the Report by offering definitions of terms and commenting on links with similar projects being undertaken by other international agencies. The third section outlines a conceptual framework for the Report and maps out the relationship between disaster risk and human development.

Chapter 2 reviews the findings of the DRI. This is a first step in achieving a worldwide accounting tool for development and disaster risk status. In addition to starting the process of mapping global patterns of risk and vulnerability, this exercise flags key gaps in knowledge and indicates the national mechanisms needed to enhance data collection.

Chapter 3 explores the development processes that contribute to the configuration of disaster risk, as identified in the DRI. It also allows for the examination of pressures known to shape risk that could not be included in the DRI through lack of international data. Perhaps most important of these is the overarching role of governance. The second role of Chapter 3 is to present examples of good practice in disaster risk reduction projects undertaken within a developmental approach. This material supports a growing number of accounts of best practice including recent reviews undertaken by the International Strategy for Disaster Reduction (ISDR), The International Federation of Red Cross and Red Crescent Societies (IFRC) and The Department for International Development (DFID).[1]

Chapter 4 returns to the key needs identified in Chapter 1 for disaster risk reduction to be appropriately mainstreamed into development policy. Building on these arguments and informed by the evidence presented in Chapters 2 and 3, key policy recommendations are advocated.

The Technical Appendix sets out in detail the methodology used to identify vulnerability factors and model national levels of disaster risk in the DRI. Progress made on the modelling of a multi-hazard DRI is also reported.

The conceptual framework of disaster risk used in the Report is outlined in Chapter 2. At the same time, a formal glossary of terms is presented at the end of the Report. However, it is helpful to outline five key terms here.

Natural disaster is understood to be an outcome of natural hazard and human vulnerability coming together, the coping capacity of society influences the extent and severity of damages received.

Natural hazards are natural processes or phenomena occurring in the biosphere that may constitute a damaging event and that in turn may be modified by human activities, such as environmental degradation and urbanisation

Human vulnerability is a condition or process resulting from physical, social, economic and environmental factors, which determine the likelihood and scale of damage from the impact of a given hazard. Human vulnerability includes within it the vulnerability of social and economic systems, health status, physical infrastructure and environmental assets. It is possible to look at these subsets of vulnerable systems in isolation, but here we are concerned with the broad picture of human vulnerability.

Coping capacity is the manner in which people and organisations use existing resources reactively, to limit losses during a disaster event. To this can be added *adaptive capacity,* which points to the possibility for society to redirect its activities proactively, to shape development in a way that minimises the production of disaster risk.

1.3 Disaster Losses are Increasing

Over the last quarter century, the number of reported natural disasters and their impact on human and economic development worldwide has been increasing yearly. Existing records, while less reliable before 1980, can be traced back to 1900. This longer time period also shows a relentless upward movement in the number of disasters and their human and economic impacts.[2]

It is troubling that disaster risk and impacts have been increasing during a period of global economic growth.

At best this suggests that a greater proportion of economic surplus could be better distributed to alleviate the growing risk of disaster. At worst is the possibility that development paths are themselves exacerbating the problem; increasing hazards (for example through environmental degradation and global climate change), human vulnerability (through income poverty and political marginalisation) or both.

Measuring disaster loss is itself a major conceptual and methodological challenge. On the one hand, it is necessary to define what losses can really be attributed to disasters, as opposed to other kinds of development loss. On the other hand, a major obstacle to describing and analysing disaster loss and its impact on development is the lack of reliable data and information on all levels. This is perhaps one reason why policymakers have been slow to act on the link between disaster and development.

The question of how many disasters occur and the losses that they represent can only be answered in relation to a given level of observation and resolution. Disaster losses occur on all levels, from individual household losses associated with everyday environmental hazards to losses due to exceptional catastrophic events, such as major earthquakes and cyclones that can affect entire regions. Seen from a local perspective, all these losses would be relevant and important. From a global perspective, most local level disasters are effectively invisible.

Global databases of disaster loss are maintained by reinsurance companies, such as Munich Reinsurance Group and Swiss Reinsurance as well as by the Centre for Research on the Epidemiology of Disasters (CRED), an independent academic institution. Only the latter is in the public domain and therefore accessible for analytical purposes. EM-DAT: The OFDA/CRED International Disaster Database, or EM-DAT as it will be referred to in this Report, reports losses associated with large scale and many medium-scale disaster events, but does not include losses associated with small-scale events or those medium-scale events not reported internationally.

While data on human mortality is relatively robust, data on economic loss and livelihood erosion is generally not considered to be complete or reliable at this stage. While the reinsurance companies give more emphasis to economic loss, given their focus on insured losses, this is unlikely to provide a clear picture of livelihood losses, particularly in developing countries.

Comprehensive economic assessments of disaster loss have been carried out by the Economic Commission for Latin America and the Caribbean (ECLAC), the World Bank and other regional and international bodies following major natural disasters. Such assessments, nonetheless, constitute snapshots in time and do not capture accumulative economic loss at either the national or global levels. At the same time, there is likely an underestimation of the impact of disaster on livelihood sustainability and the erosive pressure disasters can exert on social capital. In particular, the contribution to livelihood failure, household collapse and poverty of slow-onset and small-scale disasters is likely to have been played down through lack of data.

Detailed national databases of disaster loss are available in some countries, but do not provide complete global or even regional coverage at this stage. At the same time, national databases show similar deficiencies as the global databases regarding the reporting of economic loss and livelihood erosion.

BOX 1.1 THE ECONOMIC IMPACT OF DISASTERS

Disaster losses are conventionally categorised as:

- **Direct costs** — physical damage, including that to productive capital and stocks (industrial plants, standing crops, inventories, etc.), economic infrastructure (roads, electricity supplies, etc.) and social infrastructure (homes, schools, etc.).
- **Indirect costs** — downstream disruption to the flow of goods and services — e.g., lower output from damaged or destroyed assets and infrastructure and the loss of earnings as income-generating opportunities are disrupted. Disruption of the provision of basic services, such as telecommunications or water supply, for instance, can have far-reaching implications. Indirect costs also include the costs of both medical expenses and lost productivity arising from the increased incidence of disease, injury and death. However, gross indirect costs are also partly offset by the positive downstream effects of the rehabilitation and reconstruction efforts, such as increased activity in the construction industry.
- **Secondary effects** — short- and long-term impacts of a disaster on the overall economy and socio-economic conditions — e.g. fiscal and monetary performance, levels of household and national indebtedness, the distribution of income and scale and incidence of poverty, the effects of relocating or restructuring elements of the economy or workforce.

Reported data on the cost of disasters relate predominantly to direct costs. Figures on the true cost of indirect and secondary impacts may not be available for several years after a disaster event, if at all. The passage of time is necessary to reveal the actual pace of recovery and precise nature of indirect and secondary effects.

Ongoing research suggests that the secondary effects of disasters can have significant impacts on long-term human and economic development.[3] Most obviously, disasters affect the pace and nature of capital accumulation. The possibility of future disasters can also be a disincentive for investors. In examining the longer-term impact of disasters, it is also important to recognise that a disaster is not a one time event but, rather, one of a series of successive events, with a gradual cumulative impact on long-term development.

Source: Benson (2002)[4]

1.3.1 Economic loss as an indicator of disaster impact

Economic losses are often reported with reference to only the direct losses from infrastructure and assets destroyed during large-scale disasters. They seldom take into account the economic implications of reduced levels of production linked to damage in productive assets or infrastructure that in turn limit access to raw materials, energy, labour or markets (see Box 1.1 on previous page).

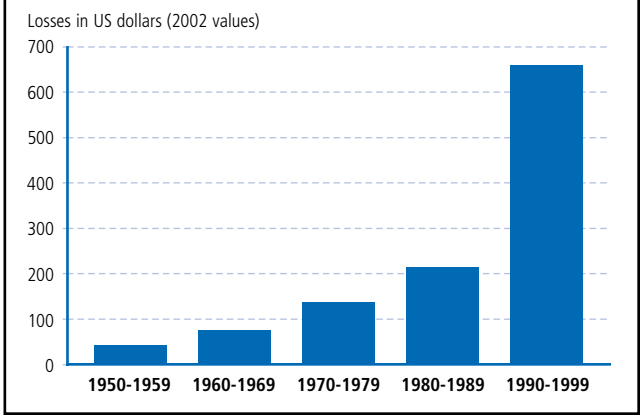
In absolute terms, the recorded economic cost of disasters has been increasing over decades (see Figure 1.1). According to Munich Re, real annual economic losses in 2002 averaged US$ 75.5 billion in the 1960s, US$ 138.4 billion in the 1970s, US$ 213.9 billion in the 1980s and US$ 659.9 billion in the 1990s.[5]

Munich Re estimates that global economic losses for the most recent ten years (1992-2002) were 7.3 times greater than the 1960s. The *World Disasters Report 2002* assesses the annual average estimated damage due to natural disasters at US$ 69 billion. Two-thirds of these losses were reported from high human development countries.

Figure 1.2 shows economic loss by World Region for disaster events triggered by a natural hazard between 1991 and 2000. The unequal distribution of impacts is clear. In Europe and America, losses are shown to be higher than in Africa, but this is a reflection on the value of infrastructure and assets at risk, not impact on development potential. In less developed regions of the world, low losses reflect a deficit of infrastructure and economic assets rather than a low impact on development. And even a small economic loss may be critically important in the case of countries with a very low GDP. What economic loss data cannot show is the variable capacity of people and businesses from different regions to protect themselves from economic loss, for example, through insurance or government aid. Africa's much smaller economic losses may be more significant in terms of slowing progress in human development.

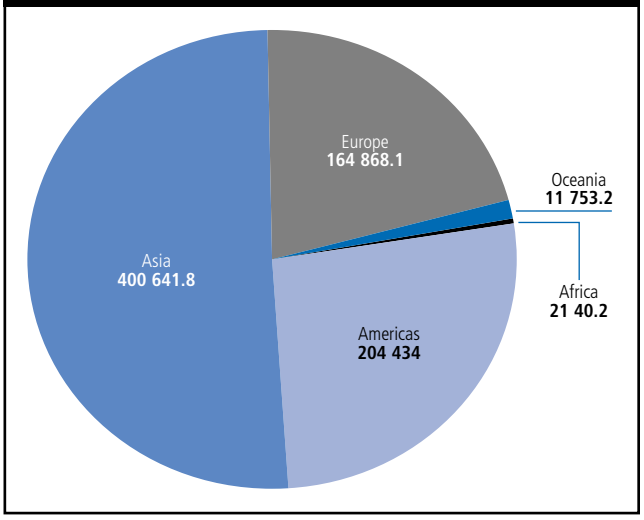
The use of economic loss as an indicator of disaster impact on development varies for different natural hazards. For example, earthquakes often appear to trigger the most expensive disasters, but losses are concentrated. Individual floods may not record large losses, but total human impact may be higher. Asian countries experience the greatest collective economic losses to disaster, with flood being a common hazard in this region and human development may be even more at risk here than these data suggest.

FIGURE 1.1 ECONOMIC LOSSES DUE TO NATURAL DISASTERS FROM 1950 TO 2000



Source: Munich Re

FIGURE 1.2 TOTAL AMOUNT OF DISASTER DAMAGE BETWEEN 1991 AND 2000 IN MILLIONS OF US DOLLARS (2000 VALUES)



Source: EM-DAT: The OFDA/CRED International Disaster Database

1.3.2 Human loss as an indicator of disaster impact

In the last two decades, more than one and a half million people have been killed by natural disasters. The total number of people affected each year has doubled over the last decade.

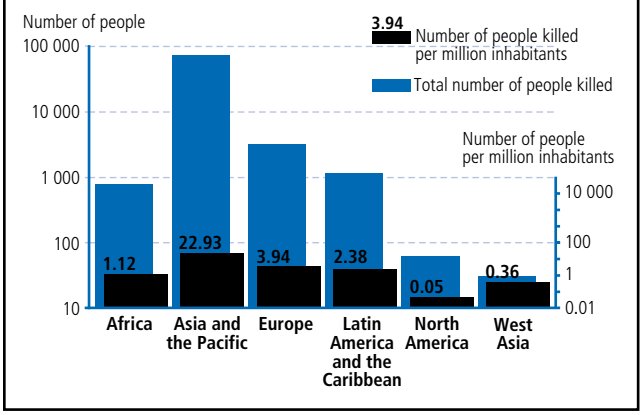
Human deaths are the most reliable measure of human loss and are the indicator used in this Report. However, as with economic data, this reveals only the tip of the iceberg in terms of development losses and human suffering. Worldwide, for every person killed,

around 3,000 people are exposed to natural hazards.[6] This scale of impact fits more intuitively with the order of magnitude one might expect from disaster. But even here the ways in which people are identified as being affected is partial. Estimates are based on assessments of the number of people experiencing damage to livelihoods or to a dwelling, or interruption of basic services. But these are difficult data to collect in a post-disaster period, particularly if there is not an accurate pre-disaster baseline. More difficult still is factoring in longer term impacts, such as the consequences of the death or incapacitation of a primary income earner on a household or extended family, the consequences of migration or resettlement, or the number of people experiencing secondary health and educational impacts.

Data from EM-DAT[7] reveals that in examining human deaths to disasters with a natural trigger by world region (Figures 1.3 – 1.6), a common thread is seen across hazard types. The Asia-Pacific region experiences the greatest impacts both in terms of total lives lost and when lives lost are calculated as a proportion of regional population, due to earthquakes, tropical cyclones and floods. The exception to this comes from the high concentration of deaths associated with drought in Africa. Drought events are often part of a bigger picture that can include armed conflict, extremes of poverty and epidemic disease with death touching only the surface of livelihood disruption and human suffering. The erosion of development gains under such circumstances are clear.

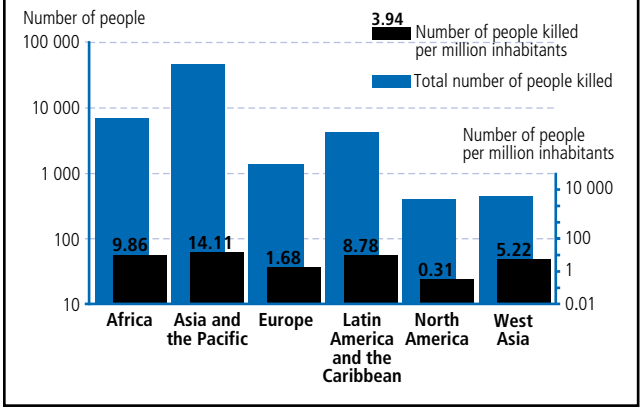
The concept that humanitarian emergencies associated with drought can only be fully understood by considering the role played by armed conflict, extreme poverty and epidemic disease is a useful entry point for rethinking the disaster-development relationship. If disasters apparently triggered by drought are often more

FIGURE 1.3 TOTAL REGIONAL MORTALITY, EARTHQUAKES, 1990–1999



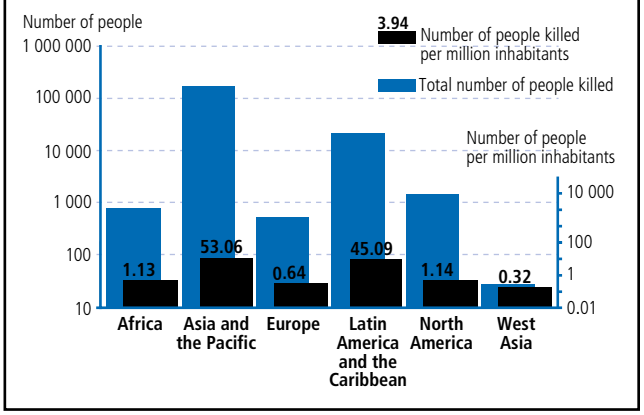
Source: EM-DAT: The OFDA/CRED International Disaster Database

FIGURE 1.4 TOTAL REGIONAL MORTALITY, FLOODS, 1990–1999



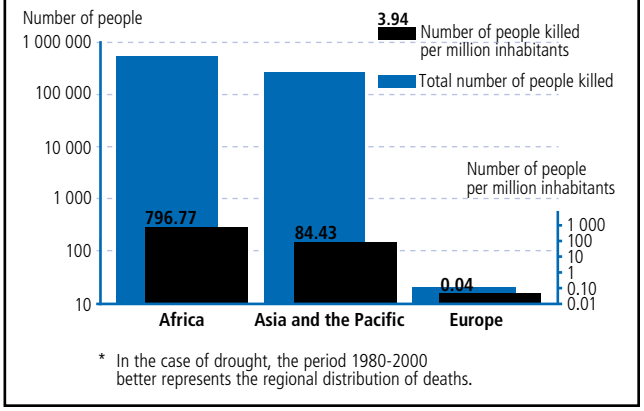
Source: EM-DAT: The OFDA/CRED International Disaster Database

FIGURE 1.5 TOTAL REGIONAL MORTALITY, TROPICAL CYCLONES, 1990–1999



Source: EM-DAT: The OFDA/CRED International Disaster Database

FIGURE 1.6 TOTAL REGIONAL MORTALITY, DROUGHTS, 1980–2000*



* In the case of drought, the period 1980-2000 better represents the regional distribution of deaths.

Source: EM-DAT: The OFDA/CRED International Disaster Database

properly thought of as complex emergencies, as much to do with human as environmental processes, why not other disasters associated with tropical cyclones, earthquakes or floods?

Regional losses in Latin America and the Caribbean are dominated by disasters triggered by tropical cyclones and flooding. Africa and West Asia also suffer from high losses from flooding. Europe and North America show lower absolute and relative numbers of deaths to all hazard types, with the highest impact for these regions being registered by Europe's relative losses to earthquakes.

The severe famines associated with drought that unfolded in sub-Saharan Africa in the 1980s are shown by extending drought losses to a time period of 1980-2000.

1.4 Disaster Risk and the Millennium Development Goals: A Framework for Action

A considerable incentive for rethinking disaster risk as an integral part of the development process comes from the aim of achieving the goals laid out in the Millennium Declaration. The Declaration sets forth a road map for human development supported by 191 nations. Eight Millennium Development Goals were agreed upon in 2000, which in turn have been broken down into 18 targets with 48 indicators for progress. Most goals are set for achievement by 2015.[8]

The MDGs contain cross-cutting themes in development and disaster risk policy, each tied to specific targets and indicators for progress. They require international collaboration to be met. All signatory countries now claim to be working toward these goals and donors are providing sharply focused aid packages to support their endeavours.

The risk to development stemming from natural disaster is recognised in the Millennium Declaration in Section IV, entitled "Protecting Our Common Future". Within this section is stated the objective: "to intensify our collective efforts to reduce the number and effects of natural and man-made disasters".[9]

Natural disasters occur when societies or communities are exposed to potentially hazardous events, such as extremes of rainfall, temperature or wind speed or tectonic movements, and when people are unable to absorb the impact or recover from the hazardous impact. While it is commonplace to talk about natural disasters, both vulnerability and hazard are conditioned by human activities. Reducing the number and effects of natural disasters means tackling the development challenges that lead to the accumulation of hazard and human vulnerability that prefigure disaster.

The accumulation of disaster risk and the unequal distribution of disaster impacts prompt a questioning of the development paths that have been taken by countries more or less at risk from disaster. Natural disasters destroy development gains, but development processes themselves play a role in driving disaster risk. To follow the example quoted earlier, when a school built without earthquake resistance collapses during a tremor, is this an example of disaster risk undoing development, or of inappropriate development prefiguring disaster risk?

The MDGs direct development planning towards priority goals. Each of these goals will interact with disaster risk. On the surface, these goals will contribute to a reduction of human vulnerability to natural hazard. But it is the processes undertaken in meeting each goal that will determine the extent to which disaster risk is reduced. Building schools is not enough for a sustainable and long-term development gain, schools exposed to natural hazard must be disaster resistant, and people using them need to prepare for disaster.

This implies a two-way relationship between the kind of development planning that can lead to the achievement of the MDGs and the development processes that are currently associated with an accumulation of disaster risk. Unless disaster risk considerations are factored into all development related to the MDGs, well-meaning efforts to increase social and economic development might inadvertently increase disaster risk. At the same time, the realisation of existing (let alone future) levels of risk will slow down and undermine efforts to achieve the MDGs.

The primary responsibility for achieving MDGs lies with individual countries. To date, 29 countries have published Millennium Development Goal Reports.[10]