UNITED NATIONS INTERNATIONAL STRATEGY FOR DISASTER REDUCTION (UN/ISDR)

Making the case for disaster risk reduction in Africa

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December 2006

‘More effective prevention strategies would save not only tens of billions of dollars, but save tens of thousands of lives. Funds currently spent on intervention and relief could be devoted to enhancing equitable and sustainable development instead, which would further reduce the risk for war and disaster. Building a culture of prevention is not easy. While the costs of prevention have to be paid in the present, its benefits lie in a distant future. Moreover, the benefits are not tangible; they are the disasters that did NOT happen (Kofi Annan 1999).

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1. Introduction

1.1 Context

The recognition that disasters impede development and that disasters result from failed development has provided impetus for efforts, particularly in recent years, at all global, regional and national levels, to address the challenge of reducing disasters as a development challenge.

Since the beginning of the last decade of the 20th century, international efforts to deepen global understanding and acceptance of the importance of disaster reduction for development have evolved from the International Decade for Natural Disaster Reduction (IDNDR) to the Yokohama Strategy and Pan of action for a Safer World, and, subsequently to the International Strategy for Disaster Reduction (ISDR). The links between disaster reduction and sustainable development were further recognized and operationalized in the Johannesburg Plan of Implementation of the World Summit on Sustainable Development (WSSD). During the World Conference on Disaster Reduction, the international community adopted the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters (HFA) as the overarching global strategy and set five areas of priority for further expanding, deepening and strengthening local, national, regional and international actions to reduce disaster risks.

In Africa, the African Union, together with the NEPAD Secretariat, developed the African Regional Strategy for Disaster Risk Reduction (the African strategy), with the support of the UN Inter-Agency Secretariat of ISDR (UN/ISDR), and in cooperation with the United Nations Development Programme (UNDP) and the African Development Bank (ADB). The Strategy was endorsed by the 10th Meeting of the Africa Ministerial Conference on the Environment (AMCEN) and was favourably noted by the 2004 African Union Summit, which called for the formulation of the Programme of Action for the Implementation of the Africa Strategy (2005-2010). The African Ministerial Meeting on Disaster Reduction endorsed the Programme of Action for 2006-2010 which was adopted by the Executive Council of the African Union.

Despite the development of these strategy, policy and programme instruments, investment in disaster risk reduction (DRR) has been lagging behind requirements needed to effectively reduce the risk of disasters in Africa. A review of constraints to DRR in Africa showed that low investment in DRR is due to several constraints, including: inadequate knowledge of DRR measures, weak institutional frameworks and incentives for DRR, low evidence of the cost-effectiveness of DRR measures, low capacity for cost-benefit analysis (CBA) of DRR interventions, and, inadequate consideration of the role of non-efficiency factors in investing in DRR (UNISDR et al. 2004).

To increase the pace, scope and impact of DRR, there is the need to significantly increase investment of financial, human and knowledge resources in prevention, mitigation, response and reconstruction interventions. Hence, UNISDR-Africa commissioned this

study on the cost and benefits of DRR measures that can be used as an advocacy tool by National Platforms to help sensitize decision-makers and the public on the need to increase investment in DRR.

1.2 Rationale for the study

To demonstrate the value of DRR interventions, it is necessary to briefly explain the inter-linkages between disasters and development, including how disaster impede progress towards achievement of the MDGs. It is also essential to show the trend in disasters, and, to illustrate the costs of disasters. These presentations would help make the case for why it pays to invest in DRR.

Since disasters forestall development, it is necessary to reduce their occurrence and impacts by increasing investment in DRR measures. Evidence from the literature has shown that DRR is cost-effective, partly because DRR measures also have development benefits even in the absence of disasters. Consequently, a key step in catalyzing increased investment in DRR is to show evidence that disaster mitigation pays and that disaster reconstruction is cost-effective in reducing future disasters.

The availability of resources for investment in DRR is limited partly by the loss of resources invested in development interventions that fail because of several factors, including the effect of natural hazards. When development interventions fail, not only is the original investment lost, additional resources have to be expended to replace them, contributing to the lowering the availability of resource that could partly be spent on direct DRR measures. Consequently, it is also important to integrate natural hazard risk considerations into cost benefit analysis of development interventions to show how disaster risk might affect planned development investments. This integration has not been routinely done in assessing development projects.

It is not enough to determine the effect of disaster risk on development interventions. It is also necessary to assess the impact of planned development programmes and projects on disaster risk by ensuring, when preparing and implementing development programmes, that they do not increase disaster risk by increasing people's vulnerability to hazards .Analysis of the ways in which development programmes and projects affect disaster risk is a necessary element of disaster risk reduction.

Increased investment in interventions that directly reduce disaster risk requires allocation of increased financial, human and other resources by the government and by non-government entities, including development partners. However, given limited development resources and several competing development needs, authorities and the public will not increase investment in DRR if they are not convinced of the value of doing so. Unfortunately, the value of DRR does not seem to be evident partly because there has been limited effort to show the cost-benefit of DRR interventions globally in general and Africa in particular. To effectively reduce disasters, showing the value of DRR, including making the economic case through increased application of cost benefit analysis, is necessary to induce increased investment in DRR. This requires, among

others, empowering analysts to be able to demonstrate the value of DRR to decision makers by undertaking risk-modified cost-benefit analysis of programmes and projects that aim directly at reducing disaster risk.

One of the reasons for the paucity of application of CBA to development projects and in assessing DRR measures is the difficulty of undertaking comprehensive risk-modified CBA. Issues that need to be considered for effective risk-responsive CBA include comprehensively assessing disaster losses, capturing indirect and secondary costs and benefits of DRR measures, such as non-market environmental impacts, applying CBA in preparedness and risk transfer measures, and, considering macroeconomic costs and benefits of DRR interventions. It is also necessary to integrate CBA within comprehensive risk assessment programmes because CBA is only one of the decision tools applicable in selecting among risk mitigation alternatives.

However, effectively demonstrating cost-effectiveness by applying risk-modified CBA to assessment of development projects and undertaking CBA of DRR measures is necessary but may not be sufficient to induce the requisite investment in disaster mitigation. This is because there are other factors that inform the investment decisions that need to be considered. These factors include improving communication of risk analysis, non-efficiency and political issues, determining who pays for cost-effective DRR, how to collect the costs if necessary, how to reduce public and private resource constraints to increased investment in DRR, and, strengthening incentives for DRR.

Given these needs, the aim of the study is to produce a report that can be used by public officials, particularly those in government finance agencies, to make the case for increased public investment in DRR in Africa.

1.3 Scope of the study

Based on the above rationale and objective, the study:

(a) shows the need to invest in disaster reduction by making the generic case for reducing disasters as a development challenge and presenting the cost of disasters in Africa
(b) presents evidence that investment in DRR shows positive value
(c) shows ways of integrating natural risk in CBA of development interventions in general to help reduce the impact of disaster risk on development programmes and projects
(d) recommends approaches to assessing the potential impacts of development interventions on disaster risk
(e) demonstrates the process of doing cost benefit analysis of measures directly aimed at reducing disaster risks in particular
(f) presents guidance on how to enhance the use of risk assessment tools by addressing issues that weaken the application of risk-modified CBA, and, by suggesting how to integrate CBA in broader risk decision making

(g) proposes how analysts and planners can better convince national authorities to invest in DRR by improving communication of risk analysis and considering other factors besides cost benefit issues.

The study does not compute the benefit cost of specific DRR projects in Africa. Instead, the study presents a compilation of results of computations of cost-benefit of DRR interventions found in the literature. Also, although the study is about how to make the economic case for DRR interventions, it does not provide reasons why the value of any DRR intervention covered is high or low, except when the reasons are necessary to explain the computation.

Because the topic of CBA is very extensive and there exists vast literature on the method, the study only presents an outline of the methodology of CBA in Section 4. This report focuses more on the application of CBA to analyzing the decision making in situations of risk.

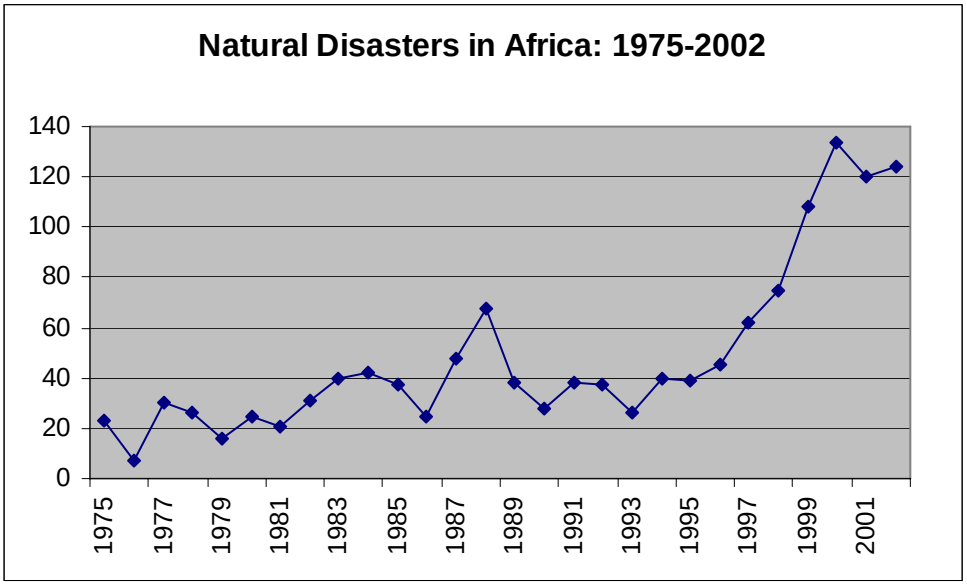
2. The need to invest in disaster reduction

2.1. Disasters are rising in Africa

Several hazards underlie disasters in Africa with the most common being epidemics, mainly vector-borne (particularly malaria) and communicable diseases (mainly HIV/AIDS). The OFDA/CRED International Disaster Database (EM-DAT 2003) show that from 1975 to 2002, epidemic accounted for 32% of the disaster occurrences in Africa, followed by flood (27%), drought (21%) and windstorm (9 %). Other disasters were: insect infestation, famine, earthquake, landslide, wildfire, volcano, and, extreme temperature.

The average annual occurrence of disasters has increased in Africa during the past three decades, as seen from Figure…

Figure 1



Source: EM-DAT: The OFDA/CRED International Disaster Database,
Universite catholique de Louvain, Brussels, Belgium

The occurrence of disasters from 2003 to 2005 shows a trend similar to that of previous years. The rising trend of disasters is largely due to increasing vulnerability. The major factors of vulnerability to natural hazards in Africa are poverty, development pressures, fragile and degraded environment, diseases (especially malaria and HIV/AIDS), weak governance, and, armed conflicts. Also, several factors, including unplanned urbanization, inadequate urban services, are transforming the urban setting of Africa into an amplifier of hazards and a locus for the concentration of risks (UNEP 2002). In addition, low development capabilities and weakening traditional coping strategies, social

protection arrangements and mutual support systems also contribute to the high vulnerability of Africa to disasters.

2.2 Costs of disasters in Africa are high

The direct impacts of disasters (such as human casualties and damage to or destruction of the natural and built environment) and indirect impacts (such as effects on human activities, including flows of goods and services during and after disasters) are significant.

2.2.1 Estimates of number of people killed or affected by disasters in Africa

Direct intangible outcomes of disasters, in terms of human casualties, are high in Africa. The number of people killed and affected by the major disasters are shown in Table 1.

Table 1

Direct intangible impacts of major disasters in Africa: 1900-2006

Disaster (period)	Events	No. killed	No. killed per event	No. affected	No. affected per event
Epidemics	572	436,226	763	11,680,900	20,421
Floods (1900-2006)	523	20,141	39	39,790,759	76,082
Drought (1900-2006)	479	1,046,543	2,185	325,645,582	679,945
Windstorms (1900-2006)	161	4,593	29	14,005,810	86,993
Earthquakes (1901-2006)	68	21,012	309	1,655,155	24,341
Famines (1931-2002)	48	37,539	782	50,983,301	1,062,152
Slides (1903-2006)	22	721	33	19,740	897
Wildfires (1911-2006)	19	147	8	22,572	1,188
Volcanoes (1900-2006)	15	2,213	148	500,353	33,357
Extreme temperatures (1936-2006)	10	218	22	1,000,000	100,000
Waves/surges (1901-2006)	5	312	62	111,913	22,383

Source: EM-DAT: The OFDA/CRED International Disaster Database,
Universite catholique de Louvain, Brussels, Belgium. Database as at 23 October, 2006

Based on the data source for Table 1, drought has been the most dominant cause of human mortality from disasters in Africa, followed by epidemics, although other evidence points to epidemics as the largest source of human mortalities[i]. Table.. shows that about 2,200 people die from every drought episode. Drought, and associated famines, also affects the largest number of people. Combined with famines, drought affects nearly 1.7 million per event.

Overall, the ratio of people affected to the total population is significant. For example, flood affected 4.5 million people in Mozambique in 2000, equivalent to 24 percent of the total national population, while drought affected 12.5 million people, or 46 percent of the

national population, in Kenya in 2002, and the entire population of 12.5 million people in Ghana in 1982..

2.2.2 Estimates of costs of damage from disasters in Africa

The economic losses from disasters comprise primary effects, consisting of the direct costs of physical damage and indirect cost of disruption of economic activity, and secondary outcomes relating mainly to the effects of the disaster on general socio-economic conditions (Queensland Government 2002). It is difficult to estimate total economic losses from disasters in Africa in this report because of data constraints, but there are indications of the cost of direct damage from the CRED database.

The estimated costs of damage from major disasters in Africa during the period 1900-2006 are shown in Table 2. Damages from earthquakes are most costly, totaling $11 billion from 1901 to 2006 while damage from drought totaled $4.5 billion. Damage from earthquakes averaged $163 million per episode, followed by damage from windstorm causing $23 million per event. In total, destruction from eight of the major hazards affecting Africa amounted to $56.7 billion.

Table 2

Indicators of costs of damage from major disasters in Africa

Disaster	Events	Total Damage (US $000)	Damage per event (US $000)
Drought (1900-2006)	479	4,472,093	9,336
Earthquakes (1901-2006)	68	11,073,899	162,852
Famines (1931-2002)	48	89,000	1,854
Floods (1900-2006)	523	3,941,585	7,537
Volcanoes (1900-2006)	15	9,000	600
Waves/surges (1901-2006)	5	30,050	6,010
Wildfires (1911-2006)	19	10,000	526
Windstorms (1900-2006)	161	3,708,718	23,036
Total	1,318	56,684,345	43,008

Source: EM-DAT: The OFDA/CRED International Disaster Database,
Universite catholique de Louvain, Brussels, Belgium Database as at 23 October, 2006

Absolute levels of economic losses from disasters are historically lower in Africa than other regions of the world. This is exemplified by the situation from 1991 to 2000, shown in Table 3.

Table 3

Total amount of disaster damage (1991-2000)*
(US $ millions)

Continent/region	Total amount of damage	% share in total damage
Africa	2,140.2	0.3
Americas	204,434.0	26.1
Asia	400,641.8	51.1
Europe	164,868.1	21.0
Oceania	11,753.2	1.5

*In 2000 values

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

The levels of the cost of disasters are lower in Africa[ii], partially because of lower amounts of damage, due to the lower value of infrastructure and property at risk from disasters, and the nature of coverage of disaster costs in international disaster databases. It is important to note that available international databases on disasters mainly cover the large, discrete and high-impact events that get space in national and international statistics[iii]. The economic and other developmental impacts of large disaster events do not fully cover the real economic costs of disasters as they exclude recurrent but localized hazards. Including the impacts of these localized disasters would significantly raise the estimated cost of disasters in Africa[iv].

2.2.3 Some regional and country-level effects of disasters by type of hazard

Globally, the World Bank estimated that disaster damages constituted between 2 to 10 percent of the GDP of exposed countries between 1990 and 2000 while the IMF estimated that large disaster caused damages of over 5 percent of GDP of low-income countries between 1997 and 2001 (DFID and ERM 2005).

Evidence from the literature shows that low-income countries, the majority of which are in Africa, bear the heaviest burden of disaster costs relative to the size of their national economies (UNDP 2004). Therefore, although absolute economic losses in Africa may be lower than in other regions of the world, the impact of disasters on development potential is highest in Africa due to the relatively lower level of development capacity.

The following examples indicate the magnitude of the economic impacts of disasters in some African countries by hazard type.

Flood:

- 1997/98: Kenya: $1.8 billion destruction of infrastructure and property in Kenya
- total losses to Mozambican economy from the 2000 floods were estimated at $600 million, with direct losses accounting for 46% of total losses. The GDP growth rate dropped from 8% in 1999 to 2.1% in 2000 (Wiles, et al 2005).

- 2001: Algeria: about 800 deaths and economic loss of about $400 million (Jalil 2003).

Drought:
- 1991/92: Southern Africa: reduced sub-regional GDP by $3 billion; cost of relief operations at least $4 billion; South Africa real GDP declined by 2.4% and by 8% in Malawi (Benson and Clay 1998, Clay et al. 2003).
- 1991/92: Lesotho: 4.8% loss of GDP at factor cost, loss of cereal production equivalent to 24% of the 1990 agriculture (Vordzorgbe 1992).

Windstorm:
- 1984: Swaziland: cyclone cost $54 million in damage (EM-DAT)
- 1999/2000: Mozambique: cyclone Eline caused $600 million losses in physical damage, forgone production and food imports that contributed to a 6 percent reduction in economic growth in 1999/2000

Malaria:
- the direct and indirect costs in sub-Saharan Africa exceed $2 billion annually based on 1997 estimates; (WHO 1998).
- Africa: slows down economic growth by up to 1.3% annually
- its control would generate short-term economic benefits of between $3 trillion and $12 trillion annually to Africa (UNEP 2002).

2.3 The costs of disaster mitigation and recovery in Africa are high

To adequately address the impacts of disasters and to determine investment needs for disaster reduction in Africa, it is useful to know the cost of disasters but it is necessary to determine how much it costs to mitigate or recover from disasters. Africa governments and people attempt to overcome the disaster impacts exemplified above through investments in disaster mitigation and recovery, including reconstruction, from government, donors, and the private and non-governmental sectors. Given limited financial resources, most African countries rely on donors to finance disaster mitigation and recovery, as in the case of normal development activities.

The cost of disaster prevention, mitigation and reconstruction is high. Data on investments needs for disaster reduction are not readily available but indications can be gleaned from such investments by development institutions. As the biggest global source of development finance, the World Bank's financial assistance for mitigation and recovery projects in Africa provides a useful indicator of investments in disaster management in Africa[v]. Africa had the largest number of projects financed by the World Bank from 1984 to 2003 (World Bank 2006). Between 1980 and 2003, the World Bank provided $7.97 billion in assistance for 162 mitigation and reconstruction projects to 39 African countries (World Bank Homepage 2006). Mitigation projects dominated, accounting for 78.4% of total lending. Madagascar, with 13 projects, has received the largest World Bank finance, amounting to $327 million. Madagascar and Cote d' Ivoire each received the largest financing for individual projects of $150 million.

Disasters impose costs that are higher than available resources to prevent them (through mitigation programmes) or to redress their effects and impacts (through recovery interventions). For example, comparing the cost of disasters and available financing for reconstruction, it is evident that the cost of disasters exceed available resources for recovery. Table.. showed the total cost of damages alone (excluding other direct effects) from disasters in Africa during the decade of 1991-2000 was $2.14 billion, compared to World Bank's financing over two decades for reconstruction of $1.72 billion.

Even where resources are available, time lags between the time of need and the actual time of delivery of resources, as well as gaps in value between needs, pledges and actual disbursements reduce the effectiveness of those resources and impose additional costs. Even if resources were adequate and available on time, diverting them to address disasters amounts to reducing overall resources available for development. Partly for this reason and partly for other reasons adduced below, disaster reduction should be treated as a development issue.

2.4 Direct and indirect impacts of disasters on efforts to meet the MDGs

Governments are pursing efforts to achieve the MDGs. But disasters retard those efforts through their direct and indirect impacts, which are presented in Table 4.

Table 4
Examples of direct and indirect impacts of disasters on efforts to meet the MDGs

MDG	Direct impacts	Indirect impacts
1. Eradicate extreme poverty and hunger	• Damage to housing, service infrastructure, savings, productive assets and human losses reduce livelihood sustainability	• Negative macroeconomic impacts, including severe short-term fiscal impacts and wider, longer-term impacts on growth, development and poverty reduction • Forced sale of productive assets by vulnerable households push many into long-term poverty and increases inequality
2. Achieve universal primary education	• Damage to education infrastructure • Population displacement disrupts schooling	• Increased need for child labour for household work • Reduced household assets make schooling less affordable
3. Promote gender equality and empower women	• As men migrate to seek alternative work, women/girls bear increased burden of care • Women often bear the brunt of distress coping strategies, such as from reduced food intake	• Emergency programmes may reinforce power relations that marginalize women • Domestic and sexual violence may arise after disasters
4. Reduce child mortality	• Children are often most at risk • Damage to health, water and sanitation infrastructure • Injury and illness from disaster weakens children's immune systems	• Increased numbers of orphaned, abandoned and homeless children • Household asset depletion makes clean water, food and medicine less affordable
5. Improve maternal health	• Pregnant women are often at high risk from death/injury in disasters • Damage to health infrastructure • Injury/illness from disaster weakens women's health	• Increased responsibilities and workloads create stress for surviving mothers • Household asset depletion makes clean water, food and medicine less affordable
6. Combat HIV/IADS, malaria and other diseases	• Poor health & nutrition following disasters weakens immunity • Damage to health infrastructure • Increased respiratory diseases	• Increased risk from communicable and vector-borne diseases • Impoverishment and displacement following disaster can increase exposure to disease and disrupt health care
7. Ensure environmental sustainability	• Damage to key environmental resources and exacerbation of soil erosion or deforestation • Damage to water management and other urban infrastructure • Slum dwellers in temporary settlements often heavily affected	• Disaster-induced migration to urban areas and damage to urban infrastructure increase the number of slum dwellers without access to basic services and exacerbate poverty
8. Develop a global partnership for development	• Impacts on programmes for small island developing states from tropical storms, tsunami and related hazards	• Impacts on commitments to good governance, development and poverty reduction nationally and internationally.

Source: UNISDR 2005

2.5 DRR is a development concern

Disasters constitute a development issue because they can make development risky and unsustainable while development processes can cause or reduce disaster risks. Losses from disasters negat**e** some development gains and exacerbat**e** poverty**,** partly because natural hazard vulnerability causes, exacerbates or is linked with other vulnerabilities and risks. Because of these inter-relationships between disaster risk and other vulnerabilities reducing the risk of natural hazards also helps reduce threats from other livelihood hazards. Thus, effective disaster risk reduction ensures sustainable development.

But, development patterns that do not balance wealth creation, equity or environmental soundness are unsustainable and cause disaster risks, mainly through worsening underlying factors of vulnerability to hazards or contributing to conditions that cause or exacerbate environmental degradation (UNDP 2004). In contrast, sustainable development strengthens the security of populations so that disaster reduction interventions can effectively help them to alleviate or avoid disaster risks to themselves, their livelihoods and the supporting physical, economic and social base. This mutually beneficial relationship between reducing disaster risks and ensuring sustainable development occurs when disaster losses are addressed in a development context and development processes and patterns adequately address threats from disasters and other livelihood risks.

3. Investments in DRR show positive value

3.1 Examples of economic returns to DRR interventions

Given the relationships between disasters and development, it can be expected that effective risk reduction should show positive development impacts. Evidence from the comparison of the costs and benefits of DRR interventions at the global and national levels, including in Africa, shows that investments in DRR show positive returns. Examples are provided below.

3.1.1 Global and national-level evidence

Global level

- Losses in 1990s could have been reduced by $280 billion with investment of $40 billion in mitigation and preparedness (DFID and ERM 2005)
- Every $1 spent on mitigation can save $4-10 in recovery costs (UCL et. al 2002)

Non-Africa national level

- China: $3.15 billion in flood control measures prevented potential losses of $12 billion (DFID 2004)
- USA: $1 spent by FEMA on hazard mitigation saves $4 in future disaster management costs (Multihazard Mitigation Council 2005)
- England: investment of GBP730 million in the Thames Barrier in London averted potential property loss of GBP3.5 billion (Twigg 2002)
- Philippines: flood and lahars protection yielded benefits of 3.5 – 30 times the project cost (Dedeuwaerdere 1998)
- Jamaica and Dominica: mitigation measures during infrastructure (school and port) construction could have avoided potential losses of 2-4 times the mitigation cost (Vermeiren, et al 1998)
- Peru: flood control system yielded benefit cost ratio of 3.8 and IRR of 31% (Mechler 2005)
- Indonesia: integrated flood control yielded benefit cost ratio of 2.3 and IRR of 23% (Mechler 2005)
- India: flooding control in Bihar gave benefit cost ratio of 3.8 (Venton and Venton 2004)
- India: drought control in Andhra Pradesh gave ratio of 13.4 (Venton and Venton 2004)

3.1.2 National level evidence from Africa (World Bank Project Documents Site 2006)

- Malawi: rural livelihoods project yielded financial rate of return of 17% and ERR of 15%
- Burkina Faso: Agricultural diversification and market development project gave ERR of 23% and IRR of 25%

- Kenya: Western Kenya Integrated Ecosystem Management project showed a economic rate of return (ERR) of 23.4% for the land productivity model and 14%-38% for the labour productivity model.
- Ethiopia: Seed systems development project showed ERR of 36% and benefit cost ratio of 3%
- Uganda: El-Nino emergency road repair project showed ERR of 143%
- Madagascar: LAC Alaotra rice intensification project showed ERR of 25&
- Ghana Oil Palm development project showed ERR of 21%

Several projects World Bank-financed disaster-related projects showed positive gains but their cost-benefit indicators were not explicitly computed[vi]; alternative approaches were used to indicate their potential or realized positive benefits over costs.

3.2 Efforts to determine cost-benefit of DRR are limited but growing

As seen from above, there is evidence that DRR pays, but, worldwide, research on both the costs of disasters from natural hazards and on the costs and benefit of DRR interventions has been limited (Venton and Venton 2004, DFID and ERM 2005). Consequently, the demonstration of that evidence is difficult and has been limited.

There is little assessment evidence on the comparative impacts of disasters in countries with and without developed and undeveloped DRR programmes, largely because monitoring, evaluation and appraisal procedures for development programmes and projects often do not systematically incorporate the risk of vulnerability to and impact of natural hazards (Kramer 1994, DFID 2004). It is important to base estimates of disaster reduction costs and benefits on post-project outcomes because project analysis ex ante (project appraisal) estimates can be significantly different from actual outcomes. However, project and programme monitoring and assessment often focuses on analyzing outputs and places less emphasis on assessing post-project outcomes and impacts. Consequently, systematic studies and data on the costs and benefits of DRR are scarce.

Several studies have estimated the macro impacts of disasters, but most of the assessment of disaster impacts have focused on quantification of immediate direct damages, mainly to provide estimates of financial requirements for emergency assistance and reconstruction needs[vii]. In general, economic impact assessment suffers from several drawbacks including problems of valuing costs and benefits, particularly indirect and intangible effects, in monetary terms, inadequate standardization of assessments, and, limited scope of coverage (Twigg 2002). These difficulties contribute to the paucity of DRR cost-benefit studies. Also, most available studies have focused on determining economic costs and benefits. But since disasters do not cause only economic effects, there is the need for cost-benefit of social impacts though application of vulnerability analysis methods.

Nonetheless, efforts, are increasing to fill the gap. Recent efforts to show the economic value of DRR interventions in areas such as India, Southern Pacific, Philippines, Vietnam, USA, Europe, China, Caribbean region and Bangladesh, as seen from the

examples provided in Section 3.1.1 above. Also, the topic was a subject of discussion at the 2005 World Conference on Disaster Reduction in Kobe (Mechler 2005), the ProVention Consortium developing guidance on adapting project appraisal and evaluation to better take account of natural hazard risks, including determining the economic benefits of disaster reduction (ProVention Consortium 2005), and, the topic will be covered as a programmatic activity under the Global Fund for Disaster Reduction and Recovery (GFDRR), a UNISDR and World Bank partnership initiative to support implementation of the Hyogo Framework for Action (UNISDR and World Bank 2006)..

4. Integrating natural risk in CBA of development interventions

4.1 Conventional CBA of development projects: outline

Economics aids decision making on the allocation of scare resources among competing uses with the goal of maximizing the welfare of society. Cost benefit analysis is an economic decision tool used to organize information about projects, including costs and benefits, and to determine the cost-efficiency of investment decisions aimed at enhancing private and public welfare. CBA involves comparing the flows of costs and benefits of an investment decision to help determine the desirability of undertaking the investment from a private and social welfare viewpoint. Regarding its place in project analysis, CBA is typically conducted during the feasibility stage of the project cycle.

Projects are financed by governments, non-government entities or a combination of both. Also, projects have cost and benefit implications for the individual participants in the project and for wider society. Consequently, two types of analysis are undertaken in determining the desirability of undertaking the investment. Financial analysis involves determining the financial effects of the project on the various participants in the project whereas economic analysis assesses impacts on society and the likelihood that the project will generate benefits to the total economy significant enough to warrant the investment. Appropriate methods are applied to estimating financial or economic benefits and costs, and in determining relevant financial or economic measures of project worth[viii].

In project analysis, the value of costs and benefits arising with the project is determined and compared with values without the project in place to generate the incremental net benefit of undertaking the project investment. This is different from comparing the 'before' and 'after' situation.

The objectives of the analysis determines the definition and identification of the costs and benefits of the project. Thus, a cost is any factor that reduces the objective of the project and a benefit is one that enhances the objective. Depending on the objective, a project can be characterized by tangible and intangible costs and benefits. Also, there can be secondary costs and benefits that are external to the project and need to be addressed in economic analysis.

But whether considering private interests only (financial analysis) or public interest (economic analysis), CBA involves evaluating investments with future costs and benefits, of different durations and, often, of varying size. Addressing these issues requires taking account of the time value of money by discounting costs and benefits.

After identifying, pricing and valuing costs and benefits, the next step in the project analysis process is to determine whether to accept or reject the projects or alternatives by comparing discounted costs and benefits. The appropriate rates of return to investment in analyzed project alternatives are compared to select the optimal one.

Details of the concept, method and applications of CBA can be found in: standard texts such as Gittinger (1982), UNIDO (1972), Little & Mirrlees (1974), Irvin George (1978), Squire and Van der Tak (1975) and will not presented here. However, it is important to note that conventional CBA utilizes:

- methods of valuing costs and benefits (monetary and non-monetary valuation techniques)
- methods for accounting for externalities (shadow pricing)
- methods for accounting for the future value of costs and benefits (discounting)
- criteria for making investment decision after analyzing costs and benefits, involving use of:
    - financial benefit-cost measures, such as:
        - financial ratios (efficiency, income, creditworthiness)
        - break-even or payback period
        - incremental net benefit
        - benefit-cost ratio
        - net present value or worth
        - internal rate of return (IRR)
        - sensitivity analysis
    - economic benefit-cost measures, such as:
        - benefit-cost ratio
        - net present value or worth
        - internal rate of return
        - sensitivity analysis
        - risk assessment

4.2 Difficulties and limitations to cost-benefit analysis

There are several difficulties in applying the conventional CBA approach and limitations to its use in investment appraisal. These include the following:

- difficulties in incorporating institutional and governance factors such as behavioral responses from both beneficiaries and bureaucrats in applying cost-benefit investment appraisal techniques which can lead to unrealistic evaluations
- difficulty in correctly judging and estimating the macroeconomic or wider impacts of investment projects and externalities
- striking the right balance between public and private involvement; for example, traditional cost-benefit approach, which focuses primarily on spending and does not adequately factor in the implication of different public-private financing options
- demanding data requirements
- the assumption that the best level of protection is that which minimizes overall cost (other factors determine risk preference)
- the assumption that costs and benefits are known (difficulties in assessing non-market values)
- difficulties in accounting for distribution of costs and benefits (between winners and losers)
- difficulties in discounting to balance present and future costs and gains

4.3 Alternative approaches to analyzing costs and benefits

Because of these limitations, CBA is not the only method applicable to analyzing costs and benefits. Other approaches include: cost-effectiveness analysis and multi-criteria analysis. In cost-efficiency analysis a goal is first set and then projects are designed to minimize the costs to achieve the given goal. In this approach, the benefits of projects do not need to be known and assessed. In multi-criteria analysis, multiple objectives and their trade-offs are identified, then the different objectives are weighted and the project that best meets the objectives is selected.

But these approaches also have limitations. The cost-effectiveness approach requires clear quantification of goals, which can be difficult. Also, where no single goal can be established, this approach becomes limiting. Regarding the multi-criteria approach, the attaching weights can lead to cumbersome computational difficulties.

For all the above reasons, any approach adopted to quantitatively analyze project investment decision-making needs to be complemented by non-economic considerations.

4.4 Integrating risk analysis in economic appraisal of development projects

The role of risk analysis is to characterize to the extent possible the different degrees of risk and uncertainty about a particular DRR intervention or portfolio of interventions. CBA, as a cost-efficiency method, is undertaken in the context of uncertainty. But usually in conventional CBA, project risk is accounted for through sensitivity analysis. When risk is included, it is often addressed by computing expected values of project outcomes which ignores the cost of risk. To adequately consider risk and uncertainty conventional CBA needs to be modified. Thus, when project costs and benefits are uncertain, it is necessary to incorporate risk in benefit-cost analysis. Methods proposed for dealing with risk and uncertainty in conventional project decision analysis (such as in Mishan (1982), Poliquen (1970), Anderson, Dillon and Hardaker (1977), Reutlinger (1970), and, Arrow and Lind (1970)) are adaptable for assessing the risk effects of disasters in project analysis.

Kramer (1995) proposed a number of methods for CBA when considering risk. The two basic approaches to include risk in project analysis are the limited-information approach and the probability-based (full information) approach.

Information on natural hazards and their effects is commonly neither specific or complete. In these very common circumstances limited-information approaches are appropriate. Methods than can be used include: varying project measures in sensitivity analysis, adding a risk premium to the discount rate, applying a cut-off period, and, game theory approaches that focus on avoiding losses.

Where sufficient information exits that makes it possible to obtain the probability distribution of project benefits and/or costs, either from historical data or subjective

judgment of experts or beneficiaries, a number of methods can be applied to undertake probabilistic CBA. These methods range from simply ranking expected net present values to undertaking safety-first, mean-variance or stochastic dominance analyses (Kramer 1995).

5. Assessing the impact of development interventions on disaster risk

It is not enough to determine the effect of disaster risk on development interventions. It is also necessary to assess the impact of planned development programmes and projects on disaster risk by ensuring, when preparing and implementing development programmes, that they do not increase disaster risk by increasing people's vulnerability to hazards .Analysis of the ways in which development programmes and projects affect disaster risk is a necessary element of disaster risk reduction.

Determining the impacts of development actions on disaster risk involves analyzing ways in which development programmes, projects and policies affect the hazards profile and processes, as well as vulnerability and exposure to hazards: sustainability analysis of target area. These analyses can be done within the generalized framework of Strategic Environmental Analysis (SEA) that includes standard Environmental Impact Assessment (EIA). Impacts of development on hazards can be analyzed using EIA approaches because most natural hazards in Africa are environmental, while impacts on vulnerability and exposure can be analyzed using SEA approaches.

In general, environmental assessments are carried out to identify risks by projects to the environment, including environmental hazards. The standard EIA process can be modified into a full blown tool for risk assessment by explicitly consider the impacts of environmental hazards on project objectives, in addition to conventionally assessing the exacerbation of hazard effects caused by the project.

SEA is a method with practical tools and guidelines for systematic analysis of environmental or integrated sustainability issues in strategic planning of development and disaster reduction interventions. It involves analysis of links between the ecological system and human society, analysis of specific problems, identification of mitigating opportunities, and, strategic planning for addressing the problems. SEA uses a range of techniques to help determine the likely environmental and social effects of policies, plans or programmes at the strategic level. The particular technique depends on several factors including the type of intervention (such as policy or plan), sector (energy or agriculture), geographical area (local, region, country), type of stakeholder, and type of environmental objective pursued. Thus, the method can be applied to a wide range of situations, including area-based planning, sector-wide programming, integrated development, stakeholder mapping, development of strategic partnerships, and, integrated projects.

Because hazards affect livelihoods at the sector level and DRR interventions involve actions at the sector level, it is important to undertake both EIA and SEA analyses at the sector level. This involves determining the effects of various sector development actions on natural hazards using the relevant analytical tool. For example, in agriculture and rural development, increasing agricultural productivity without provision for hazard-resistant cropping technologies and services, and, investment in soil health needed to restore soil fertility under intensive cultivation leads to higher output instability and risk. Infrastructure and service development, services that are not made hazard-proof, such as education infrastructure that is not disaster-proofed and health infrastructure that is not

resistant to hazards, can constitute hazards in themselves and exacerbate harmful effects of natural hazards. Also, road infrastructure in fragile areas weaken soil stability and cause flash flood by blocking natural drainages. In water resources management: applying large-scale water management can lower water tables and increase run-off. Also, water extraction and hydropower generation without hydrological monitoring can help deplete groundwater resources, including aquifers.

6. Doing cost-benefit analysis of DRR measures

Section 4 covered the consideration of risk from natural hazards in determining the desirability of investing in conventional development projects, such a roads, health and other sector projects, whose primary objective is not disaster reduction. This Section deals with how to apply the concept and practice of conventional cost-benefit analysis in assessing the desirability of investing in projects aimed directly and primarily at disaster reduction and recovery.

6.1 General considerations in applying cost-benefit analysis to DRR project assessment

The economic case for disaster mitigation can be made through determining the value of DRR using CBA and other risk assessment tools. However, to make an effective case for mitigation, it is necessary to understand the value of disaster reduction interventions.

The objective of the analysis provides the standard for defining costs and benefits. Thus, it is not always that positive CBA of DRR interventions imply higher expected return. The value of DRR can be a change in output (as defined) and/or minimization of output loss. Disasters often cause instability of output and returns. Therefore, DRR involves tradeoff between higher output and more stable output. Thus, expected return can be negative but outcome variability reduced (stability increased).

There are cases where a development project was designed without consideration of risk and which yielded a positive net benefit. However, with the inclusion of risk, net benefits can become negative if a disaster wipes off the previously determined positive net benefit of the project. In these circumstances, a secondary risk mitigating or transfer project can be introduced to protect the primary project's outcomes. The benefit from these add-on risk projects is the saving in damage avoided and reduced volatility of benefits from the main project. CBA should be applied to both the main and secondary projects if the costs of the secondary project are lower than the benefits to the integrated project in terms of costs avoided of the main project.

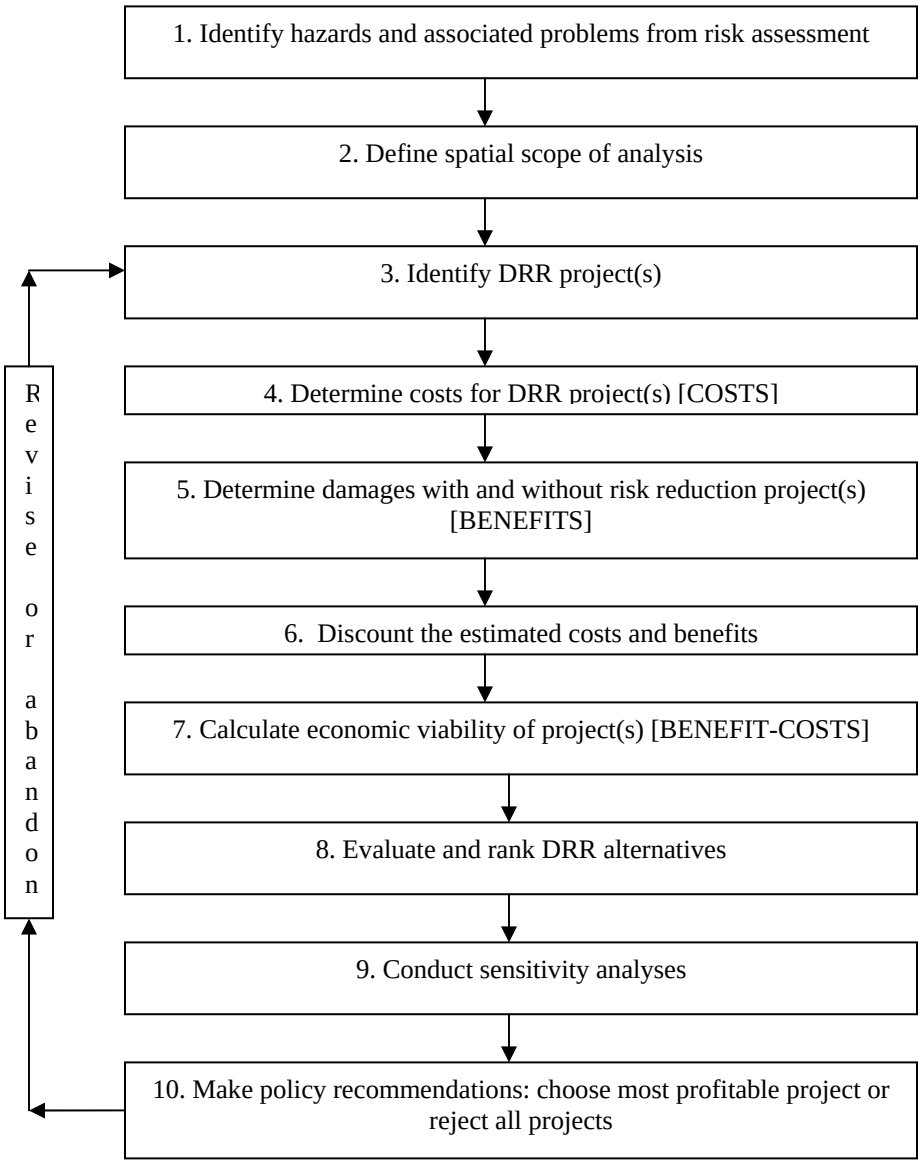
However, it is important to consider that managing risk often entails high opportunity costs. Thus, it is not prudent to merely compare the cost of risk management in a DRR project with the potential or actual costs avoided if expected hazards occur and make a positive determination of high benefits from the DRR intervention. Where this comparison is done, the opportunity cost of the DRR measure needs to be taken into account, particularly in risk transfer projects where risk reduction finances have to be diverted from other needs.

6.2 Steps in cost-benefit analysis of DRR interventions

Steps in CBA of DRR interventions are shown in Figure 2 below. In the figure, projects broadly refer to DRR measures, including programmes and policies.

Figure 2

Steps in cost-benefit analysis of disaster risk reduction projects



Source: Adapted from Mechler (2005) and AusAID (2005).

6.2.2 Estimating costs of DRR interventions

The costs of DRR interventions to be considered in CBA comprise all the costs to all stakeholders in the measures. This total costs involves direct and externality costs. Direct costs are fixed and variable costs in financial CBA. In economic CBA, these are opportunity costs or shadow prices. Externality costs take account of costs of the

intervention to those not directly involved in implementing the project but are impacted by it.

6.2.3 Estimating benefits of DRR measures

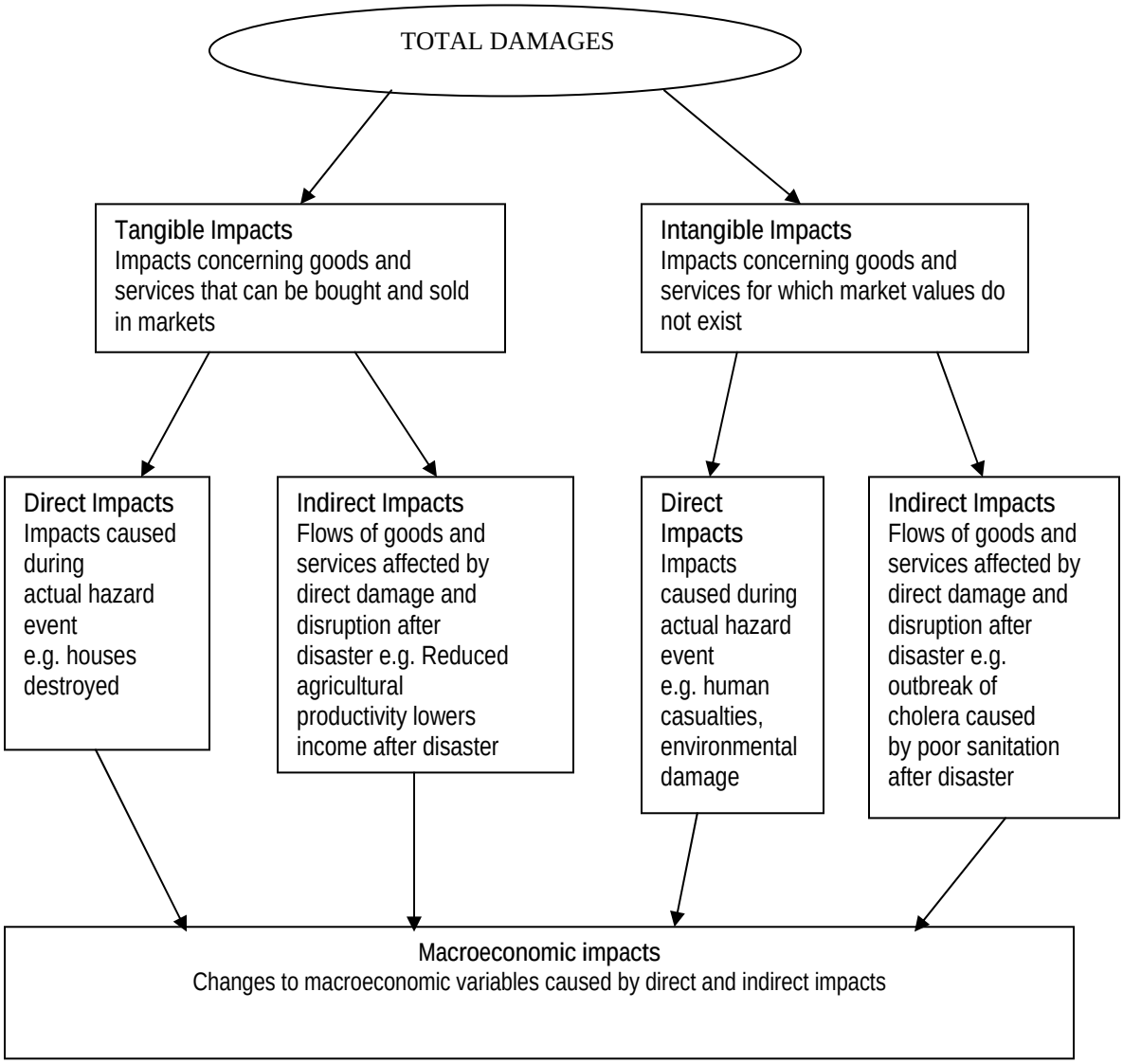
The benefits of the planned measure are the totality of the value of damages, losses and casualties that will be avoided as a result of implementing the planned project. The annual value of these benefits can be estimated through the following steps:

Step A: estimate the monetary value (to the extent possible) of benefits for one typical hazard event with or without the planned project
Step B: estimate the frequency (probability) of future hazard events
Step C: estimate the annual expected benefits as the product of Step (A) and Step (B)

In undertaking Step A, it is useful to identify all possible hazard impacts of the proposed intervention. In general, disasters result in tangible and intangible impacts. These can be either direct or indirect. The types of generic disaster effects are shown in Figure 3. The ability to identify and estimate the values of these impacts depends on good quality and comprehensive data. This requirement is even more necessary in the case of valuing intangible impacts of possible disasters for which no markets exists. Two types of approaches are commonly used to value intangible impacts: revealed preference approaches and stated preference methods. Revealed preference approaches are useful when individuals or groups concerned make explicit choices in markets that show their preferences for ways of estimating the values of the non-market good or service lost due to the disaster. Ways of estimating values of non-market intangible impacts include: using the replacement, production, proxy, change in earnings, hedonic pricing or travel cost methods (AusAID 2005). Stated preference methods are used when people express their preferences through what they say, not through choices they make, for their willingness to pay for non-market goods and services. A common approach is the contingent valuation method.

Figure 3

Direct and indirect tangible and intangible impacts of natural disasters



Source: AusAID 2005

7. Improving integrated risk decision analysis for DRR investment

One of the reasons for the paucity of application of CBA to development projects and in assessing DRR measures is the difficulty of undertaking comprehensive risk-modified CBA. This section presents issues relating to improving integrated risk decision analysis for DRR investment by proposing enhancements to CBA (as described in Section 6). These improvements are required to address difficulties and pitfalls in CBA and enhance its potential to effectively assess the desirability of investing in DRR. Issues of risk communication are addresses in the next section

7.1 Strengthening disaster loss assessment

The objective of disaster reduction and sustainable development should be to minimize losses from natural hazard events to the extent possible. Meeting this objective depends on the ability to assess losses from occurring and potential hazards. Also, accurate, comprehensive and timely loss estimation is key to estimating disaster costs and benefits in determining the most effective and efficient options to reduce disaster risks.

Generally, there are three types of potential losses from disasters: direct, indirect and secondary losses. Direct losses are losses due to direct contact with the hazard. They refer to the financial value of loss of and damage to assets. These losses are usually the first to be assessed in disasters. Indirect losses are the loss of output and income due to interruption in production and services. Both direct and indirect losses have tangible and intangible aspects. Secondary losses result from impacts on social conditions and economic performance in the longer term, such as due to social disorder, migration, increasing public sector deficits, loss of business confidence and worsening poverty.

The practice of comprehensive loss assessment from actual and potential hazard events is limited in Africa. Risk assessment, involving both hazard and vulnerability assessment, is the best starting point for estimating the value of disaster losses, particularly potential losses. In the event of a disaster occurring, two types of assessment are recommended: a situation (damage) assessment that describes what actually happened, and, needs assessment that states what needs to be done. The latter can be done in three stages: (a) assessment of relief needs for immediate response actions, (b) full assessment of damage and loss to lives and property which should cover both direct and indirect losses to the extent possible, (c) assessment of the loss potential from future hazard event before other disaster occur which should include consideration of secondary losses. Within this framework, the second and third stage assessments can form the basis for reconstruction efforts (Gilbert and Kreimer 1999). These assessment can utilize any or a combination of three types of approaches to loss estimation: (a) the rapid assessment or averaging approach using mainly pre-existing loss data, (b) the synthetic approach that uses existing data applied on the basis of synthetic assumptions about the conditions of assets, and (c) the survey or historical approach based on surveys of recent hazard events to determine disaster loss (Queensland Government 2002).

7.2 Improving CBA of DRR interventions

Sections 4 and 6 highlighted the key method of CBA and its application to assessing DRR interventions. However, there are several weaknesses and difficulties in applying CBA to DRR project assessment (Kramer 1995, Gilbert and Kreimer 1999, Mechler 2003, DFID and ERM 2005), including the following:

- complexity of the method can vary considerably in application
- the method is weak on non-monetary valuation (e.g. life)
- indirect cost and benefits rarely included
- secondary impacts are generally ignored, particularly on macroeconomic variable, social dimensions and poverty
- there is relative focus on mitigation with no application to preparedness planning and management
- inadequate application of risk modified CBA makes its effectiveness difficult to judge

Thus, to improve the conduct of CBA, it is necessary to focus on:

- capturing indirect costs/benefits and secondary impacts
- estimating probability distributions for disasters, affected output, etc
- evaluating non-market, including environmental, impacts
- application of CBA in preparedness measures
- application of CBA in risk transfer measures
- non-economic considerations (social, cultural, political and other preference considerations
- considering macroeconomic costs and benefits and other secondary impacts

7.3 Integrating CBA in broader risk assessment

It is also necessary to integrate CBA within comprehensive risk assessment programmes because CBA is only one of the decision tools applicable in selecting among risk mitigation alternatives. Thus, CBA is not stand-alone decision tool: it is applied as part of the decision-making stage in risk assessment for selecting among competing alternatives. The core activities of this stage consists of examining options for addressing risks determined in the earlier stages through identifying and analyzing alternative options, determining the level and incidence of benefits and costs, as well as the feasibility, effectiveness and potential adverse effects of the options. The place of CBA in the decision-making stage of comprehensive disaster risk assessment is shown in Table 5.

However, there are instances when it may not be feasible, cost effective or timely to undertake CBA of DRR options. It then becomes necessary to undertake a quick evaluation to identify DRR options that would warrant full blown CBA. A suitable method is the STAPLE/E approach based on criteria relating to Social, Technical, Administrative, Political, Legal, Economic and Environmental feasibility. In general this approach is most suitable for analyzing non-structural measures of DRR.

Table 5

CBA in the context of comprehensive disaster risk assessment

Management stages	Risk assessment stages and steps	Outputs
Decision-making	• Evaluate Risks 1) Set criteria for risk evaluation (based on cost-benefit and other decision models) with stakeholder participation based on socially acceptable risks 2) Compare ranked risks with risk evaluation criteria 3) Set risk priorities for action • Treat Risks 1) Identify prevention, mitigation, preparedness, response and recovery measures and options to address unacceptable risks *2) Evaluate treatment options (based on such factors as cost-benefit, risk severity, equity, feasibility and possible community reaction)* 3) Select appropriate treatments in order of preference 4) Coordinate and monitor implementation of treatments	• Stakeholders understand their hazards and possible solutions • Risk evaluation criteria determined • All risks prioritized from greatest to least based on technical viability and community acceptance • All risks documented • List of selected treatments including resource requirements • Agreed implementation plan for adopted treatments • Stakeholder ownership

Source: Vordzorgbe (2006), page 26.

8. Convincing the public to increase investment in DRR

To convince national authorities (policy makers, legislators, budget makers and controllers of public funds) to invest in disaster reduction, it is necessary to effectively demonstrate the value of DRR and to go beyond the evidence of the cost of disasters and the value of DRR to consider other factors that shape decision-making on funding of DRR.

Factors that make it possible to invest in DRR interventions with positive value include:

- improving communication of risk analysis
- showing that DRR investments have purely developmental benefits
- recognizing non-efficiency and political issues
- helping to determine who pays for cost-effective DRR
- showing how to reduce public and private resource constraints to increased investment in DRR
- strengthening incentives for DRR.
- addressing DRR project design issues

8.1 Improving risk communication to induce greater public investment in DRR

A key function of risk analysis is to describe and communicate the different degrees of risk and uncertainty about a particular DRR intervention or portfolio of interventions so clearly that decisions can be made on the best available information.

Effective communication of risk analysis to induce greater public investment in DRR should educate the public about specific risks, risk assessment, and, risk management actions and encourage personal risk reduction measures. To achieve these aims, it is necessary to show clear and convincing evidence of the effects and costs of disaster risks and to effectively show the value of investing in DRR at the personal, community, and institutional levels.

To show clear and convincing evidence of effects and cost of disasters, (a) the data should be of adequate coverage and be relevant, comprehensible, current and evidence-based; (b) the analysis should cover direct, indirect and secondary costs, including inter-generational costs and lost development opportunities.

To effectively show the value (net benefit over cost) of investing in DRR to decision-makers: (a) the information on the intervention must be comprehensive and address issues of value, cost, risk and implementation, (b) the presentation must be convincing, with adequate attention paid to the packaging and contexting of the evidence, (c) the timing of the presentation must be strategic and opportune, and, (d) the medium of presentation must be appropriate.

8.2 Showing that DRR investments have purely developmental benefits

Given the links between disasters and development and the impacts of disasters on the MDGs, reducing disaster risk can help meet the MDGs. Examples of the contribution of risk reduction to meeting the MDGs are shown in Table 6.

But it is important to stress that even in the absence of disasters, DRR measures have development benefits, partly because of the inter-relationships between natural hazards and other livelihood hazards. Effective risk management, based on stakeholder involvement, accords several benefits to development interventions, including: (a) improving understanding of the intervention, (b) enhancing confidence in time or cost forecasts of development intervention variables, (c) allowing prospective threat identification to facilitate application of corrective measures, (d) facilitating better understanding among stakeholders in designing, implementing and assessing development interventions, (e) promoting feedback to ensure achievement of the objectives of development interventions (Vordzorgbe 2006).

8.3 Recognizing the role of non-efficiency factors and political issues

It is necessary to recognize he role of non-efficiency factors, such as equity and welfare considerations relating to considerations such as DRR as a public good and the complexity of operating DRR in market economies. Also, the political nature of DRR interventions should be recognized in advocating for increased public resource investment in DRR. Thus it is necessary to: (a) demonstrate the political benefit of investing public funds in DRR, (b) take into account the political economy of DRR interventions, (c) show that DRR is necessary for political stability, and, (d) show that DRR can be a win-win solution for both politicians and communities. Above all, is necessary to emphasize the governance aspects of DRR by recognizing that DRR is a governance issue and has a role in enhancing governance of development in general.

8.4 Helping to determine who pays for cost-effective DRR

To help induce increased investment in DRR, the analysis has to help provide the information needed to determine who pays for the proposed DRR options. Thus it is important to consider public resource constraints and recognize that governments do not have to bear the full cost of DRR alone because investing in DRR is a shared responsibility of all stakeholders. Also, the analysis should propose how governments can induce enhanced non-government investment in DRR by strengthening incentives for investment, as indicated in Section 8.5 below. Further, it can help identify roles of private sector in investing in DRR, such as in structural measures, relief, reconstruction, insurance and financial services.

Table 6
How risk reduction helps achieve the MGDs

MDG 1: Eradicate extreme poverty and hunger
- Reducing livelihood vulnerability helps eradicate poverty and improves equity and food security.
- Reducing macro impacts of disasters promotes growth, fiscal stability and public service provision
- Common strategies and tools can be applied to both poverty and disaster reduction

MDG 2: Achieve universal primary education
- Safe school infrastructure and training of staff and students in emergency preparedness helps promote school attendance
- Reduced vulnerability increases household assets to be invested in education and broadens options for education

MDG 3: Promote gender equality and empower women
- Disaster risk reduction provide tools for women to move towards greater equality with men in society
- Better disaster risk reduction helps protect women from disproportionate impacts of disasters
- Participatory approaches to risk reduction provides platforms for women engagement in broader development decision-making

MDG 4: Reduce child mortality
- Disaster risk reduction helps protect children from death and injury from hazards
- Health infrastructure and personnel in hazard-prone areas are better protected
- Appropriate safety nets can help support children, including meeting their health needs

MDG 5: Improve maternal health
- Disaster-related injury and illness is reduced
- Improved household and community livelihood and food security helps reduce women's workload and improve family nutrition
- Health infrastructure and personnel in hazard-prone areas are better protected

MDG 6: Combat HIV/AIDS, malaria and other diseases
- Public health risks are reduced, nutrition and health status improved, and resistance to epidemic diseases boosted
- Reduction in disasters frees resources for social investment, reducing vulnerability to illness
- Community organizations and networks involved in disaster reduction constitute a resource for health promotion and vice versa

MDG 7: Ensuring environmental sustainability
- Fewer disasters will reduce destruction of natural assets and the man-made environment
- Reduced disaster-related migration to urban slums and reduced damage to urban infrastructure will help improve urban environments
- Good governance of disaster reduction interventions will help reduce rural and urban environmental damage through greater compliance with environmental regulations, policies and legislation
- Disaster risk reduction can help reduce climate change

MDG 8: Develop a global partnership for development
- International initiatives to increase funding for disaster reduction could increase development resources
- Efforts to develop international partnerships for disaster reduction provide platforms for broader international development initiatives and help promote better public-private collaboration
- Effective international governance regime for reducing climate change risk and other disasters will help reduce disparities in national bargaining power within the international community

Source: UNISDR 2005, UNDP 2004.

8.5 Showing how to reduce public and private resource constraints to increased investment in DRR

Low investment of public resources in DRR can be due to resource constraints. To be effective in catalyzing increased resource investment in DRR, CBA analysis can indicate ways of ameliorating public resource constraints, including through development assistance; and propose how to collect payments for the costs of the intervention if necessary.

8.6 Strengthening incentives for DRR.

To promote faster and wider adoption of structural and planning measures of DRR, there should be incentives, such as tax incentives, reduced insurance premiums and longer-term financing, for those who apply such measures. Also, governments should show the way through demonstration effect by applying these hazard mitigation measures to the development and management of public facilities and infrastructure. This also promotes accountability in the enforcement of these measures in the public domain. In addition, national engineering and construction professional associations need to ensure compliance by their members with these standards and codes while the private sector and other major groups in society need to play their parts in ensuring universal compliance of these safety measures.

Economic policy and financial tools are key in the incentives framework. The macroeconomic policy environment, such as fiscal, debt and inflation policies, need to: (a) take account of potential variability from natural hazard-related shocks, (b) assess the impacts of disaster risks on the poor and other vulnerable groups, infrastructure and economic sectors and introduce measures and guidelines to protect them, and (c) allow the allocation of requisite resources and the provision of adequate incentives for mitigating and adapting to disaster risks.

Sectoral policies: In a complementary manner, key sectoral policies, such as for food and agriculture, rural and urban development and enterprise development should be targeted at enhancing incentives for integrated land and water management to reduce land degradation arising from agriculture. Also, policies that promote development of small and medium enterprises enhance the income base of the poor, thereby empowering them to reduce the potential effects of natural disasters, particularly those emanating from drought, flood, famine and epidemics.

Financial tools play a significant role in endowing individuals and communities with the financial wherewithal to undertake disaster risk mitigation measures and to strengthen their coping capabilities. These include policies and initiatives to promote effective financial intermediation to widen access to affordable financing, and risk spreading and transfer, such as through saving, microfinance and insurance schemes.

8.7 Addressing DRR project design factors

Effective risk analysis should enable planners make adjustments in project design to reflect various attitudes of decision-makers towards risk and uncertainty. Therefore, it is important to address the following project design issues to make proposed DRR measures in CBA more acceptable to public authorities.

The design of the individual interventions should be as complete as possible with adequate attention paid to factors such as the suitability and effectiveness of the constituent components, linkages between components; internal consistency of the design; implementation efficiency; and monitoring and evaluation. The design should be kept as simple as possible.

The analysis should ensure existence of adequate institutional framework and stakeholder, including community, participation to implement the proposed measure.

The analysis should also emphasize that the proposed DRR measures do not constitute a separate sector and should be integrated into normal development programming to the extent possible. One way of doing this is to propose ways of addressing financial, economic and political risks associated with the DRR measure concurrently.

Given resource constraints, it is important to show low-cost interventions. DRR interventions need not require large financial outlays. This is because DRR involves a wide range of measures in the institutional framework, risk assessment, information management, sectoral measures of risk reduction and response. These involving interventions in policy, enforcement of compliance with standards and codes, research and communication and others. Some of these cover actions (such as participation; compliance with regulations; education and sensitization; better coordination of sectoral interventions) that do not require large investments of financial resources as needed for development of physical infrastructure.

Effectively demonstrating low-cost options requires comprehensive knowledge of DRR measures and effectively undertaking comprehensive CBA of a broad range of DRR measures at various national and local levels.

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[i] For example, UNEP sources show that malaria alone accounts for an average of about 2 million deaths annually (UNEP 2002) while HIV/AIDS accounted for 2.4 million deaths in 2002 (WHO/UNAIDS).

[ii] However, damage from famine is highest in Africa.

[iii] For example, EM-DAT: The OFDA/CRED International Disaster Database only covers disasters of a given magnitude: 10 or more people killed, and/or 100 or more people reported affected, and/or declaration of a state of emergency; and/or a call for international assistance (Tschoegl 2006).

[iv] These localized hazards include crop losses from localized pest infestation, livestock losses from irregular disease outbreaks, recurrent forest fires in arable areas, crop destruction by livestock and small geological events, such as landslides. For the majority of the poor in Africa, it is these smaller, localized and recurrent losses that affect their livelihoods, erode the development capacity of communities and weaken their coping and survival capacities, thereby limiting societal and individual resilience to major natural hazards.

[v] The African Development Bank is a significant source of development financial resources in Africa but its assistance for disaster management is only now emerging. Other sources of disaster management resources for Africa include the World Food Programme, UNDP, USAID, International Federation of Red Cross, FAO, World Meteorological Organization, IFAD, UNEP and World Health Organization.

[vi] In particular, all emergency disaster loans were not subject to formal cost-benefit analysis.

[vii] For example, see Otero and Marti (1994) for a list of studies on the effects of selected disasters in Latin America and the Caribbean from 1972 to 1994, Benson (1997A and 1997B) for coverage of some Asian countries, Mckenzie et al (2005) and Benson (1997C) for analyses of impacts in the Pacific, and, Vordzorgbe (1992) and Benson and Clay (1998) for analyses of impacts in some African countries.

[viii] There are three key differences between the two types of analysis. First, in economic analysis, taxes, subsidies, loans and debt service are treated as transfer payments and are not considered in the analysis. Second, market prices are used in financial analysis whereas in economic analysis market prices are often modified to reflect social or economic values. Third, interest on capital is regarded as part of total return to capital for society and is not deducted from gross returns but interest paid to external capital may be deducted to generate benefits. In economic analysis, shadow prices are used when there were no market prices or when they yielded a distorted signal of the social value of a good or the social cost of a resource.