. There is plenty of methodological guidance and supporting networks have appeared.[2] Far less thought has been given to M&E methods applicable specifically to disaster reduction. Technical manuals overlook it. The need for regular monitoring or performance review is occasionally noted (e.g., AS/NZS 1999) but methods are rarely discussed. The few exceptions give little detail (e.g., EMA 2000: 22–4) or, especially in older manuals, concentrate on economic cost-effectiveness (e.g., UNDRO 1991: 137–40). There is a similar neglect in disaster reduction training courses, which concentrate on raising awareness, understanding concepts, hazard/risk/vulnerability/capacity assessment, and identification and implementation of risk reduction options (e.g., Coburn et al. 1994). M&E training is more likely to focus on emergency response applications (e.g., Slim et al. 1995) or learning from the impact of past emergencies for disaster planning (e.g., von Kotze and Holloway 1996: 265–77).

It is, therefore, not surprising that organisations working in mitigation and preparedness have given low priority to M&E. A recent study of 44 US state and territory post-disaster mitigation plans found their M&E provisions to be weak: 'most plans did not even address most elements of monitoring and evaluation'. About half specified monitoring of implementation progress or development of an ongoing M&E information system, organisation and process. One-third provided for assessment of obstacles and problems in implementation; 32 per cent for updating baseline data; 34 per cent for monitoring hazards; and 23 per cent for evaluating success or failure (Godschalk et al. 1999: 360–2). Studies of NGOs' mitigation and preparedness activity, NGO post-cyclone reconstruction projects and European Union (EU) food aid/security programmes have reached similar conclusions (Twigg et al. 2000: 76–8; ITDG n.d.; EuropeAid 2000: 5–6, 11, 64).

8.2 Operational issues

8.2.1 Evaluation teams

The composition of the evaluation team is a vital matter in terms of quality and accountability (ECHO 2002). The balance between internal and external assessors is especially important. In development projects, there are no fixed rules: the appropriate size and mix are selected for the specific project, and there is increasing emphasis on gender balance and local participation (Roche 1999: 61–6). In contrast, external specialists – often men – continue to

2. For example, the Active Learning Network on Accountability and Performance in Humanitarian Assistance (ALNAP) and the MandE information forum (ALNAP 2003; MandE 2003).

dominate teams evaluating risk reduction and humanitarian aid initiatives.

External evaluators' independence and impartiality make findings more credible, reduce bias and help to overcome conflicts of interest (OECD DAC 1991).[3] This is the main reason why agencies use external consultants so extensively; donors will often insist on it. Other uses include facilitating internal reviews and 'lesson learning' exercises (Madiath 2002), and providing an outside perspective at project review meetings and collating their findings (IFRC 2002). The presence of external, especially foreign, evaluators can also reinforce the credibility of a project among beneficiaries and implementers (IFRC n.d.: 8). However, there is a significant risk that an outsider will not understand all the project's complexities, especially if time is limited. The high cost of foreign consultants and international travel acts as a constraint where funds are limited, often leading to rapid evaluations with limited field access. Access to evidence and informants may be limited and uneven in such circumstances.

In disaster reduction, small evaluation teams appear to be common; they sometimes comprise an external and a regional or local consultant. Analysis by a single person is vulnerable to individual bias, whereas teams can debate methods and findings. Feedback meetings with the implementing agency are a poor substitute for this, as the agency is likely to be over-defensive about evaluation findings. The evaluation's purpose offers some guidance to the balance of the team. If the main purpose is lesson learning, it makes sense to involve more internal staff; if it is accountability, the independence of external evaluators becomes more crucial. In practice, however, most evaluations aim at lesson learning and accountability.

There are also no fixed rules about the appropriate skills mix. Some people feel that a wide range of relevant technical skills is essential; others maintain that experience in evaluation methods is more important. In some kinds of risk reduction projects, technical expertise may be valuable (e.g., science, engineering, architecture, nutrition, economics or social sciences). Evaluators need to be able to use quantitative and qualitative data and relevant data collection tools. Knowledge of local geography, society, cultures and institutions is helpful, especially since evaluators tend to draw on previous experience in identifying good practice.

Another problem noted in some evaluations is changes in team composition, as members come and go for operational, personal and institutional reasons. This is more likely in large evaluations and those taking place in more than one country. Inconsistency of method and analysis may result, which can place much of the burden of analysis and writing up on the team leader (e.g., IFRC n.d.: 6; Wiles 2001).

8.2.2 Time and timing of evaluations

Time allocation

Time for evaluations is usually very limited. A week to ten days in-country is standard, which includes briefing, interviewing key stakeholders and site visits.[4] Much time can be taken up in arranging meetings and travelling to field sites. If a visit coincides with political or other disturbances, valuable time is lost.

Time limitations influence data collection methods. They may lead to greater emphasis on qualitative information (e.g., Richmond 1996: 2–3) and over-reliance on selective field evidence, agency documents and interviews in head offices. Many evaluation reports highlight these limitations, but it seems to make little difference to commissioning agencies. Where evaluators identify lack of time as an issue in advance, commissioning agencies should be prepared to negotiate the scope or emphasis of the evaluation. Some do this (e.g., DFID: Gander et al. 2003: 4) but it is not common.

Where there is time, preparatory visits can be made to become acquainted with the area and project, meet local project staff and explain the evaluation to them, and carry out initial data collection. This happens only occasionally, in more participatory evaluations (e.g., Organisation Development Centre 1999; Tearfund 1996; Clay et al. 1999).

Research projects are often the most successful evaluations, owing to the greater time and resources committed. SOS Sahel's analysis of a food security/cash-for-work initiative in Ethiopia had six local researchers and an external lead researcher, and took six months (see Box 8.1). A series of evaluations during and after a project's lifetime is even more effective as it allows longitudinal analysis. This happens rarely. The Disaster Research Center's evaluation of FEMA's Project Impact initiative in the United States is a notable exception. This allowed researchers to assess the project's development and potential sustainability, and to reanalyse earlier evaluation data (Nigg et al. 2001; Wachtendorf and Tierney 2001; Wachtendorf et al. 2002).

3. See UNEP 2000 for some problems arising from self-evaluation.

4. Where evaluations cover more than one country, time may be even more restricted. The authors found examples of evaluators having to cover three or even four countries in a region in only three weeks, which in some cases meant only two to three days in a country.

Box 8.1 A mix of methods in evaluation

SOS Sahel's research/evaluation of its food security and cash for work programme in Ethiopia used the following methods:

- Interview-based survey of 245 randomly selected heads of household representing 5 per cent of households in three project areas. This generated basic data on population, food availability, production, consumption, marketing, income, land and livestock ownership.
- Interview-based survey of 225 women in the above households. This covered the same areas as the other survey but included questions on the management of food and other resources at the household level.
- Interviews (questionnaire format) with 159 people working on a local road improvement project as part of the cash-for-work scheme.
- Structured interviews with 60 workers employed on the same scheme.
- Marketing survey: structured interviews with 120 farmers/traders in local markets.
- Local workshop feeding back preliminary findings to farmers, project staff and local government representatives.
- Study of household coping strategies, control of resources at household level and local support mechanisms.
- Price survey: data on food and livestock prices in two local markets joined by the road improved through the cash-for-work scheme.
- Traffic survey: recording of traffic flows on the improved road (before, during and after the improvements).
- Reports by each of the six research assistants on their fieldwork, highlighting areas of relevance.
- Oral history interviews with 17 women and 15 men.
- Structured group interviews with peasants' association committees and mixed groups, and women on food security, vulnerability, coping strategies and other issues relating to work on the road.
- Individual and group interviews (structured and unstructured).
- Preliminary analysis of findings on food security and safety net planning.
- National workshop on design issues in employment-based safety nets.

Source: Jenden 1994: 7–8

Timing

Evaluations can be carried out during implementation of a project (mid-term), at its end (final) or after (ex-post). Most take place at the end of a project or phase within it, often after only two or three years. Longer-term post-project impact evaluations are rare. This bears out the findings of other research (Twigg et al. 2000: 76–8).[5] Many of the evaluations reviewed reported that it was too early in the project's life to assess effectiveness or impact (e.g., owing to donor regulations, an evaluation of a project promoting food security through flood mitigation and rice seed distribution had to be evaluated before the next harvest).

Long-term follow-up provides a comprehensive picture of impact. For example, an independent evaluation (Watson and Ndung'u 1997) of a rainwater harvesting initiative in Kenya launched over ten years previously covered:

- impact on average sorghum yields, and comparison of yields between traditional sorghum gardens and those improved by rainwater harvesting, in good and bad years;
- how the sorghum harvest was used in good and bad years;
- impact on diet;
- impact on wealth;
- gender issues in control and decision-making;
- impact on women's status;
- how the creation of new sorghum gardens affected traditional land tenure arrangements; and
- positive and negative impact on the environment.

A difficulty with long-term impact assessments is that vulnerability is dynamic and affected by a range of external factors. The context at the time of evaluation may be very different from that at the time of

5. The lack of critical long-term studies is also apparent in the published literature.

implementation (Scoones and Hakutangwi 1996: 6). Identification of such contextual changes is therefore an important part of impact evaluation.

8.3 Data collection

8.3.1 Choice of methods and approach

There is no single evaluation methodology that is universally applicable. Instead, *the choice of techniques should be determined by the particular evaluation problems at hand* (Nagarajan and Vanheukelen 1997: 42).

Data take many forms: subjective/objective; quantitative/qualitative; cross-sectional/longitudinal; primary/secondary. A variety of tools is available for collecting data, including formal surveys, structured or semi-structured interviews, group discussions, direct observation and case studies. Each method brings its own advantages and drawbacks (Roche 1999: 97–163). The choice of method depends on the nature and scale of the project, the type of information required and the frequency, ease and cost of collection. Data that can be collected or measured easily by field workers (e.g., levels of beneficiary participation in meetings, the number of rainwater harvesting structures completed) can be put into monthly or quarterly reports. Data requiring more systematic or time-consuming collection are gathered less frequently – perhaps annually.

Many evaluations of disaster reduction projects adopt a range of data collection methods. A more participatory evaluation might include: literature review, preparatory site visit, use of semi-structured and structured questionnaires, structured and informal discussions, field observation, group discussions including workshops, informal conversations with interested groups, and feedback sessions with local actors and project management committees (Organisation Development Centre 1999). A similar methodological mix can be used for much larger projects. The review of CARE International's Central America Disaster Mitigation Initiative (CAMI), which covered four countries, comprised: review of internal documentation (monthly and quarterly reports, training and methodology manuals, financial reports, etc.); semi-structured interviews with CARE personnel and consultants in Atlanta and Central America; seven participatory workshops with representatives of target communities and municipalities; a participatory workshop with the project team to analyse the preliminary findings; semi-structured interviews with project counterparts; and wider reading and consultation (CARE International 2003).

8.3.2 Participation

Data collection methodologies can be divided into two main kinds: participatory and non-participatory (Dawson 1996: 19–20). Modern development thinking emphasises the value of the former, and many participatory methods have been developed (Chambers 1997; Roche 1999: 131–50). Participatory approaches are relatively new in disaster management, other than in food security/drought mitigation: they have only become widespread since the mid-1990s. As emphasis has shifted towards community-based approaches, traditional implementers have had to learn new skills and attitudes. This process is neither quick nor straightforward. The quality of participation may fall well short of the rhetoric. Staff find it hard to move from service delivery to a facilitating role (e.g., Madiath 2002; Allen 2003). There has been some increase in the use of participatory methods in evaluations of disaster reduction projects and a broadening of the range of tools used, but this is limited compared to development practice. M&E systems remain predominantly top-down, designed to provide information to headquarters staff and donors.

Evaluators need to obtain the views of a wide range of stakeholders. Stakeholder assessment methods are well established (Dawson 1996: 14; Roche 1999: 58–61). In community-based initiatives, where the project management structure may involve several layers, all levels of actor must be included. The evaluation of the IFRC's Golfo de Fonseca project in El Salvador and Nicaragua adopted this 'layer' or 'onion peeling' approach, talking to households, community health brigades trained by the project, community leaders, Red Cross branch members and councils, and National Society heads of departments and presidents. Questions were rephrased or adapted when they were not well understood; for example, at household level, questions about knowledge of the project were replaced by questions about knowledge of Red Cross activities in the community, as the project itself was not known to many (IFRC n.d.: 5).

In participatory projects it is crucial that the community is involved in evaluation, not just data collection, and is empowered to make appropriate decisions about future activities as a result. Although external agencies and their funders need M&E reports, collection of data solely for external use can undermine the participatory process. Experience with participatory M&E systems suggests that communities must develop their own targets, indicators and priorities, as their views of these may differ considerably from those of staff in supporting agencies (e.g., Murwira et al. 2000: 106–11). In such systems, monitoring impact primarily means monitoring change and may not rely on predetermined indicators (see Box 8.5 below).

8.3.3 Methods

This section looks at some of the main data-collecting methods and their application to disaster reduction initiatives. It is not a comprehensive review of methods but reflects issues that emerged from the evaluation reports and literature studied.

Case studies

Case studies may be created using several methods to examine individuals, communities, organisations, events, programmes or time periods. They are particularly valuable in evaluating complex situations, highlighting the need for non-standard approaches and outcomes, and exploring qualitative impact (Roche 1999: 150–4).

Mitigation and preparedness evaluations sometimes use personal stories (e.g., Watson and Ndung'u 1997). Personal or anecdotal accounts have value in supplementing more extensive data and analysis: for instance, a woman who saved a child from drowning by applying first aid learnt in a community disaster management training course (PNRC 2002: 15). They are also a reminder that projects are about people, and can help make reports more readable – an important factor in influencing agency staff. Detailed case studies are an alternative to more comprehensive surveys if time and money are limited or if a large programme is too big to assess in full. DFID's evaluation of the Pan American Health Organization's (PAHO) emergency preparedness programme documented results through project case studies (Gander et al. 2003).

There is a need for more thorough independent documentation. A growing number of case studies are appearing as printed or 'grey' literature, but they tend to be too short to be informative, and many are produced by the implementing agencies concerned, which raises questions about impartiality, especially since only 'success stories' are reported. However, some aim to be objective and explain results to internal and external readers: NGOs are the main producers of these, especially concerning drought mitigation/food security initiatives (e.g., Atampugre 1993; Strachan and Peters 1997; Murwira et al. 2000). There is also a body of independent case study literature of NGO disaster reduction initiatives (documented in Twigg 2002). But too much evidence remains in agency files.

Direct observation and visual surveys

Direct observation plays a part in most development evaluations. It is useful for cross-checking information (e.g., comparing statements to observed practice), assessing the quality of relationships between individuals and groups, and identifying factors not previously recognised.

Direct observation is part of most evaluations of disaster reduction projects, but its influence and the techniques used are usually unclear from the reports. Visual surveying of structural mitigation measures is used to determine the quality of design and workmanship, and the extent to which technologies or techniques are adopted. It forms an important part of some evaluations, such as hazard-resistant housing projects (e.g., Richmond 1996) and may be quite detailed and extensive. The resilience of structural measures is usually inferred from an assessment of technical quality, particularly where the hazard concerned has a long return period (e.g., earthquakes). It can sometimes be demonstrated by performance during repeat events, especially hydro-meteorological events, which are often seasonal. Community-built structures have been shown to protect fields, houses and drinking-water supplies from floods; strengthened tracks and footpaths have proved they can withstand heavy rains (PNRC 2002: 22–3; Carling 1999). World Neighbors' assessment of Hurricane Mitch's impact on farming systems in Nicaragua, Honduras and Guatemala, which surveyed 1,804 plots in 360 communities, generated substantial data on retention of topsoil and soil moisture, and levels of surface erosion – and led to important conclusions about the resilience of different farming methods (World Neighbors 2000).

Such evidence should be backed up by other data, such as the process by which structures were designed, built and monitored, the cost of designs and ease of operation and maintenance. Assessment of the choice of designs and sites is helpful in showing how well these respond to need. For example, an evaluation of small-scale infrastructure rehabilitation against floods in Cambodia saw how projects were identified and ranked by beneficiaries and village development committees through participatory risk assessments before proposals were developed (Tracey 2002: 15–23). This is important, given the ability of local élites to 'capture' facilities for their own use by influencing their location. Warehousing and pre-positioning of relief items, which can also be assessed visually from the physical condition of warehouses and their contents, can be triangulated against a review of stock-keeping and management practices (e.g., Lockwood 2002). The evaluation of the Intermediate Technology Development Group's (ITDG) Alto Mayo Reconstruction Project included six group discussions with beneficiaries, allowing them to explain the advantages and drawbacks of the alternative, seismic-resistant construction technology promoted by the project, and variations in its application. This was followed up by house visits to view problems identified in the meetings. Where the strength of structural features could not be assessed visually, discussions with builders were held to

ascertain their understanding and application of the technique (Richmond 1996). Surveys were used to find out if occupants of improved housing in southern India felt more secure against theft, cyclones, monsoon rains and fire (Platt 1997: 40). Evaluations should also consider structures' long-term durability, key issues being the capacity for effective operation and maintenance of structures (who will clear drainage culverts, for example, or repair water-retaining bunds?) and the wear and tear caused by everyday usage (e.g., carts using a track or crossing a dam).

Evaluators can look further for evidence of impact. The effectiveness of flood-control measures such as culverts and bridges may be seen not only in water levels and flows but also in improved road/track access during the wet season – indicated by reduced journey times, lower transport costs or more frequent use of transport routes (Tracey 2002: 21). Beneficiary communities are very sensitive to such benefits and their views should be obtained (e.g., Carling 1999).

Group discussions and focus groups

Group discussions are an important component of M&E (Roche 1999: 116–26). Most of the evaluations reviewed by this study involved discussions and workshops of some kind with beneficiaries and other stakeholders, but the reports say little about how these were planned and facilitated, who their participants were and how they were selected. Time pressure may lead to ad hoc and unsystematic discussions.

Focus groups featured in a few evaluations. A focus group is a carefully planned and moderated discussion to obtain perspectives on a defined area of interest in a non-threatening environment. Participants express their views openly; it is not an attempt at problem-solving and does not seek consensus. Focus groups are particularly useful in evaluation, where the aim is to obtain as wide a range of stakeholder/beneficiary views as possible. Groups should comprise participants who share similar concerns and responsibilities but are strangers or have minimal contact with one another in their daily lives. Because groups differ in their composition and dynamics, multiple groups are organised to discuss a given topic. Groups typically contain six to ten people: large enough to provide for a range of views but small enough for everyone to contribute (Wachtendorf and Tierney 2001: 2–3).

The DRC's approach to focus group evaluation (see Box 8.2) indicates the potential of this method, but it could not be used in many circumstances. That evaluation was extensive (in time and coverage), well resourced and carried out by an expert team of disaster sociologists. Focus groups also seem to be a particularly Northern method. Participatory discussions undertaken as part of PRA exercises in developing countries are typically less labour-intensive and structured.

Interviews

Individual and group interviews can capture stakeholders' knowledge and perspectives, identify differences and bias, and are an important tool in triangulation of evidence, although interviewing requires certain skills and attitudes to be effective (Roche 1999: 108–16). In mitigation and preparedness evaluations, individual interviews with stakeholders play an important role. They are used to identify agencies' commitment, the strength of working relationships and coordination mechanisms, the extent to which concepts and methods are understood and the quality of information flows. Community interviews indicate levels of commitment, understanding of the project, the nature of community participation and differences of opinion.

The observed prominence of interviews with professionals (in the implementing agency and its partners or other interested organisations) as evaluation evidence is due to the requirements of evaluators' TOR, the desire for multi-stakeholder perspectives and perhaps particularly the limited time available to evaluators. Whether interviewing agency representatives and other professionals in offices is more useful than site visits is debatable – evaluation guidelines usually warn against over-reliance on a narrow sample or range of 'expert opinion' (e.g., Nagarajan and Vanheukelen 1997: 54).

Although semi-structured interviews are a main source of evidence in most evaluations, reports do not detail the methods and topic or question frameworks used. Evaluation findings can be significantly slanted as a result of omissions or bias in the interview approach.

Formal questionnaire-type surveys were not commonly used in the evaluations surveyed – again, probably due to limited time and resources. Larger-scale or research-oriented evaluations are more likely to use formal surveying techniques and scientific interview methods. These are also central to epidemiological studies of risk factors. More effort could be made to adapt sociological methods of gathering and analysing interview data, such as those used by the DRC and others in disaster research in the United States. But all evaluations should develop interview frameworks and if possible pre-test questions (the latter appears to be very rare).

Rapid assessments

Small-scale or rapid assessments can provide valuable insights, especially when focused. For

Box 8.2 Use of focus groups in evaluation

The evaluations of FEMA's community-level Project Impact (PI) initiative by the Disaster Research Center (DRC) made extensive use of focus groups as part of a much larger evaluation. The method allowed comparison over time and across different communities, making it possible to determine whether new issues had emerged, old issues had been resolved, understanding of the PI philosophy had changed and new creative programme activities had been undertaken. It also enabled the evaluators to look in more detail at issues previously raised during interviews with key stakeholders.

Participants were chosen from representatives of PI communities who attended annual summits in Washington DC. It used a stratified sampling procedure, based on respondents' functional position in the community, the length of time their community had been involved in PI, community location and whether it was urban or rural. Eleven focus groups were convened over three years, with 71 members.

Participants were given in advance a list of the questions to be discussed. These addressed five main issues:

- Strategies used for building disaster-resistant communities.
- Organisation of PI initiatives.
- Building disaster mitigation partnerships with different sections of the community.
- Suggestions for FEMA regarding oversight and management of PI.
- The future of PI in local communities.

Members of the DRC team were given training in the skills needed for conducting focus groups, including observing and recording participants' actions during the group sessions (e.g., body language, the tone of the interactions between group members), keeping notes while sessions were in progress, identifying prominent themes and keeping track of salient points. Discussions were taped and later transcribed. All participants were briefed on DRC's confidentiality policies and asked to sign consent forms, were reassured that no statements would be attributed, and were asked to keep the comments of other members confidential.

Each group had a moderator and assistant moderator. The moderator kept the discussion on track, made sure everyone was comfortable with the flow of discussion, and ensured that everyone had an equal opportunity to speak. The assistant monitored time, took notes and observed participants' behaviour. The sessions lasted approximately two-and-a-half hours. Participants were at ease and engaged throughout the discussions. Many took their own notes and afterwards stated that they had learned a lot from other community representatives.

The method provided detailed and valuable evidence of the kinds of activity being undertaken, and the approaches and processes needed to move forward with mitigation programmes.

Source: Wachtendorf and Tierney 2001

example, the Orissa branch of the Indian Red Cross assessed the effectiveness of its disaster preparedness work when a weak cyclone struck in November 2002. The initial assessment was based on telephone calls from local voluntary coordinators and emergency team members in eight locations. These conversations focused on: when the warning was received, and from which sources; actions taken by local disaster preparedness teams and villagers; and details of the event (wind speed, condition of the sea, rainfall) and its impact. The phone calls provided plenty of local detail, from which it was possible to build up a picture of the situation on the ground and actions taken almost as they happened, the effectiveness of warning and response mechanisms and factors affecting them, and variations between the locations. This was not a substitute for field surveys, but it would not have been possible to carry out such surveys immediately after the event, and it helped to identify priority issues for further assessment (Orissa State Branch, Indian Red Cross Society 2002).

Simulation

Simulation exercises are commonly used to test emergency preparedness. They are not common in evaluation but are potentially useful. In the IFRC's Camalotte programme review, a two-day workshop for national and local project coordinators took the form of a simulation exercise to test their understanding of the programme and capacity to implement it. The workshop was based on a fictitious community. Participants completed a series of exercises simulating the entire project cycle, including: relevant concepts (community, community development, participation); community selection; approaching community members; analysis; needs identification; development of objectives and indicators; measuring indicators; planning; community processes; conflict; evaluation; and narrative and financial reporting. Although levels of skill varied greatly, the workshop allowed staff to demonstrate their knowledge and skills and identify areas needing improvement (Gelfand 2003: 3, 9–10). Simulation was also used in the Philippines, where

Box 8.3 An approach to interviewing

Faced with the challenge of collecting data from a wide range of stakeholders, some evaluations choose to focus on a smaller group of key stakeholders. The DRC's Year 2 evaluation of FEMA's PI initiative took this approach. Its data-collection method comprised:

- Telephone interviewing: 24 in-depth interviews with 'key stakeholders' in seven pilot PI communities identified in the Year 1 evaluation.
- Face-to-face interviews in the seven communities. Site visits of two to three days were made to each community to conduct less formal interviews and collect educational or other relevant materials. Between two and eight people were interviewed in each community: all were 'especially knowledgeable about PI activities'.
- Systematic collection and analysis of documents providing descriptive information on PI activities

Those interviewed by telephone were sent questions and response aids in advance to help them to prepare for the interview. These included questions on PI and checklists to document progress. The interview schedule covered questions on:

- Changes in the community 'climate' (e.g., economics, elected political officials and their priorities, and disaster events).
- Changes from Year 1 baseline information.
- Modifications of Year 1 PI activities.
- Partnership status (e.g., continuing involvement of Year 1 partners, strategies for new partnership development, partnership momentum).
- Assessment of integration of PI into community activities.
- Organisational structure for PI.
- Creative ideas.
- Lessons learned.
- Major highlights and challenges.
- Resources and future needs.

Source: Nigg et al. 2001

villagers re-enacted their response to a typhoon and discussed what they had acted and seen. This gave insights into how people had responded to warnings and why (Bellers 1996). In both the Camalotte and the Philippines cases, it was important that participants had an opportunity to discuss what was revealed by the simulation.

Workshops

Formal workshops are usually convened to feed findings back to project stakeholders and validate them but can be used in other ways. For example, PAHO convened a four-day meeting in 1999 to evaluate preparedness and response to hurricanes Georges and Mitch. More than 400 professionals from 48 countries took part, drawing up a comprehensive set of findings and recommendations in 20 working group sessions (PAHO 1999: vii). GeoHazards International convened expert workshops to assess the effectiveness of its new tools for measuring earthquake risk (GHI/UNCRD 2001).

8.4 Data analysis – indicators

8.4.1 Introduction

The setting of appropriate indicators is 'one of the key methodological problems in impact assessment' (Dawson 1996: 15). Identification and validation of appropriate indicators of impact is a major challenge to M&E of disaster reduction, though the problem is only occasionally noted in agency documents. Vulnerability and resilience are multidimensional. It is difficult to collect data on every relevant aspect, and in any case collection of unnecessary data should be avoided. However, indicators that are easiest to measure are not necessarily the most useful. Standard guidance on generic disaster reduction indicators at project level is lacking.[6] CARE has developed a menu of standard indicators of the impact of household livelihood security (HLS) interventions covering nutritional, food, health, economic, educational, environmental, habitat, social network security and personal empowerment aspects (CARE 2000: 41–80). HLS is a holistic approach, so this is not specifically aimed at disasters triggered by natural hazards. However, it enables changes in general vulnerability to be tracked and in doing so addresses some features more directly related to hazard risk (e.g., adequate housing, water availability and quality, food production and consumption, land-use practices).

8.4.2 Selection of indicators

Development M&E literature has a lot to say about selection of indicators (Roche 1999: 41–8; Dawson 1996: 14–15). Indicators will vary from one project to another, according to the work and its context, but in general, it is argued, they should be both SMART

6. For national- or programme-level indicators, see Chapters 1, 2 and 9.

(specific, measurable, attainable, relevant and time-bound) and SPICED (subjective, participatory, interpreted, cross-checked, empowering and diverse) (Roche 1999: 48–50). In practice there can be tension between the participatory, subjective character of the SPICED indicator approach and the emphasis on objective measuring in the SMART approach, and evaluators may have to make an effort to reconcile this. Other questions to be asked regarding the practicality of indicators (Noson 2002: 83–4) include:

- *Measurability*. Is the indicator measurable? Is it sufficiently sensitive to an improvement or deterioration in conditions?
- *Ease and cost of collection.* How easy is it to obtain the information required? How costly will this be? Can the community participate? Are some relevant data already collected?
- *Credibility and validity.* Are the indicators easy to understand or will people end up arguing over what they mean? Do they measure something that is important to communities as well as implementing organisations?
- *Balance.* Do the selected indicators provide a comprehensive view of the key issues?
- *Potential for influencing change.* Will the evidence collected be useful for communities, implementers and decision-makers?

Even with this guidance in mind, it is rare to find all the evidence one wants. Indicators are *indicators*: they are not necessarily final proof. Indicators do not need to record absolute change. It is often enough to identify relative change. Part of the process of collecting baseline information should be to identify valid indicators for M&E. However, experience as work progresses may highlight other issues and require changes. Where baseline data are lacking, or indicators are difficult to assess or simply irrelevant, new indicators must be developed. In practice, this happens quite often, but the process must be managed carefully to avoid confusing stakeholders. An open, participatory approach is needed here, which should aim to achieve the highest possible level of consensus. Some development agencies have experimented with approaches to assessing change that do not use predetermined indicators – instead, poor and vulnerable people review the changes that have taken place over a particular time and related factors (see Box 8.5 below).

M&E is designed to measure change (positive or negative). However, disaster mitigation can present problems because of what has been called its 'reverse logic': i.e., the success of an initiative is that something – the disaster or a particular form or level of loss in the event of a disaster – does *not* happen.

8.4.3 Baseline data

Evaluation relies on good baseline data. Project design should be based on baseline studies, linked to objectives and indicators of achievement. Baseline data collection can be targeted towards areas defined by the indicators. However, it is impossible to predict all the information that might be needed, and the collection, analysis, storage and recovery of information may be inadequate. The problem of absent or deficient baselines is common to projects of all kinds and makes baseline reconstruction necessary – by reviewing project documents and records, obtaining data collected by other organisations, and interviewing key informants (Roche 1999: 74–9). In many disaster reduction initiatives, adequate baseline data are not collected, leaving evaluators struggling to find adequate measures of success. Several evaluations comment on this problem. Findings from previous evaluations are sometimes used as baselines, explicitly or implicitly (e.g., Gander et al. 2003; Coyet 2000). The DRC's evaluation of Project Impact (PI) created a retrospective baseline: an 11-point checklist of possible mitigation actions that could have been undertaken by the seven PI pilot communities before the initiative began. In-depth interviews with key stakeholders and project documentation were then used to form judgements about how much progress was being made during the project. A simple quantitative score was used to assess which areas mitigation activity was taking place in. An increase in the range/type of mitigation activities then became an indicator of progress. This overview was supplemented by more detailed follow-up on the progress of individual activities in each community, and the reasons for this (Nigg et al. 2001: 2–4).

A vulnerability/capacity analysis (see Chapter 5) should provide good baseline data and guide interventions. Application of the same method during or after the project should make it possible to draw meaningful conclusions about impact. The apparent failure to use this form of analysis for evaluation purposes may be due to the following factors:

- Vulnerability and capacity analysis is a new technique for most agencies, and has been used mostly in pre-project assessments. To date, there has not been much opportunity to apply it to evaluation.
- Agencies find it difficult to analyse data collected in such exercises, particularly to weigh up data on diverse aspects of vulnerability gathered in a variety of ways using different indicators. Until staff acquire greater confidence in vulnerability analysis techniques, they will be reluctant to use it in evaluations, especially where the findings go before senior staff or donors.

- Considerable resources are required for comprehensive risk or vulnerability analysis. Few project budgets would allocate the same level of resources for evaluation – evaluations are generally under-resourced anyway.

8.4.4 Quantitative and qualitative indicators

The tension between the needs for subjectivity/participation and objectivity/measurement in evaluation is often played out in decisions about whether to use quantitative or qualitative indicators. Research on NGOs and disaster mitigation has shown that NGOs are comfortable with indicators of output (especially quantitative indicators), but unsure about how to select and apply indicators of impact (Twigg et al. 2000: 76–8). Our research suggests this is also true of other types of agency.

Quantitative indicators are widely used to assess progress towards stated targets (e.g., numbers of community disaster response teams trained and equipped). These are relevant, especially in marking process. For example, between 1994 and 2001 the Philippine Red Cross's Integrated Community-based Disaster Preparedness Programme formed disaster action teams in 64 communities, which all developed action plans; 100 mitigation measures of different kinds were carried out. A breakdown of these measures into different types indicated their nature (PNRC 2002: 6, 20–1).

Where quantitative data are plentiful (see Table 8.1), evaluators can be tempted to place too much reliance upon them. These numbers do not demonstrate the project's effectiveness: there is no measure of *quality* here.

Many evaluations reviewed make extensive use of qualitative indicators, particularly to show increased capacity for disaster reduction. Qualitative data typically comprise the views of stakeholders collected through workshops, focus groups and semi-structured interviews. Simple qualitative indicators can give a good impression of progress and achievement especially if checked on a regular basis, though even this is often lacking.

Table 8.1 Quantitative output indicators in a disaster preparedness project[7]

	Indicator	Target	Achieve-ment
1.	Number of households oriented in disaster preparedness and management.	120,000	140,000
2.	Number of volunteers trained in disaster preparedness and management.	118	118
3.	Number of [partner agency] staff trained in disaster preparedness and management.	600	598
4.	Number of other NGO staff trained in disaster preparedness and management.	80	72
5.	Number of government representatives trained in disaster preparedness and management.	118	118
6.	Number of flood-level indicators established.	130	130
7.	Number of peoples' voluntary teams functioning.	118	118
8.	Number of posters circulated.	–	2,367
9.	Number of leaflets circulated.	–	10,650
10.	Number of radio sets distributed.	118	118
11.	Number of torches and whistles distributed.	118	118
12.	Number of e-mail connections installed.	2	4
13.	Number of grain stores constructed.	20	20
14.	Number of grain store maintenance teams trained.	20	20
15.	Number of grain store management teams trained.	20	20
16.	Emergency credit fund established.	1	1
17.	Number of grain store management teams trained in credit operation.	20	20
18.	Flood insurance fund established.	1	1

7. The source of this table has not been identified for reasons of agency confidentiality.

Participatory methods tend to generate qualitative data. In cases where quantitative data would have been valuable but are not readily available, participatory methods can provide relative data through ranking and comparison (see Box 8.4). They have also been used to measure the adoption, decline and relative significance of indigenous and newly introduced drought mitigation strategies by communities during the lifetime of a food security project (Scoones and Hakutangwi 1996: 6–8).

Box 8.4 Obtaining crop production data through participatory methods

An evaluation of a rainwater harvesting project in Kenya used a variety of PRA methods to obtain information. To obtain relative data on the use of increased sorghum yields and constraints on sorghum production, the evaluators used the techniques of ranking and proportional piling, in which individuals were given piles of stones (or donkey dung by the lakeshore, where stones were not available) and asked to place them in separate piles to indicate amounts.

Data on crop yields proved more difficult. Local-level monitoring systems were of limited use and there were widespread variations in the types of soil, pest levels and rainfall between different sites. Moreover, the sorghum growers were reluctant to reveal their full yields to outsiders. Here it was necessary to piece together limited evidence from different sources: project records, discussions with project staff and the gardeners' own assessments, compared against data from previous project reviews and workshops. The evaluators noted that no outsiders making short visits can expect to obtain specific data on such sensitive subjects, and that easily obtained replies might well be erroneous.

Source: Watson and Ndung'u 1997

Combining quantitative and qualitative indicators is a common approach, as for instance in the DRC's PI evaluation. Quantitative indicators included the numbers of particular types of initiative that were ongoing, completed, planned or rejected by each of the seven pilot communities. The typology was broad, split into four main categories: risk and vulnerability assessment/plan development, mitigation, partnerships and public education/information. Individual activities were grouped under these headings. This method provided basic but clear benchmarks for the rate and extent of uptake of particular kinds of mitigation measure. Additional qualitative evidence taken from informants included descriptive data on the nature of activities undertaken and issues involved, and their rating of the value of the programme in stimulating improvements. Follow-up evaluation enabled the DRC to refine the method to identify activity types and cause-effect linkages more effectively (Nigg et al. 2001; Wachtendorf et al. 2002).

8.4.5 Causality: linking process to impact

Process (activity and output) indicators measure the implementation of project activities, and are usually quantitative. Outcome or impact indicators, which can be quantitative and qualitative, measure changes that occur as a result of project activities. Analysis of the relationship between the two indicator types is essential in understanding the chain of cause and effect (Roche 1999: 24–6, 32–4, 79–86). Such analysis is difficult. Many factors combine to create vulnerability. No intervention can address them all and all projects are influenced by them. Moreover, modern disaster management thinking emphasises the need for multidisciplinary approaches addressing different dimensions of vulnerability. Disaster reduction initiatives may therefore be complex, comprising a wide range of structural and non-structural measures that should be mutually reinforcing.

Where they adopt such an approach (e.g., a drought mitigation programme comprising relief, food for work, and income-generation: Tearfund 1996), it may be impossible to identify specific linkages between cause and effect. Even a seemingly straightforward disaster preparedness project can involve a number of varied, interlocking components (e.g., Madiath 2002). Where initiatives involve several partners providing complementary inputs to a common programme, it is difficult if not impossible to evaluate the impact of each partner's work (e.g., Jegillos 1996: 15). Where projects cover several countries and address higher-level issues such as policy in addition to institutional capacity and actions on the ground, the challenge becomes even greater. Occasionally, evaluations recognise the risk of such approaches being too wide-ranging, leading to a loss of focus on hazard threats (e.g., Madiath 2002). The problem is, of course, reduced if evaluators can focus on specifics.

Most disaster reduction evaluations focus on outputs rather than outcomes or impact, partly due to their timing. Agency reports to donors are also predominantly activity-focused, with relatively little analysis of outcomes (and often some rather tenuous linking of output to outcome).

This is not to say that process indicators are unimportant – they often have to act as proxy indicators of impact. They are particularly important where hazards are infrequent (e.g., earthquakes).

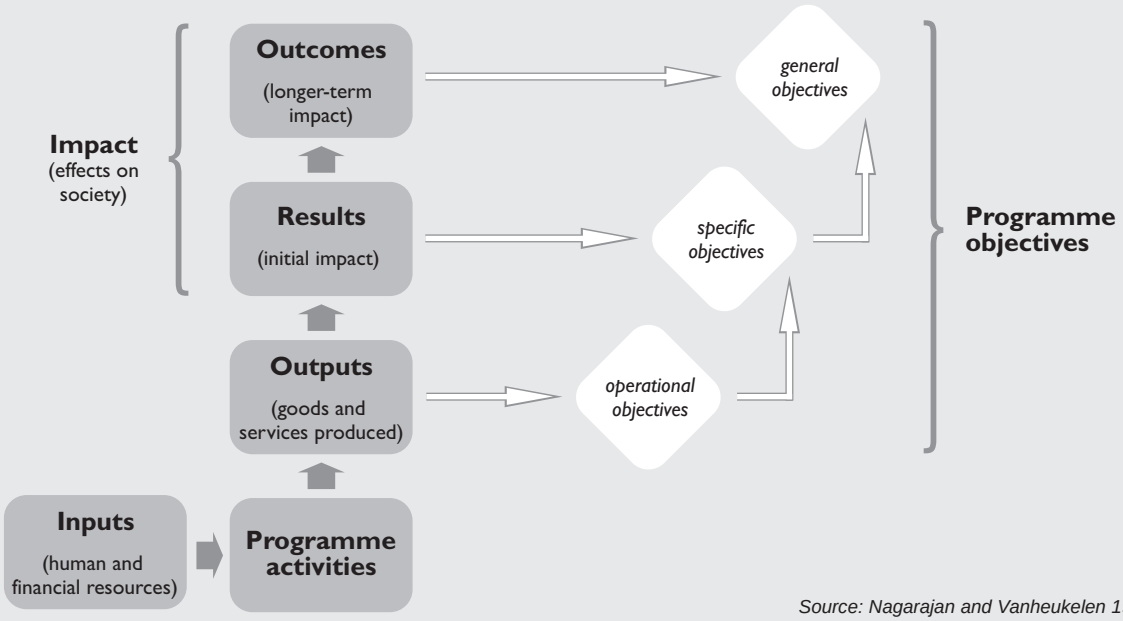
Actions carried out during a project give some indication of potential effectiveness. In a community disaster preparedness initiative, for example, process indicators might include: recruiting, training and establishing a community disaster management team; organising public meetings to identify threats and the most vulnerable households; building relevant structures (e.g., evacuation shelters, embankments); and ongoing evacuation drills. Potential impact may be inferred from various kinds of data. For example:

- An evaluation of a food security project in Cambodia concluded that distribution of 86.8 tonnes of rice seed to 3,750 families in 98 villages might – in combination with the rehabilitation of small-scale irrigation systems – have a significant impact on food security in the following year. The conclusion was not based on the distribution figures alone but drew on more qualitative evidence of the project's approach: the most vulnerable beneficiary families had been selected by the target villagers (the elderly, handicapped, blind, injured, those with little or no land, or with insufficient rice seed as a result of floods) through participatory village meetings, and the government's Department of Agriculture, Forestry and Fisheries had provided technical assistance (market survey of available seed and quality-control testing of potential seed varieties). Nevertheless, the evaluation was still making explicit assumptions about potential impact the following year (Tracey 2002: 13–15, 24–5).
- Implementation of measures recommended by a vulnerability analysis or to address issues highlighted by it. For example, 12 measures for improving the capacity of the Palestine Red Crescent Society recommended in a VCA in 2000 had been implemented by 2003 although one key aim – a national disaster plan – had not been accomplished (IFRC 2003a). The extent of implementation of measures can be substantiated through discussions with stakeholders.

Process indicators have value in suggesting likely outputs and impact, as well as helping to ensure the project is on track, but it is essential to assess the quality of the process and ask what it is leading to. One of the main purposes of evaluation is to analyse a project's 'intervention logic' (see Figure 8.1). Where projects' M&E place undue emphasis on process, this may be because of unclear objectives or insufficient consideration of impact.

Projects with clear objectives and targets develop a hierarchy of indicators that link process to impact and thereby make M&E more coherent (e.g., CARE 2000: 177–87). One example is the Strategic Objective and Results Framework of the Asian Urban Disaster Mitigation Program (AUDMP), with projects in nine countries (see Annex 8.1). The principal indicators are mostly numerical and the emphasis overall is quantitative, which is recognised to be a limitation (Scheurer et al. 2002). Nevertheless, the framework goes down to a more detailed level characterising subsidiary evidence required to arrive at the main conclusions, and outlines sources of information and the

Figure 8.1 Intervention logic of a programme



Source: Nagarajan and Vanheukelen 1997: 17

evidence-gathering activities to be undertaken. These subsidiary indicators are somewhat more diverse.

As with logical frameworks, creation of hierarchies of indicators allows evaluators to form judgements at all levels (activity-output-outcome-impact) to assess cause-effect linkages, and to form a view about overall coherence (e.g., LUXCONSULT S.A. 1997: 12–15). In many, if not most, cases, disaster projects lack such indicator frameworks. Clear frameworks also mitigate the problem of project participants being unclear about, or having different views of, goals and objectives, which is commented upon in several evaluation reports. However, there is a risk that use of logical frameworks or similar devices can impose excessive rigidity upon project thinking – a particularly important issue given the desirability of participatory approaches to projects. By their nature, participatory processes take a long time – much longer than is usually assumed in project plans. They can be difficult to monitor and the desired output or impact may change over time (Christoplos and Mitchell 1998: 12–13).

Some NGOs use PRA methods that enable communities to identify cause-effect linkages. For example, participants in an evaluation of ITDG's Chivi food security project, which had a strong community development component as well as technical interventions, drew up 'impact trees' expressing their view of the linkages between the project's different elements (Scoones and Hakutangwi 1996).

8.4.6 Triangulation/cross-checking

Cross-checking (or triangulation) of different data sets and sources is helpful in isolating particular factors affecting success or failure. Triangulation is particularly important in the case of qualitative evidence collected through stakeholder interviews, where much of the evidence may be anecdotal or inferred. Good evaluations ensure that a wide range of stakeholders is consulted and the results are cross-checked (Roche 1999: 86–93). The IFRC's Golfo de Fonseca evaluation noted the value of community-level triangulation 'as more often than not the information provided by community health volunteers, community leaders and household interviews presented some discrepancies and variations' (IFRC n.d.: 6). In projects involving partnerships, triangulation of interview data or documents can quickly reveal differences between partners in their aims or expectations (e.g., Jegillos 1996: 4–11). Direct observation is a useful way of checking if there are discrepancies between what people say and what they do (Twigg 2004: 136).

Feedback workshops with stakeholders appear to be more common in evaluations of mitigation and preparedness initiatives. These provide a linked triangulation-validation mechanism. They usually take place towards the end of an evaluation, when it is too late for further data collection or cross-checking with informants in the field, but some evaluations hold workshops at different stages or levels.

8.4.7 Unforeseen impacts

Tracking unforeseen impacts is a major methodological problem. Indicators chosen to verify impact can only identify expected change, and will only reflect those changes that have been made explicit or agreed by the stakeholders. But what happens where change is unexpected or was not agreed by stakeholders, or where a particular stakeholder group did not reveal an area of change that was important to them? M&E systems need to be sensitive to this problem, sometimes referred to as the 'indicator dilemma'. Beneficiary participation is clearly essential here.

For smaller projects, it may be enough for staff to identify potentially unanticipated impacts at the outset and monitor them. But in larger, more complex projects or those where social process is of central importance, formal systems for identification of unexpected impacts may be needed (Dawson 1996: 19–20). The 'group-based assessment of change' method (see Box 8.5) is an example of a method for addressing this problem. The potential of this relatively simple method to capture changes in vulnerability deserves further testing.

8.4.8 Control groups

Some development project evaluations have used control groups for comparison (e.g., Roche 1999: 79–81). This is not necessarily straightforward. In the case of risk reduction, it is arguably unethical to study at-risk groups that one has not attempted to protect – the argument is even stronger in humanitarian response. The DRC's evaluations of Project Impact used a control group: it held focus group interviews with representatives from both communities that had joined the scheme and others that were not involved in it, to determine whether experiences and approaches used in the seven pilot projects would be transferable without the substantial government seed funding provided for the pilots (Wachtendorf and Tierney 2001).

Some evaluations interview community members not involved in projects (e.g., Richmond 1996: 3; Scoones and Hakutangwi 1996: 9) although it is not always clear if such interviewing is systematic or ad hoc, and the purpose is usually to identify reasons for non-participation. Talking to groups that have dropped

Box 8.5 Group-based assessment of change

This method, piloted by ActionAid in Viet Nam, works without predetermined indicators. By keeping questions as open as possible, it produces unexpected but important information that might have been missed in a more defined evaluation format. Representative samples from groups of poor people supported by a project are asked how well the rest of the group members have fared during the past year, in particular:

- Which members' households have experienced improvement in their situation, which have experienced deterioration and which have remained in the same condition?
- For households whose situation has improved or deteriorated, how has their situation changed?
- For households whose situation has improved or deteriorated, why has their situation changed?

Individual answers are collated to gain a picture of change within the group. Repeat exercises give a fuller picture of the dynamics of change.

Although intended to give a comprehensive picture of local livelihoods, the piloting of the method in Viet Nam shed light on vulnerability to hazards by indicating the relative significance of harvest failure due to a recent drought among those households whose situation had deteriorated. The low importance assigned to this factor surprised the facilitators (and was perhaps misleading, since other data from the exercise showed that food production deficits were an important aspect of deterioration).

Source: Smith 1998: 15–16

out is important. The IFRC's review of its Camalotte regional programme in the Rio de la Plata river basin of Argentina, Paraguay and Uruguay made a point of visiting one Red Cross branch that was no longer involved in order to understand its reasons for withdrawing (Gelfand 2003: 2–3).

8.4.9 Identification of beneficiaries

The importance of identifying who benefits from an initiative cannot be overemphasised. There is a tendency in most of the evaluations studied to assume that benefits are spread evenly across a community, especially where evaluators focus on lives saved rather than the impact of an event on livelihoods. Drought/food security evaluations usually do address the question, reflecting their origins in development work, where identification of the most vulnerable is acknowledged to be a crucial factor. Only a few evaluations of disaster reduction in other contexts have considered targeting and differential vulnerability in any depth (e.g., Venghaus et al. 2000: 33–6).

Failure to appreciate differential vulnerability is noticeable in the case of gender issues. Occasionally evaluators recognise that these have only been addressed superficially by a project (e.g., Gelfand 2003; Parker and Ullah 2000) but it is rare for evaluations to discuss the subject in any depth. More commonly, both projects and evaluators are content with limited indicators – for instance, the number of women taking part in project activities such as training – as evidence of greater gender equity in disaster reduction.[8] This echoes earlier research showing that NGOs have not yet engaged fully with gender issues in their mitigation and preparedness projects (Twigg et al. 2000: 69–72). Even large organisations may have limited financial and technical resources for mainstreaming gender and it is clear that long-term strategies are needed (Gander et al. 2003: 21–4).

The literature on gender and disasters has become quite extensive in recent years, including a growing body of case study evidence of women's vulnerability, involvement and empowerment through disaster reduction initiatives (Twigg 2004: 80–8; Gander et al. 2003: I: 74–7). Practical guidance is available for organisations seeking to ensure gender aspects are incorporated into risk and vulnerability analysis (Enarson et al. 2003). Tools for evaluating gender-specific outcomes of disaster reduction actions are not widely available although the framework and indicators outlined by Gander et al. (2003: I: 72–3; reproduced in Annex 8.2) form a useful starting point that should be tested in the field.

Vulnerability caused by other socio-economic factors, including ethnicity, age and disability, is almost completely ignored by evaluations. It was noticeable that many evaluations studied failed to define the socio-economic characteristics of those involved in interviews and discussions, and even the number of those taking part was often omitted from reports.[9]

8. Again, evaluations of drought/food security are more likely to explore gender issues in depth. These might address topics such as control of mitigation structures/resources and the benefits arising from mitigation, influence on decision-making, division of labour and impact on women's status (e.g., Watson and Ndung'u 1997).

9. Sample sizes ranged widely from a handful to hundreds, depending on the scale of the evaluation. Where it could be identified, the proportion of women involved in providing information to evaluators was typically about one-third.

8.4.10 Factors in sustainability

With so many evaluations taking place within a relatively short time of a project's commencement, evaluators often find it difficult to judge the likelihood of it being sustainable. The issue is often covered in evaluators' TOR, but their assessments are frequently provisional and subjective. Many disaster reduction projects are one-off initiatives, in any case; those that are planned with replication or expansion in mind are more likely to focus on these issues in evaluations (e.g., CARE International 2003; Scheurer et al. 2002). As in the development sector, disaster reduction initiatives are more likely to be both sustainable and effective where extensive time and effort go into preparatory work with communities, partners and other local stakeholders. Experience in diverse participatory risk reduction projects demonstrates the benefits of spending six months to one year on this, depending on local circumstances (e.g., Schilderman 1993; Murwira et al. 2000; CARE International 2003).

The optimal time for achieving organisational or community self-reliance also varies according to the project's nature and location. A project that is too short runs the risk that local organisations and communities will not have acquired sufficient capacity to maintain its work; but if a project goes on for too long there is a risk of creating too much dependence on the implementing agency. At the review of the Bangladesh Red Crescent Society's cyclone preparedness project in Cox's Bazaar, project staff and communities were almost unanimous that three years was sufficient for achieving sustainable community disaster preparedness (Madiath 2002: 21), but the question is not asked sufficiently often by evaluations for general conclusions to be drawn.

Some evaluations identify external factors that affect sustainability. A review of Red Cross disaster preparedness/reduction in the Democratic People's Republic of Korea (DPRK) noted the damaging impact of a drastic reduction in government funding of the DPRK Red Cross in early 2002, which, combined with currency devaluation, had forced the Society to restructure itself and reduce the number of paid technical staff at provincial level (Lockwood 2002: 5–6). The DRC's evaluation of Project Impact drew attention to local-level initiatives' vulnerability to government reorganisation, personnel change or change of governing party, as well as to economic downturns or local business relocations; the need for sustained funding also became more acute as the initiative moved beyond its initial phase (Nigg et al. 2001: 23–4; Wachtendorf et al. 2002: 70). To assess the opportunities for widening PI to other communities, the DRC interviewed communities in and outside the scheme. Annual evaluations over three years tracked and analysed processes to build up a picture of the likelihood of this pilot project being sustained and replicated; the issue of 'sustaining momentum' was a prime focus for the evaluators (Wachtendorf and Tierney 2001; Wachtendorf et al. 2002).

Post-project impact evaluations provide the best opportunity to assess sustainability, and this issue is likely to feature strongly in their TOR. An evaluation of an earthquake-resistant housing project in Peru several years after intervention could assess the extent of technology diffusion, the quality of the technology, factors influencing take-up in different locations and the effectiveness of awareness-raising channels. Another benefit was that 'there is less tendency to gratify the implementing agencies and more likelihood that complaints and criticisms may be aired' (Richmond 1996). A participatory evaluation of rainwater harvesting work in Kenya, covering impact over ten years, formed judgements about the level of dependence on external inputs (food, technical support, tools, seeds, storage and draught animals), acquisition and application of technical skills and knowledge, extent of technical innovation, expansion of rainwater harvesting structures and abandonment of existing ones, costs and benefits, and the project's institutional base and support (Watson and Ndung'u 1997: 36–54).

Where evaluations take place too early to judge sustainability, what indicators can be used to assess the likelihood of its being achieved? Evaluators need to show some imagination here. One indicator that has been used is the level of stakeholder contributions of financial and other resources to the project, on the grounds that the likelihood of long-term sustainability is intrinsically linked to the degree of 'ownership' (Bethke et al. 1997: 61; Tracey 2002: 16).

In community-based projects, the strength of community organisation is the central factor. Tools for assessing this are deployed in development work (Dawson 1996: 37–40). Many of the evaluations reviewed looked at community capacity building for reducing the impact of potential disasters,[10] reflecting the current priority given to community-level initiatives. Such projects often place great emphasis on creation or revival of local groups such as disaster management committees. But existence of such groups is a weak indicator of their capacity to manage risk, and attitudinal analysis may only demonstrate short-term enthusiasm.

Evidence of group activity is therefore needed. This might include: preparation of risk/vulnerability maps and assessments; preparation of emergency plans;

10. For example, CARE International 2003; Gander et al. 2003; Madiath 2002; Organisation Development Centre 1999.

running awareness-raising activities or practice evacuation drills; exchange visits with other local groups or institutions; structural mitigation work (e.g., tree planting, building shelters or water tanks); purchase of equipment (e.g., radios, flashlights, boats); and creation of sub-groups for particular activities (e.g., search and rescue, early warning). The frequency, nature and quality of such activities and the degree of community involvement can be monitored and evaluated internally or by outsiders. Simple activity mapping exercises can give a good picture of the level of activity (e.g., Gander et al. 2003: I: 62–63). Communities' ability to fund and manage mitigation projects is another indicator, as in Nicaragua, where a target community felt empowered to ask its municipality for a police post and waste management ordinances, and to ask the Ministry of Health to provide training in keeping drinking water clean (CARE International 2003). The IFRC's Golfo de Fonseca evaluation felt that, although it was too soon to evaluate impact, there were signs of 'a change process at community level', shown particularly in the active involvement of health committees in first aid, disaster preparedness and hygiene campaigns and households' positive response (IFRC n.d.: 8). Discussions with community groups' members reveal the importance to them of greater confidence (especially significant for women, who may not have played a role in such activities before: e.g., Gander et al. 2003: II: 14; Schmuck 2001).

Particular attention should be given to community disaster management committees/groups. There is mixed evidence of the value of new community disaster management organisations when formal or informal community organisations that might undertake the task already exist. In some cases, they are artificial creations whose long-term value must be questioned (e.g., Tracey 2002: 23–4). In others, they are effective, particularly in disaster preparedness/response, where the role is clear and the tasks specific (e.g., Gander et al. 2003: II: 14; Parker and Ullah 2000: 21–2; British Red Cross 2000; Delica 2003). Often, however, evidence of this is anecdotal, picked up by evaluators in passing: the case needs supporting by more thorough data collection, particularly comparing the performance of different communities and organisations.

Interviews with community members can indicate how they view various types of community organisation and their own roles in them, and hence build up a picture of whether community disaster management organisations (CDMOs) are genuinely 'owned' by their members. Topics that might be covered through such interviews include (Tracey 2002: 23–4, 40):

- What do community members/representatives of community organisations think about their CDMO? How effective is it?
- What do they feel about their representatives on the CDMO? Are they responsive to community needs?
- Are elections to the CDMO satisfactory? Are all groups adequately represented?
- What do community members think about the selection of projects by the CDMO?
- Is the CDMO sustainable? What support does it require (e.g., training)?

Interviews with community members who do not take part in a project can be used in understanding reasons for their lack of participation. If non-participation is due to barriers to entry (e.g., cost, discrimination), this has implications for scaling up.

8.4.11 Evidence from disaster response

General

Observed or documented response to disaster events is a strong indicator of the impact of pre-disaster mitigation and especially preparedness activities. Repeat hazard events are the ideal opportunity to test measures – allowing for each event's uniqueness in its location, scale, timing and impact. There are many documented examples of such effectiveness, notably from the Red Cross Red Crescent's experiences of disaster preparedness (e.g., IFRC 2003b; IFRC 2003c: 14; PNRC 2002: 5, 22–3). Perhaps the best-known example is the cyclone preparedness programme of the Bangladesh Red Crescent Society (BDRCS), which over more than 30 years has built up a network of volunteers and shelters covering 3,500 villages, supplemented by other awareness-raising and community mobilisation activities. Here, success is measured by the capacity to move people to safety ahead of impending cyclones: for instance, in May 1994 750,000 people were evacuated safely and only 127 died (British Red Cross 2000).

Evaluations of post-disaster assistance

Evaluations of actions to respond to disasters can also provide insights into the effectiveness of pre-disaster mitigation and preparedness measures. Typically, a disaster response evaluation addresses issues such as:

- *Assessment*: Timing, extent and quality of coverage/data; involvement of local vis-à-vis external actors; quality of presentation of findings (i.e., can they be read and understood quickly?); communication of findings (speed, presentation).
- *Communications*: Staff knowledge of information needs and systems; volume, frequency and direction of information flows; coverage and reliability of communications technology/infrastructure.

- *Operations*: Adequacy of stockpiles, transport and distribution of resources; interaction between agencies/coherence; human, technical and material capacity; involvement of local organisations and communities in needs assessment and relief distribution; adherence to common codes and standards; connectedness (linkages between emergency and other aid, between relief and development).
- *Targeting, impact and empowerment*: Ability to reach those most in need and address the needs of the poorest and most vulnerable; extent to which assistance empowers beneficiaries (e.g., through participation in processes); appropriateness – extent to which goods and services provided meet priorities of beneficiaries (e.g., livelihoods as well as immediate needs); timeliness, efficiency and cost-effectiveness of aid delivery; impact (lives saved, alleviation of suffering, positive and negative effects of assistance on livelihoods).
- *Monitoring and evaluation*: Systems and capacity to carry out M&E; level of beneficiary participation; transparency and accountability (to beneficiaries and donors).

The quality of response reveals the level of capacity and preparedness – and hence provides indicators of the impact of certain kinds of activity, especially disaster preparedness. However, this is not usually spelt out explicitly in evaluations of disaster response, or is a lesser line of enquiry. A few evaluations identify disaster reduction as an area for investigation. This now features regularly in evaluations of appeals from the United Kingdom's Disasters Emergency Committee (DEC) (e.g., ETC (UK) Ltd 1999: 21–41; Young and Associates 2000: 26–8; INTRAC 2000: I: 20–2; Valid International and ANSA 2001: I: 30–5), although the discussion is often rather general or addresses isolated components, and may not permit assessment of the quality or effectiveness of particular measures. The evaluation of the DEC's Gujarat earthquake appeal adopted the Red Cross Red Crescent's NGO Code of Conduct as an assessment framework: this has, inter alia, a commitment to disaster prevention (principle 8): 'Relief aid must strive to reduce future vulnerabilities to disaster as well as meeting basic needs' (Humanitarian Initiatives et al. 2002: II: 39–42). This has been picked by other evaluations as an evaluation tool (e.g., de Hennin and Kormoss 2003: II: 47–9) and it is likely that future evaluations will refer to this and/or similar codes and standards.

Sharma's review of mitigation and preparedness elements within the response to the 1999 Orissa cyclone for Christian Aid is unusual in concentrating on this issue (Sharma 2001). This surveyed partner NGOs' response and especially rehabilitation activities to identify the extent and nature of relevant activities (e.g., preparedness plans, establishment of local preparedness committees, community training, awareness campaigns, construction of houses and information centres, provision of equipment, distribution of radios), comment upon their sustainability and integration with ongoing development work, and identify gaps or weaknesses (ibid. 2001). The extensive public opinion survey carried out for the evaluation of the DEC's Gujarat earthquake appeal involved survivors in discussions about changes in local capacity and vulnerability as a result of the response to the disaster (Humanitarian Initiatives et al. 2002: III: 28–31).

Two other main areas where evaluations of post-disaster response address disaster reduction are:

- *Post-disaster reconstruction*. Unless new structures are hazard-resistant, projects recreate the original risk. Operational agencies have to balance this need with that of providing affordable shelter to as many people as possible. Several evaluations have described and commented on this dilemma, drawing on visual, documentary and interview data, and identifying technical and socio-economic issues (e.g., Borton et al. 1992; Jones et al. 1994; Valid International and ANSA 2001: I: 30–2; Humanitarian Initiatives et al. 2002: II: 39–40; III: 32–42). Post-disaster shelter and reconstruction make up a complex topic that requires separate treatment (see Davis 1978; Barakat 2003).
- *Livelihood support*. This is becoming more common, especially in famine response, reflecting the increasingly widespread acceptance of 'developmental relief' approaches by aid agencies. Its extent is unknown, and the validity of different approaches remains the subject of discussion, which is also outside the scope of this study (Twigg 2004: 320–36). However, it is becoming more normal for evaluations to comment on it, particularly on the distribution of agricultural assets such as seeds, tools and livestock during or after emergencies. Evaluators sometimes view these as disaster mitigation or vulnerability reduction strategies but often report too soon after the disaster to give a thorough assessment of their likely impact. ETC (UK)'s evaluation of the DEC Sudan appeal (1998) judged that the early declaration of the emergency had allowed agencies to intensify measures that reduced the number of people at risk of death or disease from famine (ETC (UK) Ltd 1999: 21–41).

A methodology for assessing the quality of disaster reduction measures through evaluations of post-disaster relief operations appears to be absent. It would be helpful to develop one. A framework need not be complex, but could define key indicators and means of verification. For example, the speed of distribution of relief goods after a disaster – a good indicator of preparedness – can be assessed through internal records and beneficiary feedback.

Process documentation of critical incidents is another tool for measuring the performance of preparedness measures. Post-event analyses are very important, although simulations and scenario exercises give some indication of likely performance (Jegillos 1996: 29, 35–6). DFID's extensive evaluation of the response to the 1995–8 Montserrat volcanic emergency described and explained the event and disaster management process in detail to identify institutional and systems weaknesses. This included analysis of scientific monitoring and risk assessment, disaster preparedness structures and systems, interaction between scientific knowledge and emergency policy, and emergency planning and operations (Clay et al. 1999: I: 25–32; II: 49–82).

It is also relatively easy to isolate each element in the preparedness-response system for analysis. For example, responses to early warnings have been studied on many occasions through a range of surveying and discussion techniques, which has shed light on community attitudes and the effectiveness of warning systems (Twigg 2003). Such knowledge has supported the development of sophisticated methods for evaluating the condition of early warning systems (Chapter 9). The role of individual tools and methods is also relatively easy to track. PAHO commissioned an evaluation of the effectiveness of its SUMA (supply management system) inventory and tracking system for humanitarian supplies in the response to the El Salvador earthquakes of 2001, based on internal documents, field reports and qualitative data from interviews with 30 individuals in key stakeholder agencies (Nicolás and Olson 2001). The value and cost-benefit of flood shelters was noted in the evaluation of the DEC's 1998 Bangladesh floods appeal (Young and Associates 2000: 20).

8.4.12 Programme evaluations

The study found few examples of programme evaluations (i.e., of several projects making up a wider programme); most were of single projects. The European Commission is a notable exception, having evaluated regional and global programmes (de Haulleville and Halatov 2002; de Haulleville et al. 2003), and global food aid/security policy and programming (EuropeAid 2000). The evaluation of ECHO's global disaster reduction work analysed 46 projects to identify common lessons (de Haulleville et al. 2003).

Reviews of sets of individual evaluations can identify salient lessons and themes that are more likely to be widely applicable in policy and operations (OECD DAC 2001: 68–9).[11] A good example is an IFRC review in 1999 that drew on evaluations of disaster preparedness programmes in three continents to generate reflections on six issues: appropriateness of a regional approach; integration with other activities; partnerships and capacity building; programme communication; impact and issues concerning disaster preparedness delegates; and volunteers (Mitchell 1999). These issues appeared in all or most of the programmes evaluated and also echoed findings in the IFRC's international strategy. The review therefore assisted reflection on strategy within the IFRC (ibid. 1999).

More reviews of this kind are needed. The evaluation principles are the same as at project level, but the greater scale and complexity impose additional demands in data collection and analysis. Boundaries are harder to define, there are more stakeholders involved, the focus is more diffuse and causality is harder to identify (OECD DAC 2001: 68–9). Additional resources are required, and evaluators probably have to place extra emphasis on documentary evidence, questionnaires and telephone interviews rather than field visits (e.g., Mochache 2001: 2–3).

8.4.13 Specific areas of disaster reduction

Ideally, project planners and evaluators should have access to sets of indicators covering every aspect of disaster reduction activity, which they can adapt as appropriate. Because these activities are so diverse, considerable work will be required to develop such indicator sets: this will probably be a long-term, iterative process. Guidance on the application of the indicators will also be necessary.

8.5 Application of evaluation findings

The evaluation process must be as open as possible with the results made widely available. For evaluations to be useful, they must be used.

11. In the humanitarian sector, this role is undertaken by ALNAP and the findings are published annually (e.g., ALNAP 2002).

Feedback to both policy-makers and operational staff is essential (OECD DAC 1991).

The way in which impact assessment findings are recorded, presented and shared is of great, and often underestimated, importance (Dawson 1996: 29).

Future challenges in disaster reduction include measuring progress, thorough reporting and dissemination, and advocacy based on documented successful practices (de Haulleville et al. 2003: 28).

Agencies use M&E in a variety of ways (Roche 1999: 234–64). Willingness to acknowledge and learn from experience is essential; M&E must lead to improvements in agencies' work to reduce risk. M&E reports are potentially valuable documents. They allow for practical lessons to be learned within and across programmes and regions. They provide a basis for discussion about better practice and policy change. They also contribute to institutional memory, which is important in organisations that suffer from rapid staff turnover. The need for better feedback is generally acknowledged and widely discussed in aid agency circles; similarly, the institutional obstacles are well understood; and guidance on good practice generally is becoming available (OECD DAC 2001).

Further research is needed to assess the extent to which agencies working on disaster reduction absorb lessons from evaluations, at programming or policy levels. It appears that agencies of all kinds are poor at absorbing the particular and general lessons that come from evaluations, and there are a few indications of this in other research (ITDG n.d.). Often the review or evaluation report is filed rather than acted upon. Many organisations have poor information storage and retrieval systems. Few staff have time to reflect upon lessons learned. In NGOs particularly, overwork and pressures of work constitute a 'systemic weakness' preventing thinking and innovation (Twigg and Steiner 2002: 75).

Most of the evaluations viewed by this study were forward-looking, seeking to assess projects' appropriateness, highlight strengths and weaknesses, and draw lessons for future work.[12] However, several found that agencies placed too little emphasis on lesson learning and feeding lessons into management of ongoing activities. One team observed that: 'Although significant resources are invested in regular evaluations and monitoring missions, the actual changes to a programme that such undertakings make are not always proportional to the inputs.' It used an evaluation workshop to explore why previous recommendations had not been implemented: this identified a number of institutional and other influences (Venghaus et al. 2000: 27–30).

There are exceptions. DFID's evaluation of PAHO's emergency preparedness programme in 2003 was intended to assist PAHO in strategic planning under new directorship and in developing a five-year workplan for donors (Gander et al. 2003: 3). ITDG's ongoing monitoring and reviews led to concrete changes in its livelihood options for disaster reduction in South Asian projects (Lockwood and Alonso 2003: 26). ECHO's regional and global reviews are designed to feed into organisational strategies (e.g., de Haulleville and Halatov 2002; de Haulleville et al. 2003). A review of the BDRCS's community-based cyclone preparedness project in Cox's Bazaar found that: 'The largest attribute that has enabled the project to remain steadfast to the stated approach has been the openness to learning; learning from the experience of others but more importantly from the project's own experiences through a process of action-reflection-learning' (Madiath 2002: 14). Reviews of the BDRCS's cyclone preparedness work in the early 1990s influenced its reorientation towards a more participatory approach (Venghaus et al. 2000: 18–19).

The OECD DAC guidelines recommend 'systematic dissemination' of results (OECD DAC 1991), but more transparency is needed in disaster reduction M&E, where general failure to share evaluations hinders learning. This culture of concealment runs counter to the principle of accountability that many agencies claim to follow. The best collection of evaluation reports is the ALNAP database[13] but most of its documentation is confidential. Many agencies distribute other information on successful projects, but this can tend towards agency propaganda. However, publication of evaluations is slowly becoming more common: the European Commission, which now publishes development and humanitarian evaluations online,[14] is a model of good practice (EuropeAid 2001).

Evaluation findings should be fed back to all project stakeholders before reports are submitted, to allow for discussion and clarification. It is not clear how often this happens. Participatory evaluations are more likely to do so (e.g., Organisation Development Centre 1999): participation creates 'ownership' of the final product among stakeholders, increasing the likelihood that lessons will be acted upon, although participatory feedback workshops can be time-consuming (e.g., Venghaus et al. 2000: 10). The

12. The OECD DAC notes that evaluations should be available at a time that is appropriate for decision-making processes (OECD DAC 1991).

13. http://www.odi.org.uk/alnap/database.html

14. http://europa.eu.int/comm/europeaid/evaluation/ http://europa.eu.int/comm/echo/evaluation/index_en.htm

Canadian Council for International Co-operation's Reconstruction and Rehabilitation Fund, reviewing partners' work following floods and cyclones in Bangladesh in 1988–91, recommended discussion workshops for partners to share experiences and discuss how earlier recommendations were being turned into action (Buchanan et al. 1992: 25). Evaluations by external consultants often limit feedback to debriefing sessions with the commissioning agency.

PAHO has created a Partnership for Health Preparedness, which is a forum for liaison, dialogue and collective reporting to its three core donors: DFID, USAID and CIDA. Annual meetings and joint programme reports have improved donors' understanding and allowed more open exchange between partners. The process has also enabled PAHO to reflect on the overall effects of its programme and give more consideration to output-, outcome- and impact-level results instead of previous overemphasis on individual programme activities in separate reports to each donor (Gander et al. 2003: 36–8).

There are situations where evaluation findings are challenged by the organisations or programmes evaluated. The comments of those evaluated are rarely recorded, but the experience of those involved in disaster reduction suggests that it is unusual for evaluation findings not to be challenged, and there have been occasions where the main findings have been rejected.

8.6 Conclusion

Organisations working in disaster mitigation and preparedness have given low priority to M&E, particularly in comparison to their counterparts in relief and development. In several respects M&E practice lags behind those other fields. Most evaluations take place at the end of a project, often after only two or three years. Longer-term post-project impact evaluations are rare. Although there has been some increase in the use of participatory methods in evaluations of disaster reduction projects, this is limited compared to development practice. M&E systems remain predominantly top-down, designed to provide information to headquarters staff and donors. Time for evaluations is usually very limited, leading to overemphasis on selective field evidence, agency documents and interviews in head offices. Small evaluation teams dominated by external specialists – often men – appear to be common.

Many different data collection methods can be used effectively in evaluation. Evaluations generally use a mix of methods, and the range in use appears to be widening. However, there is too much reliance on interviews with other professionals (in the implementing agency and its partners or other interested organisations) as evidence.

Identification and validation of appropriate indicators of impact is a major challenge to M&E of disaster reduction, though the problem is only occasionally noted in agency documents. Better guidance on generic disaster reduction indicators at project level is badly needed. In many disaster reduction initiatives, adequate baseline data are not collected, leaving evaluators struggling to find adequate measures of success. The potential value of vulnerability analysis as an iterative process for creating baselines and assessing change has yet to be explored.

Most disaster reduction evaluations focus on outputs rather than outcomes or impact, partly due to their timing. Agency reports to donors are also predominantly activity-focused, with relatively little analysis of outcomes (and often some rather tenuous linking of output to outcome). Agencies appear comfortable with indicators of output (especially quantitative indicators), but are less sure about how to select and apply indicators of impact, which may be more varied and qualitative. Where quantitative data are plentiful, evaluators can be tempted to place too much reliance upon them, although a number of evaluations do make extensive use of qualitative indicators. Projects with clear objectives and targets develop a hierarchy of indicators that link process to impact and thereby make M&E more coherent.

There is a tendency in most of the evaluations studied to assume that benefits are spread evenly across a community, especially where evaluators focus on lives saved rather than the impact of an event on livelihoods. Drought/food security evaluations usually do address patterns of distribution of benefits, reflecting their origins in development work, where identification of the most vulnerable is acknowledged to be a crucial factor. Only a few evaluations of disaster reduction in other contexts have considered targeting and differential vulnerability in any depth.

With so many evaluations taking place within a relatively short time of projects' commencement, evaluators often find it difficult to judge the likelihood of their being sustainable. The issue is often covered in evaluators' TOR, but their assessments are often provisional and subjective.

Observed or documented response to disaster events and their consequences is a strong indicator of impact. Evaluations of post-disaster assistance can also provide insights into the effectiveness of mitigation and preparedness measures. However, this is not usually spelt out explicitly in such evaluations, or is a lesser line of enquiry. It would be

helpful to develop a more structured framework for assessing the quality of disaster reduction measures through post-disaster assistance evaluations, defining key indicators and means of verification.

The study found few examples of programme evaluations (i.e., of several projects making up a wider programme); most were of single projects. Reviews of sets of individual evaluations can be valuable in identifying salient lessons and themes that are more likely to be widely applicable in policy and operations.

Greater consistency of evaluation formats and quality would be helpful. Some agencies have relatively standardised formats that help lesson learning from different projects (e.g., the European Commission's are based around the OECD DAC's five key criteria of relevance, efficiency, effectiveness, impact and sustainability: EuropeAid 2001), while ALNAP has developed a 'quality proforma' to help evaluators and evaluation managers (ALNAP 2001).

Further research is needed to assess the extent to which agencies working on disaster reduction absorb lessons from evaluations, at project or policy levels. However, it appears that agencies of all kinds are poor at absorbing the particular and general lessons that come from evaluations. More transparency is needed in disaster reduction M&E, where a widespread failure to share evaluations hinders learning. This culture of concealment runs counter to the principle of accountability that many agencies claim to follow.

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Annex 8.1 Asian Urban Disaster Mitigation Program (AUDMP): Strategic Objective and Results Framework

Programme goal	Reduced natural disaster vulnerability of urban populations, infrastructure, lifeline facilities and shelter in the Asian region.
Programme objective	Establishment of sustainable public and private sector mechanisms for disaster mitigation in the Asian region.
Objective indicator No. 1	**Number of operational plans developed with resources identified by national collaborating institutions to carry out mitigation measures after demonstration activities end.**
Standard/ target	Ten operational plans. By the end of their respective demonstration activities (approx. 18 months), the national collaborating institutions will develop plans for future action, identifying costs and a strategy for acquiring the resources needed for continuing to implement disaster mitigation activities. Each national implementing team (collaborating institutions) may submit a broad collaborative plan or may submit individual plans to continue or adapt their respective activities beyond the project completion date. Target is based on at least one plan from each participating country.
Data sources	Actual plans sent to ADPC Management Team.
Objective indicator No. 2	**Number of replications or adaptations of mitigation skills and procedures promoted in AUDMP demonstration activities by other organisations, communities or countries in the Asian region.**
Standard/ target	25 replications or adaptations. Replication should be initiated during the programme period even if not completed until after the programme ends. Replications may be of methodologies, sets of skills/procedures, guidelines/standards or policies. Replications must be attributable to the example of the demonstration projects. Target has been revised upward (from five) to reflect national project targets.
Data sources	Activity reports; surveys and evaluations; requests for guidelines/models received by ADPC Management Team and national partners.
Critical activities	Process documentation of demonstration activities and methodologies. Promotion and public awareness efforts with relevant government officials, decision-makers, community groups and professionals (e.g., promotional materials, training, city-sharing workshops, community meetings, electronic networking).
Objective indicator No. 3	**Amount of investment from non-AUDMP funding sources attracted by programme and demonstration activities.**
Standard/ target	Additional investment of 5 per cent of the total programme budget will be attracted from local, regional and/or international organisations. Reports from national collaborating partners should list: local public and private investment, in cash and in kind; and external support acquired (for example, from international organizations, bilateral donors, regional institutions). This indicator measures investments and contributions above and beyond the required 15 per cent 'counterpart contribution' specified in the contracts between ADPC and national partner institutions
Data sources	In-kind contribution forms, contractual documentation, loan agreements; organisational reports, activity reports; financial records.
Critical activities	Establishment/maintenance of linkages with other organisations and businesses; documentation and exploration of opportunities for cost-sharing; programme promotion via international forums, etc.

Objective indicator No. 4	**Number of households potentially benefiting from AUDMP-sponsored activities to reduce disaster vulnerability.**
Standard/ target	Estimated (TBD) households. Represents 100 per cent of households in the communities targeted for implementation of the demonstration projects. This indicator does not measure participation or satisfaction – only potential coverage of vulnerability-reduction activities. This indicator also does not measure coverage of national policy changes.
Data sources	Municipal census data, national demonstration project documentation.
Critical activities	Establishment/maintenance of linkages with other organisations and businesses; documentation and exploration of opportunities for cost-sharing; programme promotion via international forums, etc.
Result No. 1	Improved capacity of municipal officials to manage risk, apply mitigation skills and technologies.
Indicator 1.1	**Number of new or improved assessment methods and guidelines/standards used for public and private sector development.**
Standard/ target	At least ten new or improved methods or guidelines/standards adopted and used during the programme period. Count ordinances, development regulations, building standards, vulnerability/risk analyses – any means a community or municipality has for controlling or regulating development, incorporating hazard information. Monitor applications and enforcement of standards/regulations by city officials and private professionals. Target is based on one new or improved assessment method or set of guidelines/standards used per national demonstration project. (Replications outside the targeted demonstration sites are counted under Objective indicator No. 2. National policy changes are counted under Result No. 3.)
Data sources	Regularly scheduled activity reports; municipal records; SOPs (standard operating procedures) and published regulations.
Critical activities	Preparation of hazard, vulnerability maps; identification of elements at risk. Recommendations for mitigation strategy; identification of implementation options and priorities.
Indicator 1.2	**Number of emergency preparedness and response plans written or revised to reflect improved information on hazards and vulnerability.**
Standard/ target	At least eight municipal emergency plans written or revised during the programme period. To be counted, they must be stand-alone plans; adoption of a plan formulated by a larger entity (regional, provincial, etc.) does not count, although the plan itself might qualify as a replication if influenced by the demonstration project activities. Target is based on one plan per national demonstration project.
Data sources	Current and prior municipal emergency preparedness and response plans; business plans; community service plans.
Result No. 2	Improved access to hazard mitigation information and skills (techniques, methodologies, experience) throughout the region.
Indicator 2.1	**Percentage of public and private sector professionals with AUDMP-initiated disaster mitigation training who are using the knowledge gained in fields impacting disaster management or urban development.**
Standard/ target	75 per cent of the public and private sector professionals trained in AUDMP-initiated mitigation courses held during the programme period. Count as a baseline the participants in regional and national core courses, not those taking project-specific skills training.
Guidelines	Number trained during LOP estimated to be 150.
Data sources	ADPC and national partner training organisation records. Surveys of individuals and employers, conducted approximately six to nine months following the training, to track whether the knowledge conveyed is being put to use. Activity reports (showing number trained and number of trainees working in related jobs), course schedules, course participant lists with names and position information.
Critical activities	Development of training materials/curriculum, conduct of courses; follow-up survey/assessment tool.

Indicator 2.2	**Number of institutions where AUDMP-initiated training and professional development course modules are institutionalised.**
Standard/ target	At least 12 institutions (ADPC plus one for each country conducting a demonstration project) offer these courses in their regular curriculum for at least three years following project completion. The institutions must demonstrate capability (curriculum and resources) and promotional efforts to hold the course by the end of the project period.
Data sources	Training institution curricula; course attendance records; activity reports.
Critical activities	Development and conduct of core course modules; signing of MoUs with National Partner Training Institutions.
Indicator 2.3	**Level of participation in the AUDMP regional information and contact network established during the programme.**
Standard/ target	Total participation in the network increases by 30 per cent annually during programme period. First year target is 25 organisations, which becomes the baseline for future increases. Participation means active involvement in issues dialogues, information exchange and dissemination, and/or collaborative activities.
Data sources	AUDMP Networking Guide; AUDMP contact database records; documentation of information requests and responses/information dissemination; questionnaires and interviews on info use; national activity reports.
Critical activities	Information outreach and exchange activities, distribution of project 'bulletins', network development at the regional and national project levels, construction and maintenance of programme database, etc.
Result No. 3	Improved policy environment for disaster mitigation.
Indicator 3.1	**Improved policy environment for disaster mitigation.**
Standard/ target	At least four national policies established or revised as a result of AUDMP demonstration activities, training and/or promotion of mitigation strategies and techniques. Count broad national policies, not ordinances or standards/guidelines.
Data sources	Actual policy documentation, legal or regulatory approvals; budget allocations; evaluations.
Critical activities	Policy workshops, policy assessments and recommendations; training, information and networking activities.

Source: http://www.adpc.net//AUDMP/ME-Framework.html

Annex 8.2 Gender equality results and indicators for disaster-related programmes

(1) General results incorporating gender equality

General results. *Gender dimension*	Possible indicators
Improved community capacity in disaster preparedness. *Equal participation of women in activities such as training, risk mapping and volunteer brigades. Strengthening of women's leadership in community activities.*	Number of community, family disaster plans done. Number of women, men, youth trained as volunteers. Percentage of local residents (women, men) who took part in simulation exercises. More effective response to next disaster.
Improved disaster prevention through pilot works. *Equal participation of women in training, construction of pilot works.*	Number of preventive works constructed. Number, percentage of women/men involved in training, construction.
Increased municipal capacity and commitment to disaster preparedness. *Participation of women officials in developing municipal plans, and incorporation of women's concerns.*	Number of municipal budgets, laws, land-use policies that included disaster preparedness. Financial and technical resources allocated. Degree to which women were consulted, or took part in municipal decision-making. Degree to which women's needs or concerns were reflected in municipal plans.
Increased public awareness about disasters. *Participation of women in workshops and local events. Women involved in preparation of educational materials and media coverage.*	Number of workshops, media reports, local events. Number of pamphlets produced, distributed. Number of women/men involved in educational activities. Better understanding of disasters.
Stronger local organisation and coordination among disaster-related institutions. *Increased collaboration between women's organisations and other local groups. Participation of women in local decision-making.*	Number of meetings, joint activities held. Participation of all groups in local events. Number of women and women's groups involved in local coordination. Municipal disaster committees included women's groups.
Greater role of children and youth in disaster preparedness. *Equal participation of women teachers and girl students in educational activities. Active role played by girls in youth brigades.*	Number of girls/boys who took environmental course. Number of girls/boys who participated in educational activities. Type of role played by girls/boys.
Improved environmental management, decreased soil erosion. *Equal participation of women in conservation projects and training.*	Number of women/men trained in conservation techniques. Number of conservation projects implemented. Amount of soil erosion after techniques used.

(2) Gender-specific results and indicators

Gender-specific results	Indicators
Increased participation of women in community disaster preparedness and response, especially in non-traditional roles. Increased participation of men, especially in non-traditional roles.	Number of women trained in disaster management. Number of women mobilised during response. Types of activities undertaken by women, including search and rescue, reconstruction. Non-traditional activities undertaken by men, such as disaster-related health and education.
Strengthened capacity of women's organisations to participate in and lead community disaster preparedness.	Training received by women's organisations. Women's groups played a greater role in community disaster structures, response.
Increased participation and leadership by women in municipal disaster preparedness planning and programmes.	Number of women officials involved in disaster decision-making, planning and programmes before/after project. Role of women on municipal councils.
Integration of women's needs and priorities in local disaster planning.	Women consulted about disaster-related needs. Degree to which women's concerns are reflected in local disaster planning.
Increased self-esteem, empowerment and leadership by women in disaster preparedness.	Number of women trained in leadership, self-esteem. Number of women/men actively involved in decision-making, planning, implementation. Change in women's perception about their role and capacity.
Greater community recognition of women's role and capacity in disaster preparedness.	Women's groups consulted by local disaster authorities. Number of women/men chosen to lead local initiatives. Changed attitudes about women's role and capacity.
Increased cooperation between women's groups and other community organisations on disaster preparedness and other local issues.	Involvement of women's groups in local disaster committees. Number and quality of meetings between women's groups and other organisations. Number of joint initiatives related to disasters and other local issues.
Strengthened capacity of local partner organisations to do gender analysis and promote gender equality.	Gender analysis done by partners. Gender-disaggregated data generated for project monitoring, evaluation. Gender training provided to local partners. Partners replicated training with other local groups.

Source: Gander et al. 2003

Chapter 9

Appraisal and evaluation of structures, systems and organisations

9.1 Disaster reduction structures and systems

The complexity of holistic risk management adds to the difficulty of assessment. Most methods address discrete or small-scale interventions, where the range of approaches and stakeholders is limited. But larger-scale interventions, especially those at a higher (or system) level, have a very important role to play in disaster reduction. How can one assess and evaluate these – not just the impact of system-level interventions, but also their performance and capacity? Methodological guidance for assessment/evaluation in these contexts is very limited; much is recent and experimental. There is a significant gap in our understanding of such matters. Nevertheless, there is potential for bringing various frameworks and principles together to form a common baseline for assessment. This could be supplemented by developing more detailed indicators, many of which may already be suggested in disaster planning/preparedness guidelines.

9.1.1 National-level disaster reduction systems

Governments are central actors in disaster reduction. Every country is expected to have a national disaster reduction system. There is no single model for such a system, but normally it would comprise: a disaster (or risk) management policy that addresses preparedness and mitigation; a strategy for attaining policy goals; a legal basis for actions (laws, regulations); and administrative structures and systems to implement the strategy (UNDRO 1991: 3–28). Within such a framework, a variety of policies, regulations and procedures can be used to address particular kinds of risk and hazard (Coburn et al. 1994; UNDRO 1991).

National-level systems are not well covered in the literature. Individual disasters may sometimes lead to such discussion (e.g., Hossain et al. 1992). There are some comparative studies of national systems in Latin America (Lavell and Franco 1996; Trujillo et al. 2000: 51–65), but there are few detailed studies.[1] Until recently there was also little formal guidance on how to monitor progress in disaster reduction at national level. Some indicators are suggested in the UN Disaster Management and Training Programme's (UN DMTP) module 'Model for a National Disaster Management Structure, Preparedness Plan, and Supporting Legislation', which identifies eight key components in a model system (see Box 9.1).

Evaluation of national or sub-national strategies and plans is made easier by the existence of clearly defined goals and indicators (see Box 9.2). This is not widespread, although some national programmes funded by international donors have developed logical frameworks with indicators and means of verification for a range of relevant activities (e.g., Frost 2003).

The comprehensive risk management approach requires a broad perspective covering other aspects of policy, institutions and practice. Two model monitoring frameworks that appeared in 2003 attempt this:

- The ISDR's Draft Framework to Guide and Monitor Disaster Risk Reduction (ISDR 2003).
- Mitchell's Operational Framework for Mainstreaming Disaster Risk Reduction (Mitchell 2003).

Both are designed, inter alia, to assess progress by governments and other actors at national level in all the main aspects of disaster reduction, and to help set goals and targets. The ISDR framework is envisaged as a tool for comparing progress between different countries. Initiatives to develop indicators of countries' levels of risk and vulnerability (see Chapters 1 and 2) complement this. Both frameworks sidestep the problem of defining 'disaster risk reduction' precisely: this would be difficult and contested, and would impose excessive rigidity. Whilst accepting the long-term need for consensus on the fundamental components, they prefer to work with key elements that *characterise* 'disaster risk reduction', as a step towards consensus.

1. Exceptions are Godschalk et al. (1999) and InterWorks (1998).

Box 9.1 Eight key components in a model disaster management system

- *Focal point.* The focal point is the key agency that has the authority and resources to coordinate all related bodies for disaster management such as ministries, international donor agencies, NGOs and the private sector. The focal point agency needs a core of well-trained staff and adequate resources and should be supported by appropriate legislation and authority for decision-making and implementation.
- *Links between policy and operations.* The system must ensure a very close working relationship between the policy-formulating body, often in the hands of a national disaster committee, and the operational agency that must implement the decisions. For this reason, there are significant advantages in placing the focal point in the prime minister's office rather than in a line ministry.
- *Links from the centre to local government.* Links are critical between national, regional, district and community levels to facilitate implementation and ensure effective vertical communication with, for example, information flowing up and resources flowing down.
- *Coordination of relief and mitigation programmes.* Close working linkages are needed between bodies responsible for relief and mitigation programmes to ensure that risk reduction measures are introduced in the immediate post-disaster situation and to enhance future preparedness.
- *Political consensus.* Consensus must be reached among all political parties to ensure implementation of national plans and legislation.
- *NGOs.* The model must fully integrate NGOs in order to improve NGO/government cooperation and establish a comprehensive, integrated pattern of response.
- *The national preparedness plan.* Plans provide a description of a systematic approach to disaster preparedness. Plans must be constantly revised and updated and should be interlocked with and supplemented by compatible local-level preparedness plans with a more specific focus on operational issues.
- *The scope of disaster planning.* While most disaster planning describes how to react to a disaster, if disaster risks are to be reduced, it is essential that planning becomes proactive with an emphasis on preparedness and mitigation.

Source: InterWorks 1998: 1–2

The ISDR's framework ('a starting point to guide and monitor disaster risk reduction') covers five core thematic areas that underpin understanding and practice: governance; risk identification; knowledge management; risk management applications; and preparedness and emergency planning. Characteristics and provisional benchmarking criteria are attached to each area, using quantitative and qualitative indicators; but at present these are only general statements that need to be developed into more precise indicators (ISDR 2003). Mitchell's framework is more detailed and comprehensive. It is made up of 20 primary indicators of the status of disaster risk reduction mainstreaming in a country, grouped under four broad headings: politics and legislation; policy; knowledge; and practice. Three grades or levels of achievement are attached to each indicator, together with a 'super goal' characterising more remote best practice. The framework suggests the sources of evidence for each indicator that might feed into this process. Providing incremental achievement targets helps in monitoring progress, as well as demonstrating that targets are realistic. Because transparency and consensus-building between stakeholder groups are central to the process, qualitative indicators are preferred as a way to engage as many parties as possible through discussion about levels and indicators of achievement (Mitchell 2003: 7–8).

Both of the above frameworks are concepts and remain untested in the field (Mitchell's is due to be tested in part during 2004). However, a similarly comprehensive framework developed by the World Bank's Caribbean Country Management Unit to supply indicators/ benchmarks for 'good practices' in risk management has been applied. This framework breaks risk management down into three main areas: risk identification; reduction; and transfer. In each of these main areas, key elements of good practice are identified: these comprise both outcomes (the desired state or objective) and instruments (technical and institutional mechanisms that need to be deployed to reach the outcomes). One significant feature of the framework is that it disaggregates good practice further according to the institutional actor involved – i.e., distinct outcomes and instruments are identified for civil society, various actors in local and national government, the private sector, and sub-regional and regional agencies. Application of this method in the Caribbean region made it possible to assess the current state of practice and identify gaps – within

Box 9.2 Regional goals and benchmarks/indicators for emergency preparedness from Strategic Regional Policy Plan for South Florida, USA (1995)

Goal	Benchmarks/Indicators
Direct future development away from areas most vulnerable to storm surges.	■ Average annual rate of population growth in Category 3 hurricane evacuation area to be not more than 0.5 per cent for the decade 1990–2000.
No increased risk to hospital patients and special needs population due to an emergency.	■ 25% of vulnerable health-care facilities to be wind-hardened by 2000; 100% by 2015. ■ 100% of vulnerable health-care facilities to have emergency plan for licensing by 2000.
Encourage all levels of government and the private sector to work together to ensure adequate and timely shelter within the region for those residing in hurricane evacuation areas.	■ Regional sheltering capacity to be established for 25% of vulnerable regional population by 2000; for 75% by 2015. ■ Regional evacuation clearance times greater than 12 hours to be reduced by 25% by 2000; 75% by 2015. ■ Population evacuating out of the region to be reduced by 25% by 2000; 75% by 2015. ■ 25% of residences in non-vulnerable locations to be converted to home shelters by 2000; 100% by 2015.
Achieve consistency between goals and objectives of agency plans and emergency plans.	■ Emergency preparedness consistency in state statutes to be achieved by 2000. ■ Standing regional emergency planning committee to be established by 2000.
Minimise future risk to lives and property, partly through timely completion of post-disaster redevelopment plans.	■ Number of repetitive loss properties to be reduced. ■ Public facilities and infrastructure exposed to risk from emergencies to be reduced. ■ Number of lives lost to disasters to be reduced.
Achieve flexible and comprehensive emergency planning for a variety of emergencies.	■ List of basic necessities to sustain life and corresponding supplies to be identified and agreed to by 2000.

Source: Godschalk et al. 1999: 113

countries and across the region as a whole – thereby supplying a comprehensive baseline for evaluating subsequent progress (World Bank 2002a, 2002b).

Two other system-wide assessment/evaluation tools may offer models for disaster reduction. The Essential Public Health Functions (EPHF) method developed and promoted through the Public Health in the Americas Programme is an elaborate, comprehensive tool for assessing the state of national health structures, based around 11 essential public health functions, one of which (EPHF 11) is 'reduction of the impact of emergencies and disasters on public health' (PAHO 2002; Gander et al. 2003: II: 107–12). EPHF 11 covers policy development, planning and execution of mitigation, response and rehabilitation activities, integration of activities, and inter-sectoral and inter-institutional collaboration. There are four main indicator areas:

- Emergency preparedness and disaster management in health.
- Development of standards and guidelines that support emergency preparedness and disaster management in health.
- Coordination and partnerships with other agencies and/or institutions in emergencies and disasters.
- Technical assistance and support to the sub-national level to reduce the impact of emergencies and disasters on health.

In each case, a set of standards is defined and a series of sub-indicators set out as a yes/no questionnaire: there are over 80 sub-indicator questions. A quantitative scoring method enables comparison between public health systems in different countries. The EPHF method has been

applied in a comparative study of 41 countries. In the case of EPHF 11, this revealed variations in indicator performance across the region and, through analysis of the sub-indicator questions, factors behind this (PAHO 2002: 144–46). The reliance on self-assessment and the scope for subjective judgement in answering some of the questions are limiting factors and the numerical scoring system risks over-simplification, but the method's coverage is extensive and provides a useful tool for comparative analysis.

GeoHazards International's pilot Global Earthquake Safety Initiative (GESI) has developed schemes for measuring capabilities in search and rescue, fire suppression and emergency medicine as part of a wider risk analysis: these could be used independently for analysing system capacity. The method provides scores against a series of questions that are added together and matched against data of likely disaster impact to produce capacity ratings (an extract is in Box 9.3). The data needed to answer the questions are collected from published sources and through interviews and workshops with specialists in each city, thereby combining quantifiable data with qualitative expert analysis (GHI/UNCRD 2001). The approach covers key questions thoroughly but has to make a number of assumptions in generating the quantifiable results required for the overall risk analysis, which arguably introduces a degree of artificiality into the analysis. The capability assessments could perhaps be developed into a more elaborate method comprising more qualitative elements with a wider range of optional answers to each question.

Box 9.4 describes a detailed evaluation of the USA's national mitigation system (Godschalk et al. 1999). Elsewhere, especially in developing countries, a well-resourced assessment on this scale would be unlikely, but there are many methodological lessons to be learnt from the approach.

Box 9.3 GHI/GESI tool for measuring search-and-rescue capability

We assume that each rescue requires between 40 and 90 person-hours by search-and-rescue professionals, and that trapped people remain alive for 48 hours. Each city's emergency preparedness is rated from 0 to 16, with 0 being the best score and 16 the worst. Cities with the best emergency preparedness are assumed to require 40 person-hours per rescue and those with the worst rating require 90. The scoring scheme is presented below:

- Is there a detailed emergency response plan in written from that covers the city? (yes=0, no=1)
- Does the plan specifically address earthquakes? (yes=0, no=1)
- Does the plan include input from a multidisciplinary group? (yes=0, no=1)
- Has the plan been revised to incorporate actual city experience or experiences of nearby cities? (yes=0, no=1)
- Are responsibilities of different agencies clear and well defined, including how local, state/provincial and national agencies interact? (yes=0, partially=1, no=2)
- Is there a programme to make sure all key players in the plan know their roles in the plan, the emergency procedures they must follow, and how they relate to other groups? (yes=0, yes, but needs improvement=1, no=2)
- Does the plan allow adequate 'horizontal' communication and decision-making (e.g., can low- and mid-level officials make decisions if higher officials are unavailable)? (yes=0, no=1)
- Is there an earthquake-resistant communications system? (yes=0, no=1)
- Is there an emergency command centre that can be operational after an earthquake (e.g., building is safe; power and communications will function)? (yes=0, yes, but not sure all aspects will be operational=1, no=2)
- Is there a standard building damage assessment procedure? (yes=0, no=1)
- Are there any programmes to train citizens in emergency preparedness and/or to assist the official emergency response effort? (yes=0, no=1)
- Does the city conduct emergency response drills annually? (yes=0, yes, but less than annually or without all organisations=1, no=2)

The responses to the questions are summed and scaled linearly to assign rescue times to ratings between 0 and 16. We take the number of trained fire-fighters in each city as a guide to the number of trained professionals available for search and rescue. We assume that half of the trained fire-fighters are available to be conducting search-and-rescue activities around the clock for the 48 hours after the earthquake before the victims die.

Source: GHI/UNCRD 2001: 45.

Box 9.4 Assessing the planning and implementation of hazard mitigation

In the mid-1990s, a team of seven specialists carried out an assessment of the state of mitigation planning and implementation in the United States and the processes by which plans and programmes were formulated. It was the first systematic study of the complete intergovernmental (i.e., national–state–local) mitigation system and focused on the processes of state-level mitigation planning, the compliance of plans with legislative requirements, expenditure patterns, and outcomes and effectiveness of mitigation activities. The main benchmarks for measuring progress were the provisions of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (1988), the basic national legislation for disaster management, and its accompanying regulations.

The main components of the methodology were:

- *Review* of recent mitigation policy documents and proposals (instead of the normal literature review) to trace the evolution of policy.
- *Process evaluation*. Six intensive case studies of mitigation efforts in different parts of the country and in the aftermath of recent major disaster events, chosen to provide a sample of contemporary hazard mitigation experience. During field visits, the team interviewed state, local and regional mitigation officials, and other academic and private sector specialists, covering a range of issues to do with preparation of plans, institutional capacity and the roles of agencies, and decision-making processes and timing. Relevant documentation was also collected.
- *Plan content.* State mitigation plans were collected from 39 states and territories, and a systematic content analysis was carried out, checking the degree to which statutory requirements were met, coverage of different types of hazard and mitigation, procedures for implementation and M&E, and quality of individual elements. Evaluation of the plans was based against: the requirements of the Stafford Act; FEMA's post-disaster hazard mitigation guidelines; and team members' knowledge of good practice in planning. A detailed evaluation guide was drawn up, containing a scoring system for plan breadth and quality. To ensure consistency, this was tested through trial applications by different team members.
- *Expenditure patterns*. Mitigation grant data from 1,967 projects were collected and analysed to display, for example, the change over time in emphasis on different types of mitigation.
- *Linkages analysis*. Telephone surveys of state and federal mitigation officers were used to learn how they rated capacity and commitment throughout the system

Source: Godschalk et al. 1999

Disaster reduction could also learn from tools used in development. For example, UNDP's *General Guidelines for Capacity Assessment and Development to Support the Development and Implementation of National Programme Frameworks* covers several dimensions of national systems' capacities, and their context, using a range of techniques to acquire and analyse information (UNDP 1997). UNAIDS has produced modules on designing and implementing national-level systems for monitoring and evaluating measures to combat HIV/AIDS, covering principles, planning and management, data, indicators and resources (UNAIDS n.d.). There may well be methodologies developed in many other contexts that could be adapted.

9.1.2 Disaster preparedness and early warning systems

Disaster preparedness (DP)

Considerable guidance is available on DP systems (e.g., Kent 1994, Alexander 2002) but there is little specifically on M&E. The UN DMTP module on DP sets out a framework with nine operational elements, which could be used to frame evaluation criteria especially where project baselines or objectives are not clearly defined (see Table 9.1).

Researchers, particularly sociologists, have discussed and identified principles or guidelines of good disaster planning. These too could form broad evaluation criteria (e.g., Quarantelli 1998; Perry and Lindell 2003). Guidance on the contents and essential characteristics of a DP plan (Kent 1994: 14–15, 47–53; Alexander 2002: 96–7) could be used similarly, with the caveat that a DP plan is 'the product, but not the main goal, of the planning process' (Kent 1994: 14). The IFRC's National Society Disaster Management, Preparedness & Response Programme Checklist Review provides a comprehensive set of questions on how far disaster/emergency plans have been implemented (IFRC 2001a). The detailed methodology for assessing mitigation plans used in the assessment of hazard mitigation in the United States (Godschalk et al. 1999: 373–91; see Box 9.4) embraces many elements of DP.

Table 9.1 Disaster preparedness framework

Vulnerability assessment Starting point for planning and preparation, linked to longer-term mitigation and development interventions as well as disaster preparedness.	**Planning** Disaster preparedness plans agreed and in place, which are achievable and for which commitment and resources are relatively assured.	**Institutional framework** Well-coordinated disaster preparedness and response system at all levels, with commitment from relevant stakeholders. Roles and responsibilities clearly defined.
Information systems Efficient and reliable systems for gathering and sharing information (e.g., forecasts and warnings, information on relevant capacities, role allocation and resources) between stakeholders.	**Resource base** Goods (e.g., stockpiles of food, emergency shelter and other materials), services (e.g., search and rescue, medical, engineering, nutrition specialists) and disaster relief funding (e.g., for items not easily stockpiled or not anticipated) available and accessible.	**Warning systems** Robust communications systems (technologies, infrastructure, people) capable of transmitting warnings effectively to people at risk.
Response mechanisms Established and familiar to disaster response agencies and disaster victims (may include: evacuation procedures and shelters; search-and-rescue teams; needs-assessment teams; activation of emergency lifeline facilities; reception centres and shelters for displaced people).	**Education and training** Training courses, workshops and extension programmes for at-risk groups and disaster responders. Knowledge of risk and appropriate response shared through public information and education systems.	**Rehearsals** Evacuation and response procedures practised, evaluated and improved.

Source: Kent 1994

Early warning

The principal test of an early warning (EW) system's impact is the extent to which agencies and populations take effective action. This is usually demonstrated through documentation and evaluation of disaster response in the case of sudden-onset disasters (see Chapter 8), and for slower-onset food crises through assessment of ability to provide food, seeds and other livelihood support.

Sophisticated methods have been developed for evaluating EW systems during 'quiet' periods between events. The Flood Hazard Research Centre developed a criteria-development matrix method for assessing flood and cyclone warning systems (Parker 1999; Parker and Budgen 1998). The cyclone application has 27 social, organisational and institutional assessment criteria, with five levels of development for each criterion. Assessment against each criterion and development stage generates a profile of the system overall. The condition that is to be met or exceeded at each development stage for each criterion is specified in each cell of the matrix: these are almost entirely qualitative but are also based upon synthesis of previous research. The matrix can be modified by changing conditions and criteria in the light of experience. Evaluation data are collected from in-depth interviews with key informants sampled from stakeholder groups and preliminary research on EW institutions and systems. When the method was piloted in Mauritius, 52 key informants from nine stakeholder groups were interviewed (preceded by careful stakeholder analysis to ensure all relevant groups, including warning recipients, were included). The interview format was semi-structured, but in-depth and based on the main factors indicated by the 27 criteria. Data were triangulated during analysis and separate investigations undertaken to verify information or identify factors behind conflicting data. Wider surveying of vulnerable communities is valuable, if resources are available for this.

When considering early warnings, it is also important to note the role and value of community-based systems that may be complementary to, but are separate from, the larger-scale, top-down mass communications approach. Evaluation methodologies should be flexible enough to consider these systems too.

9.2 Institutional dimensions

Institutional development is a vital part of disaster reduction. Field projects must be supported by appropriate organisational attitudes, structures and systems. There is little guidance on how to do this. Analyses of institutions' ability to plan and implement disaster reduction initiatives are very rare.

9.2.1 Assessment of organisational capacity

Handbooks on development M&E cover methods for evaluating the different dimensions of organisational capacity (e.g., Roche 1999: 234–61) and understanding of relevant indicators has greatly improved (Morgan 1997). Capacity assessment tools are available, which are particularly popular in the non-profit sector (e.g., McKinsey & Co. 2001; Crooks 2003) and donor agencies (e.g., UNDP 1997). Such tools often rely on qualitative data. The data collection methods are rarely prescribed, being selected according to circumstances.

The literature on organisational capacity building with regard to disaster reduction is limited. There are some useful general discussions (Nwobodo 1999; IFRC 2003: 43–65) and institutional issues often feature in project evaluations, but more work is needed to analyse individual findings and draw out lessons. This has been done occasionally within organisations (e.g., Mitchell 1999) but would be equally valuable across organisations. Organisational aspects are addressed in the UN DMTP module on building capacities for risk reduction, primarily at local level, which sets out a range of techniques for building capacity with regard to human resource development, organisational/group development, and 'institutional' development (i.e., formalisation of group initiatives) (Bethke et al. 1997: 41–61). Other guidance on institutional appraisal is general, highlighting broad issues rather than potential methodologies (e.g., UNDRO 1991: 10).

Capacity building is not an end in itself. Linkages between indicators of enhanced organisational capacity in general and improved field activity are often taken as obvious but should be made explicit and validated. The UN DMTP module notes that it is essential to define measurable outcomes to capacity building, aimed at specific areas of risk reduction, if meaningful M&E is to be undertaken. Key areas for enquiry are sustainability, participation, acquisition of skills and implementation of strategies. The module suggests a few indicators that might be used, but emphasises that both indicators and M&E methods must be matched to the different aspects of the particular risk reduction programme being evaluated. The success of capacity building might be assessed on the basis of such factors as enabling the organisation to inventory and value resources, identify vulnerabilities, define and assess options to mitigate the impact of hazard events, and make informed decisions based on reliable, relevant and accurate data (Bethke et al. 1997: 57–61). The evaluation of PAHO's PED programme identified improved disaster reduction capacity in the Guatemalan Ministry of Health through: creation of a new risk management unit; integration of other divisions into disaster prevention; adoption of the SUMA methodology; establishment of EW systems in health centres; preparation of a national health disaster plan; and development of hospital emergency plans – implemented successfully during a dengue fever epidemic (Gander et al. 2003: I: 8; II: 8).

Planning documents for mitigation and preparedness projects may contain institutional appraisals of national governments and other partner agencies, or of organisations whose capacity is to be enhanced through a project. These may draw on formal methods but in practice tend to be relatively subjective and general. In development planning, institutional assessment guidelines focus on common internal problems (financial, technical, organisational, management, human resources and other dimensions of capacity); external aspects are more likely to include resourcing, costs/benefits, communications/public relations and related areas than physical hazard risks or the institution's vulnerability to natural hazards (e.g., UNDP 1997: 31–2).

9.2.2 Mainstreaming disaster reduction

The processes by which disaster reduction might be effectively mainstreamed into organisational policy and practice are not well understood. This problem, while generally accepted by disaster professionals, is only now being discussed seriously (e.g., Tearfund 2003) and requires much more research. Tools for evaluating mainstreaming are needed in pre-project institutional appraisal and stand-alone evaluations. Only one purpose-built tool for assessing mainstreaming has been developed and applied to date: the IFRC's well-prepared National Society initiative (see below). There are established sociological models for viewing organisational response to crises (Webb 1999), which can be used in rapid, qualitative assessment (e.g., Sutton 2003). Their potential as a working tool for evaluating organisations working in disaster reduction could be explored. Lessons might also be learned from efforts to mainstream other issues (e.g., gender, environment) into development.

The well-prepared National Society

In 2001, the IFRC drew up the *Characteristics of a Well-Prepared National Society* (WPNS) guidelines (IFRC 2001b; reproduced in Annex 9.1). These set out 33 indicators that Red Cross/Crescent National Societies can use to assess their capacity to predict disasters, reduce their impact on vulnerable communities and respond to them. The indicators cover every aspect of organisational capacity: policy and planning; structures and organisation; human resources; financial and material resources; relevance and effectiveness of disaster preparedness activity; and advocacy. They also look at external relations (e.g., the role of a National Society in government emergency planning and the extent of its coordination with other relevant organisations). A self-assessment questionnaire has been developed to help National Societies and IFRC staff obtain a picture of the status of disaster preparedness at national and international levels, and from this to decide where to concentrate capacity-building support. The self-assessment method needs to strike a balance between being quick and easy to use and generating meaningful information. Participatory assessment is desirable, because otherwise questionnaires might be completed by individuals or small groups who do not represent the views of their society as a whole or whose knowledge of its disaster preparedness work is inadequate.

Many National Societies have found the WPNS tool valuable for self-assessment and planning, providing a benchmark for monitoring progress. Many had not viewed their disaster preparedness capacity in such a way before. Some people have argued that there are already so many systems and procedures to ensure good management that there is little added value in assessing disaster preparedness, but for many others its added value lies in giving a systematic overview. Some National Societies have used the assessment findings for action planning and preparing fund-raising appeals. Collated findings have been used at regional and international level to identify strengths and weaknesses (IFRC 2002). The WPNS surveys are valuable in providing an institutional baseline for DP planning and are now seen in IFRC as a standard assessment tool, linked to other IFRC internal mechanisms for broader organisational assessment and to specific project tools such as the VCA.

Generic indicators for disaster reduction mainstreaming

Drawing partly on the WPNS experience, Twigg (2004: 24–6) has presented basic guidance on generic indicators for use by disaster management and development agencies to show how far they have mainstreamed disaster reduction (see Box 9.5). These have yet to be tested.

Although this table covers staff capacity in general terms (under 'structures and systems'), more specific indicators for human resources (numbers, skills, positions in the organisation) could be added. This might include attitudinal factors, which are important but harder to measure. A review of IFRC DP programmes concluded that: 'The positive effect of a good, confident and happy DP delegate cannot be overestimated,' citing examples where individual delegates had reinvigorated programmes (Mitchell 1999: 10). Research into NGO involvement in mitigation and preparedness has found that well-placed individuals can have considerable influence on organisational policy and practice (Twigg and Steiner 2002).

Box 9.5 General indicators for disaster reduction mainstreaming in organisations

Policy level

Policy statements should refer to the importance of disasters, vulnerability or risk and commit the organisation to addressing these issues. They should set out the agency's broad goals in overcoming the problem, linked to its strategic objectives. Firm commitments to take action are particularly important, but are likely to be vague or rhetorical, and are often absent even when the importance of disasters has been acknowledged. Hazard-induced disasters may be placed under the catch-all heading of 'external shocks and stresses', which can indicate that the agency concerned is taking a holistic approach to vulnerability, but may lead to their particular significance being played down.

Nevertheless, general policy statements are important because they give a mandate to managers and planners within organisations. A specific risk/disaster policy can be helpful, but will only be feasible for large organisations. Even there, such a policy may become just one of many.

Strategic level	The limitations of policy statements make it essential to provide support at the level of strategic planning. An organisation's strategy or business plan should not only identify the importance of disaster reduction, but also set priorities and targets for addressing the challenge over a specified period. These might cover incorporation of risk/vulnerability questions into project planning guidelines, staff training in issues and methods, assigning responsibility for relevant tasks, giving appropriate authority to those responsible and establishing monitoring and reporting procedures.
Operational guidelines	Many relief and development organisations work to operational guidelines for planning and implementing projects (and for running the organisation itself). Ranging from simple checklists to heavyweight manuals, they aim to ensure quality and consistency in the agencies' work. Risk analysis, treatment and monitoring can be inserted into the simpler operational guidelines without great difficulty. The simplest way is to add a few basic questions or criteria to standard checklists, such as: ■ Will the project affect people's vulnerability to man-made and other disasters? ■ What impact will the project have on socio-economic vulnerability? ■ What significant hazards might affect the target group? ■ What are the project's plans for identifying and reducing hazard risks to its beneficiaries? Projects should give consideration to the likelihood of disasters and, where appropriate, prepare the community and the project itself to deal with disaster situations. Detailed operational manuals are another matter: here, more detailed guidance will be required. (Organisations also need standard operating procedures for dealing with emergencies or disasters that affect themselves.) The existence of operational guidelines does not, of course, guarantee that staff will use them. There must be supporting commitment among agency personnel.
Geographical and sectoral plans	Most agencies work to geographical plans, at regional, country or district level. A few plan their work sectorally (for example, small enterprise development, health, education). Such plans should contain an assessment of the major hazards, vulnerabilities and risks facing the communities with which the project works. They should also outline appropriate risk reduction strategies.
Programme and project proposals	Programme and project proposals should include risk assessment and plans to deal with risks. Where agencies use logical frameworks of one kind or another to design their projects, the 'risks/assumptions' column should take hazards and disasters into account. Because these are always viewed as external factors beyond a project's control, mere identification of risks is only a weak indicator that project designers are actually planning to deal with them.
Structures and systems	The challenge of incorporating risk reduction into an organisation goes far beyond formal documents and project planning. Policies and practices must be understood, implemented and maintained. Risk management manuals stress that responsibility and authority must be clearly defined within the organisation, and sufficient resources allocated. Organisations should assess their own capacity to understand and address the disaster problem. Review procedures should be set in place. Organisations are run by people, and the general level of understanding, capacity and commitment needs to be increased by information sharing and training at all levels of the organisation. The process must be firmly supported by senior managers if it is to succeed, but there must also be ownership throughout the organisation.
External relations	No organisation should work alone in this field. Agencies should be linked to other key players and relevant coordinating or networking bodies to share information, expertise and resources as required. Where appropriate, they should have a clearly defined role in national and local government disaster management plans. They should also follow relevant international codes and standards.

9.2.3 Assessing partnerships

Risk reduction should be a collaborative, multidisciplinary process. Indicators cannot easily capture the strength or development of linkages with other institutions. Qualitative data, gathered from stakeholders, are generally used to assess the extent, nature and effectiveness of risk reduction partnerships. A variety of widely used stakeholder analysis methods can be applied to understand the interests, needs and capabilities of people and groups with an interest in a project (Gosling 2003: 302–7). Such evidence is often collected through interviews or focus groups (e.g., Wachtendorf and Tierney 2001). A formal agreement between organisations, such as a memorandum of understanding (MoU), provides some indication, but must be supplemented by other evidence of institutional commitment.

The amount of institutional support can sometimes be measured. In the Philippines, the commitment of local government units to the Red Cross's integrated community-based disaster preparedness programme was indicated by the extent of their financial assistance and involvement of their engineers, as well as by the participation of the units' staff in project training and local hazard mapping (PNRC 2002: 14). CARE's CAMI project found indicators of effective cooperation with municipalities in Guatemala in: the creation of risk management offices in municipalities covered by the project; staff placed in those offices, alongside the project's locally-hired promoters; agreement to keep the promoters after the project finished; risk management offices incorporated into municipal planning departments; and promoters participating in municipal planning and development activities (CARE International 2003).

Examples of approaches used to assess disaster reduction partnerships are:

- The Disaster Research Center's evaluations of FEMA's Project Impact initiative recorded the number and type of partner (federal, state and local/non-governmental) listed on pilot communities' MoUs when they first signed up to the project. At first, the evaluators recorded the number of partners who had agreed to take part, but in subsequent assessments key respondents were asked to rank each partner's level of involvement. Reasons for different levels of involvement and the effectiveness of different partnership strategies were also discussed with respondents. The method generated considerable data on the extent and distribution of partnerships over time, and about partnership strategies (Nigg et al. 2001: 12–16; Wachtendorf et al. 2002: 21–52).
- An evaluation for DFID of PAHO's PED programme mapped the programme's activities with key partners. This was only a broad-brush exercise to view the partnerships systematically, but it generated considerable evidence of interaction and influence (Gander et al. 2003: 19–21).
- In a participatory evaluation of ITDG's Chivi food security project in Zimbabwe, beneficiaries used ranking techniques to identify trends in their relationships with different local and external organisations. Venn diagrams were drawn to illustrate changing patterns of relationships (Scoones and Hakutangwi 1996: 17–24).

It should be added that outsiders' personal observations are an indicator of the nature of interpersonal relationships within and between organisations although liable to personal bias.

9.3 Conclusion

The research indicates a shortage of practical guidance on methods for appraising or evaluating higher (or system) level disaster reduction initiatives, national-level structures and systems, disaster preparedness, institutional aspects and partnerships. There is no doubt that this is a very difficult task, owing to the complexity of some of these aspects and the great difficulty in finding and validating appropriate indicators.

However, there are some recent examples of good practice in most of these areas, and some new or experimental assessment frameworks with potential value. Further development and testing of such methods is needed and the potential for their closer integration should be explored.

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Annex 9.1 Characteristics of a well-prepared National Society

Overall goal for National Society capacity building in disaster preparedness	Strengthened capacity of National Societies to predict and, where possible, prevent disasters, reduce their impact on vulnerable communities as well as the readiness to respond to and cope with the effects of disaster.
Disaster preparedness policy and planning	A well-prepared National Society has a clearly defined role in disaster preparedness (DP) recognised by government included in the national DP/emergency plan and supported by appropriate policy and legislation. It is represented and active in the national and local coordinating body for disasters. It has a national DP policy, which reflects its vision and capacities. It has a National Society DP plan that describes roles, responsibilities at central (national headquarters) and branch levels. It ensures that the DP policy and plan is disseminated and well understood amongst relevant staff and volunteers. It adheres to relevant Movement policies and guidelines, in particular the disaster preparedness policy, emergency response policy, the principles and rules for disaster relief. It endeavours to adhere to the Red Cross Red Crescent's Code of Conduct in Disaster Relief and the SPHERE Humanitarian Charter and Minimum Standards for Disaster Response.
Structures and organisation	A well-prepared National Society has the structures, systems and procedures in place that enable it to respond effectively and efficiently to disasters. It has a department or focal point at national headquarters level responsible for coordinating DP activities. It has strong branches in high-risk areas of the country with skilled and equipped volunteer teams organised, tested and capable for disaster response. It has effective information/communication procedures in place and ensures there is effective coordination between DP, health, organisational development and other National Society programmes. It coordinates closely with other organisations active in disaster preparedness and response, coordinating activities, sharing resources, information and expertise. It cooperates with the International Federation, the ICRC (International Committee of the Red Cross) and other National Societies to ensure that all DP and conflict preparedness support is well coordinated and harmonised within one coherent DP strategy. Cooperation in DP is supported by relevant MoUs or project agreements. It is linked to and part of International Federation regional and international disaster response mechanisms, such as regional disaster response teams/units, emergency response units and field assessment and coordination teams. It has access to relevant disaster data and information on hazards and risks, including early warning systems and the International Federation's disaster management information system.

Human resources	A well-prepared National Society has a sufficient number of trained staff and volunteers in all key aspects of disaster response, in particular emergency assessment, first aid, disaster reporting, logistics and relief administration. It actively recruits volunteers from all sections of the community, including vulnerable groups, and, in particular, has a strong representation and participation of women and youth volunteers. It has a strong volunteer training capacity at national headquarters/branch for core disaster preparedness and response activities, producing training material, delivering and evaluating DP training courses at central and branch level.
Financial and material resources	A well-prepared National Society has an emergency fund as well as fund-raising capacity before and during disasters, seeking broad support within the population as well as partnerships with donor agencies (e.g., governments, UN, etc.). It has a standard system in place for record-keeping, financial reporting and auditing. It has adequate logistics and procurement systems – for vehicles, telecommunications, relief goods and warehousing. It has emergency stock pre-positioned in strategic areas and an appropriate replenishment plan.
Relevance	A well-prepared National Society focuses and prioritises its DP activities through an ongoing process of vulnerability and capacity assessment (VCA). It concentrates its activities on the most vulnerable, enhancing their capacity to help themselves. It pursues, through VCA and other community participatory techniques, the active participation of the whole population in the design and planning of community-based DP activities, ensuring that programmes appropriately reflect community needs and strengthen existing local coping strategies. Donor National Societies recognise the DP plan and capacities of the host National Society, respecting this when providing support.
Advocacy	A well-prepared National Society advocates, where necessary, with government, donors and the public the need for mitigation and preparedness measures, ensuring that all key stakeholders are aware of the need for DP interventions before, during and after disasters. It raises awareness of disaster risks and hazards and DP measures through public education. It draws attention to the root causes of disasters as well as the symptoms.
Effectiveness	A well-prepared National Society monitors continuously its state and level of preparedness. It enjoys a good reputation for the quality of its work in DP, both amongst the country's leading opinion makers and the public at large. To help enhance its public image, it keeps the press well informed about its DP activities. It prepares regular progress reports and keeps the International Federation, its members, donors and the public at large regularly informed about its activities and achievements. It regularly evaluates and reviews the quality and impact of its DP work, carrying out frequent or seasonal post-disaster reviews to assess the National Society performance and lessons learned (e.g., SWOT analysis) and make adjustments to plans and activities where needed.

Source: IFRC 2001b

Chapter 10

Conclusions and recommendations for further work

Reducing disaster vulnerability in developing countries may very well be the most critical challenge facing development in the new millennium. Rapid population growth, urbanization, environmental degradation, and global climate change are all contributing to an increase in the frequency and magnitude of disasters. And their most deadly impact is on the lives and living environment of the poor.

James Wolfensohn,
President of the World Bank, June 2000.

10.1 Introduction

There is increasing recognition of the devastating social and economic impacts that natural hazards can have as human and financial costs of disasters have rapidly grown. Numbers of people affected increased threefold between the 1970s and 1990. The reported global cost of 'natural' disasters has risen even more, with a 15-fold increase between the 1950s and 1990s. During the 1990s, major catastrophes are reported to have resulted in economic losses averaging an estimated US $66 billion per annum (in 2002 prices). Record losses of some US$ 178bn were recorded in 1995, the year of the Kobe earthquake – equivalent to 0.7 per cent of global gross domestic product (Munich Re 2002).

However, few are advocating disaster reduction unconditionally. Instead, in the face of heavy demands on limited public resources, increasing concerns about disaster risks have been accompanied by an apparently strong rise in demand for evidence that 'mitigation pays'. Reflecting this, there has been considerable interest in the current study.

Underlying this demand, it is necessary to have appropriate tools to analyse and measure the costs of mitigation and the nature of the resulting flow of benefits. These costs and benefits are not merely financial and risk is not simply a matter of potential direct monetary loss. Other forms of loss – social, environmental and so on – also need to be captured, requiring an array of appraisal and evaluation tools and disciplinary approaches.

The emphasis of this initial scoping study has been very much on process, as indicated at the outset of this report. It has begun to explore how project-related systems and practices can be used to ensure that risks emanating from natural hazards are addressed appropriately, focusing on the extent to which and how hazard-related risks are currently considered in project design, appraisal and evaluation and the scope and need for an improvement in practices. As the Organization of American States (1991: 2–13) notes, 'The critical factor for the successful incorporation of natural hazard considerations into the project formulation phase is the ability of project planners to use hazard information in the design.'

Although the primary objective of the study is not an attempt to demonstrate whether mitigation pays, the study does offer some practical guidance (tools, methodologies, etc.) on how to measure mitigation, suggesting ways around some of the extremely complex difficulties entailed. It also draws together available, if highly limited, existing evidence on the net benefits of mitigation defined in the most narrow, financial terms. This evidence cumulatively suggests that returns to investment are potentially considerable, in the event a hazard occurs.

10.2 Key findings

The study's main findings are very clear:[1]

The principal finding of the study is that **many of the standard tools currently used by aid agencies in designing projects could be used to assess risks emanating from natural hazards and potential returns to mitigation**.[2] Collectively, these tools allow project planners to explore vulnerability from a range

1. More detailed conclusions of individual chapters in the report can be read at the end of each chapter.
2. The Caribbean Development Bank (2004:3) reaches a similar conclusion in relation more specifically to environmental review, stating: 'Full incorporation of natural hazards into the EIA process requires only relatively minor adjustments to existing procedures.'

of perspectives – in terms, for instance, of vulnerability of individual households, of physical structures and of the economic and financial viability of projects. They also allow project planners to explore the implications that a project could have for forms and levels of vulnerability – for instance, via environmental impacts (adverse or beneficial), changes in sources of livelihoods or changes in the structure of an economy.

The alternative – separate hazard impact assessment, as a stand-alone appraisal – would probably be far less successful in identifying forms of risk and assessing options for reduction, precisely because of the complexity and breadth of vulnerability. Natural hazards can pose many forms of risk, threatening individual livelihoods, physical structures, macroeconomic performance, environmental resources and so forth. It would be difficult to capture impacts on this eclectic grouping in a single form of analysis.

The report also finds that **there is nothing intrinsically difficult about either appraising natural hazard-related risks or monitoring and evaluating risk reduction activities** if these tasks are approached thoughtfully and resourced adequately. There are plenty of effective tools or methods that can be applied, covering physical, economic, environmental and social aspects of risk and vulnerability. The main barriers to adoption of these approaches, therefore, are not methodological.

However, **natural hazards and related vulnerability are rarely considered in designing and appraising development projects** other than dedicated mitigation ones, even in high-risk areas. Guidelines on various forms of appraisal and on evaluation typically contain few specific references to hazard-related issues. The extent to which they are considered often reflects the knowledge and experience of the individuals involved and also the political will and interest of governments and aid agencies (see Section 10.4).

Moreover, **some standard appraisal procedures are waived for post-disaster rehabilitation projects**, with the objective of speeding up the provision of support. For example, historically the Asian Development Bank has often not estimated internal economic rates of return of proposed rehabilitation projects. Where it has, figures as high as 60 per cent have been estimated, reflecting the fact that any undamaged structures are treated as sunk costs (Arriëns and Benson 1999). The World Bank has similarly simply assumed that projects involving the repair of damaged infrastructure will have high internal rates of return, rather than actually estimating them. Yet disasters create a golden opportunity to mitigate future losses, stimulating strong – but short-lived – political commitment and public will to reduce risk. This opportunity should not be foregone.

In seeking to build risks into a project it is also important to bear in mind that the **weight attached to various forms of appraisal by particular agencies and for projects in different sectors varies**. The analysis in this study has been structured around the project cycle, enabling a systematic analysis of key appraisal and evaluation practices. An array of tools and guidelines has been reviewed, some of which are inevitably more relevant to certain agencies and certain types of project than others (due to a range of institutional and other influences) and each of which captures risk differently. Some see environmental review as the primary place where risk should be considered. Most donor agencies and NGOs undertake some form of environmental review as established good practice, despite differences in choice of other priority areas of appraisal and tools of analysis. However, some projects undergo only a very limited, desk-based environmental assessment, implying that their analysis of hazard-related issues is at most highly cursory. Moreover, environmental review only covers some, not all, aspects of risk.

It is also important to recognize that **certain ways of measuring benefits of mitigation may be more appropriate for some types of natural hazard than others**. Geophysical hazard events with long return periods pose particular challenges. Probabilities of occurrence may be low, implying that they will be ignored in any quantitative financial risk analysis. However, there are strong ethical grounds for arguing that structures should be seismically proofed to appropriate standards.

Measurement is further complicated by **the fact that different groups attach different values to various forms of risk. This needs to be taken into account**, even though, in practice, it is sometimes extremely difficult. For instance, a national government may view the loss of a hospital in purely monetary terms. For a local community, the loss will be felt very differently, potentially jeopardising their lives and that of their loved ones with a wide range of consequences, not least for livelihood security. SIA and VA offer particularly useful tools for factoring in differing perceptions of risk at the community level.

Looking further along the project cycle, **it is clear that monitoring and evaluation (M&E) is still relatively neglected in disaster reduction**, at least in comparison to the development and humanitarian relief spheres. There is also still too much emphasis on assessment of activities and outputs in M&E and not enough on evaluation impact. **A more systematic**

approach to collecting and sharing information and lessons on this subject would be highly beneficial in improving project quality by helping to overcome the problem of poor lesson learning within the disaster reduction 'community'. Failure at the project planning stage to provide baselines and to clarify the structure of a project's objectives, outcomes, outputs and activities also handicaps evaluation by making it difficult to identify progress and causality.

10.3 Policy recommendations

A number of policy recommendations flow directly from the key findings of this study. Several of them could be undertaken as collaborative, multi-agency activities, potentially avoiding considerable duplication of effort as well as permitting the insights and wisdom of a much wider pool of knowledge and experience to be drawn upon.

Efforts should be undertaken to increase awareness of the fact that tools already exist to take risks into account in the design, appraisal and evaluation of projects.

Existing appraisal guidelines should be revised where necessary to provide more explicit guidance on consideration and analysis of disaster risks and options for reducing vulnerability as, for instance, the Caribbean Development Bank (CDB) is currently doing for its environmental appraisal guidelines (see Chapter 4). Following CDB's example, it is hoped that agencies would begin by collaborating in the development of generic 'how to' sourcebooks.

Guidelines should stress that risks emanating from natural hazards should be considered as early as possible in the project process so that the design of a project can be adjusted accordingly at least possible cost.

The first step in scoping the extent of natural hazard-related risk should be undertaken as part of the environmental review process, drawing together hazard information and including a preliminary vulnerability assessment.

However, assessment of natural hazards and related vulnerability should be assessed as part of all forms of project appraisal, rather than confined to environmental review alone. Vulnerability is complex and multifaceted, requiring analysis from social, economic and poverty perspectives too.

In high-risk areas, natural hazards and related vulnerability should be assessed as a matter of course as part of the appraisal process for all projects, not merely those in certain sectors (e.g., agriculture).

Safety concerns should form a central part of the appraisal process in scoping certain types of project (e.g., schools) in seismically active areas, where probabilities of occurrence of hazard events are low but potential magnitudes high.

Standard scoping and design requirements should not be waived for post-disaster rehabilitation projects, as currently can happen. In appraising such projects, it is particularly important to factor in hazard-related risks and appropriate mitigation measures.

Aid agencies should consider establishing some form of internal central expertise or focal point responsible for providing general guidance on appraising and addressing natural hazard-related risks. Many already do this for environmental assessment procedures and some (e.g., World Bank, IDB) have relatively recently established disaster management units or focal points that could also carry out this function.

Stakeholder analysis should cover natural hazard-related issues, seeking to explore perceptions of risk by different groups and the weights they attach to various aspects.

Analyses of the costs and benefits of risk reduction measures should be systematically collated by aid agencies and national governments, collectively building up a body of work on the application of tools of appraisal to the assessment of natural hazard-related risks and evidence on net benefits.

Agencies should develop guidance on methods of collecting and analysing data for monitoring and evaluating risk reduction activities. In particular, guidance is required on the identification of appropriate indicators for the many different forms that disaster reduction can take.

A more systematic approach to collecting and sharing information and evaluation lessons should be adopted. This would be highly beneficial in improving project quality by helping to overcome the problem of poor lesson learning within the disaster reduction 'community'.

In the aftermath of disaster events, agencies should collaborate in undertaking risk analyses, focusing on lessons learnt in order to further knowledge on forms and levels of vulnerability and the adequacy of existing risk management practices.

10.4 Additional requirements for ensuring that natural hazard-related risks are appropriately assessed and addressed

The development of appropriate guidelines to stimulate greater consideration of natural hazards and related vulnerability in the design and evaluation of projects is not sufficient in itself. Indeed, ensuring availability of appropriate tools and guidelines and related training is arguably the simplest task. Further critical issues have to be addressed.

10.4.1 Adequate supporting data

Hazard information is required in order to appraise and address risk. In reality, as discussed in more depth in Chapter 6, this information may be highly deficient. Historical records may be incomplete, data collection methods internally inconsistent, scientific investigation and predictive modelling capacities limited and hazard mapping partial, particularly at high levels of resolution. There are additional uncertainties relating to the impact of climate change on the frequency and severity of climatological events. Countries need to be supported in strengthening hazard information, consolidating it in a central repository and making it accessible.

Information on the impact of past disasters is also important, providing essential information on particular areas and forms of vulnerability and resilience, and playing a sometimes key role in highlighting the importance of risk assessment. Vulnerability is in constant flux – today's or tomorrow's vulnerability is not the same as yesterday's – but evidence on impacts of recent disasters is likely to provide important clues to the nature and form of current and future vulnerability and measures required to strengthen resilience. Again, however, this information is typically limited, focusing primarily on physical damage to public infrastructure rather than indirect socio-economic consequences of disaster events (see Chapter 1). The appraisal methodologies outlined in this report can – and should – be used to assess various aspects of vulnerability, to some extent obviating this problem, but improved data on impacts of past events would offer useful shortcuts. Both for this purpose and for use in strengthening political commitment and disaster management, the quality and coverage of disaster impact assessments need to be improved considerably (see also Benson and Clay 2004). Various initiatives currently under way to develop vulnerability indices could also play an important role in these regards (see Box 1.3)

10.4.2 Political will

In the immediate aftermath of major events there are windows of opportunity to enlist government and local support for mitigation. However, in the longer term, risk reduction is not a politically appealing area of spending unlike, paradoxically, its counterpart, post-disaster relief. Ways need to be found to sustain interest in, and to secure long-term commitment to, risk reduction – an extremely difficult task. National political will for disaster reduction is particularly important, both in its own right and in supporting the achievements of donors in this area. As OAS (1987: 6) notes, there are limits to donor influence: 'Donors cannot override the sovereignty of the recipient governments… they cannot fund activities that governments do not request and… they cannot control the implementation process.'

A shift in perception of what risk reduction means could help in this regard. There are many competing demands on public resources held by both aid agencies and governments, as already noted. Rather than being viewed as an additional area of investment, directly competing for funding with, say, provision of health services, basic education or clean water, risk reduction needs to be viewed as something that can be incorporated – *should* be incorporated, as a matter of good practice – into other areas of investment. Available data suggest that risk reduction of this nature could possibly often be achieved at relatively little additional cost (see Chapter 1), as well as potentially increasing levels of achievement and success in other areas of investment.

Indeed, the IACNDR (2003: 4–5) apparently already endorses this approach. As it comments: 'The history of the Americas over the past four decades has demonstrated that in most instances disaster reduction for its own sake has little political appeal and less implementation.' The IACNDR's *Inter-American Strategic Plan for Policy on Vulnerability Reduction, Risk Management and Disaster Response* therefore 'looks towards passive approaches to mainstreaming disaster reduction into development actions, particularly when dealing with economic and social sector development programs and infrastructure investment, as well as active approaches to preparing for, and responding to, emergencies in collaboration with those same sectors'.

Linking disaster reduction into other existing priority political commitments, in particular the Millennium Development Goals, could also help secure political will for disaster reduction via less direct means. Again, this does not necessarily require explicit commitment to disaster reduction nor imply that a separate series of tasks have to achieved in order to meet such commitments. As such, mainstreaming could offer an easier route to securing necessary political will.

10.4.3 Institutional and individual motivation

The identification and design of projects does not occur in isolation. Instead, it is influenced by the broader policies and objectives of an aid agency and its underlying ideology. If these do not stress the importance of risk reduction, then the issue receives little attention in appraisal and evaluation guidelines and is likely to be ignored in the design of many projects. This research has found that aid agencies' institutional systems can present significant barriers to the take-up of relevant methods. In many cases existing appraisal tools are not used to examine disaster risk in any depth, quite simply because disaster reduction is not a key priority for the agencies concerned.

Many of the interviews conducted for this study were with the 'converted' – those who acknowledge the importance of disaster reduction and seek to build it into their own work. However, those interviewed referred time and again to the wider apathy within their agencies. In the words of one interviewee, disaster-related issues were 'not even on the radar' of many of his colleagues. Many felt that the majority of their colleagues had little appreciation or understanding of potential hazard risks, largely ignoring them in their work. Yet these may be people who interpret and apply appraisal and evaluation guidelines and whose individual knowledge, experience and exposure can play a strong role in determining the precise nature of design of a project. Clearly, ways need to be found to overcome this institutional brick wall and sensitise aid agency personnel (particularly those working in higher-risk countries) to the importance of identifying and addressing risks.

An implicit and central assumption underlying the whole of this study – namely that donor procedures and guidelines for project design and implementation are carefully applied and followed – may also be a *considerable* supposition. Development agency staff are expected to take an increasing number of factors into account in scoping and appraising projects, normally working under very tight budget constraints. Project design teams typically have insufficient time to consider every issue suggested in appraisal guidelines. Instead, they have to select issues for particular consideration based on their existing knowledge and prior experience. In some instances, ways of avoiding particular requirements are deliberately sought. For instance, projects are sometimes split into two separate ones to ensure that total projected project costs are below the threshold at which a full EIA is required. A sense of realism is therefore required in considering how far one can get in adapting tools and guidelines to integrate hazard risk assessment. Many aid agency staff will not appreciate yet another series of issues to consider and may give it little more than lip service.

10.4.4 Accountability

The ultimate key to these last two requirements is accountability, an emerging issue in disaster reduction work. How can civil society hold donors and governments accountable for what does and does not happen? Both donor agencies and governments clearly need to accept greater accountability for disaster-related losses, particularly loss of life of innocent victims (see OAS 1987). Financial losses pertain to governments rather than aid agencies. However, ultimately they undermine the level of success of aid activities, limiting the progress of sustainable development and poverty reduction, and eating into aid budgets. Governments, in turn, need to assume greater responsibility for their own vulnerability, rather than relying on external agencies to step in post disaster to fund sometimes sizeable portions of relief and rehabilitation needs. Disaster reduction practitioners of all kinds need to strike a better balance between 'downwards' accountability – to vulnerable people, local partners, staff and supporters – and the hitherto dominant 'upwards' accountability – to boards of management, donors and governments.

Achieving more accountability – at operational as well as policy levels – will be a considerable feat. For instance, campaigners have been lobbying for decades to get building codes properly applied even simply to schools but progress remains very slow in many countries, as graphically and horrifyingly illustrated on television screens across the globe after a disaster. Effective approaches to ensuring accountability in disaster reduction are not well studied or documented, but there are several methods for giving disaster victims a voice and enforcing accountability that could be applied more widely (Twigg 2004: 198–212).

10.4.5 National-level programming and standards

A number of donors are moving away from support of individual projects to provision of budgetary assistance in support of agreed national development plans. Even where individual projects continue to be supported, these often form part of a cohesive programme of support, typically in line with particular national policies. Shifts towards programme and budgetary support could weaken the already limited acceptance of responsibility by aid agencies for future disaster losses. Conversely, such trends in donor programming could be advantageous. They can provide governments the opportunity to take a more comprehensive, strategic and long-term approach to the allocation of resources, a process possibly accompanied by greater attention to issues of risk. Either way, however, it is essential that mechanisms are identified and applied to ensure that

disaster reduction is accorded appropriate consideration in national government development planning. In particular, it is important to support governments in ensuring that they have strong risk management policies and procedures in place and fully implemented.

The report has not considered the influence of national standards on aid practices. For instance, Bangladesh has recently introduced a new requirement that all prospective projects have to undergo a hazard impact assessment. National standards are also highly relevant in determining appropriateness of use of budgetary support. More research is needed on this subject.

10.5 Potential scope of Phase 2

Phase 2 is intended to focus on the development of guidelines and working examples for use in amending project appraisal and evaluation methodologies and tools to integrate issues pertaining to natural hazards and related risk and vulnerability. It was envisaged at the start of the study, however, that the findings of Phase 1 and discussion of its conclusions by the project's expert Advisory Group and other stakeholders would direct the activities in Phase 2 more precisely. This process has led to the identification of five possible areas of work, all of which are dependent on donor funding, that could be taken forward during Phase 2:

- **Guidance notes on the use of standard appraisal and evaluation tools to assess natural hazard-related issues**. Project planners need practical guidelines on the scope and application of key project scoping and evaluation tools for assessing and addressing natural hazard-related risks. A generic series of clear, concise guidelines would be produced along these lines for use alongside existing aid agency appraisal and evaluation guidelines, enabling integration of hazard risk assessment into key forms of project appraisal and evaluation.
- **Development of impact indicator sets and related baseline data for evaluating different dimensions of risk reduction and guidance on their application**. Prescriptive indicators are not, of course, desirable, but some guidance on both generic and specific indicators would be valuable. Ideally, this would be an open-ended, iterative process to which many practitioners and researchers could contribute.
- **Investigation of whether and how mitigation pays**. The current study has not begun to address the question on many donor and government officials' lips: 'Does mitigation pay?' Further investigation would entail case studies of individual mitigation measures to explore the net benefits of mitigation, not only from an economic capacity, using cost-benefit tools employed by international financing institutions, but also from a social dimension, using tools for vulnerability and social analysis. Results would be synthesised with existing case study evidence into a single document and key findings drawn.
- **Country studies of appraisal and evaluation of hazard-related risks by different aid agencies and governments**. A series of country case studies would be undertaken to explore and compare how selected aid (multilateral, bilateral and non-governmental organisations) and government agencies assess and address natural hazard-related risk within a given country environment. The case studies would seek to draw out factors motivating and facilitating good practice, including the role of agency policies and procedures and statutory requirements. They would also explore potential difficulties relating to the level of availability of hazard information (differentiating by type of hazard) and its degree of real practical use. Recommendations would be drawn on steps for improving integration of natural hazard-related concerns into project design.
- **Development and testing of tools for assessing and facilitating mainstreaming of disaster reduction within aid agencies**. This would draw on knowledge of mainstreaming of other issues (e.g., environment, gender) and general institutional appraisal methods. It could perhaps be integrated with tools for mainstreaming broader environmental issues.

10.6 Other areas for further work

The study has also thrown up a second series of issues requiring further research and development. These go beyond the direct scope of this current study but, if undertaken, would play an important complementary role in facilitating the integration of natural hazard-related concerns into development activities:

- **Development of guidelines for non-scientists on how to access and use hazard information**. Generic guidelines would be produced for policy-makers, project planners and managers working at all levels

from the national to the local, indicating and explaining key data (and appropriate alternatives) required to assess probabilities of occurrence of different types and magnitudes of hazard event in a particular area, likely sources of data (local, national, international) and how to interpret and use them.

- **Development and application of frameworks for assessing national-level disaster reduction systems**. These might build on the 'disaster risk reduction' frameworks that are now being discussed and tested, as well as other approaches used by researchers and international agencies (described in Chapter 9).
- **Complementary efforts to encourage and equip national and local governments and the private sector to recognise, assess and manage risk, at both national and localised level**. The current report is targeted primarily at the international donor community. However, much risk is built up by these other sectors, as well as by civil society, and it is critical that this is understood and tackled appropriately. A considerable programme of research and related pilot applications would be required to achieve this.

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