Section 42
Governance and Democracy

Guidelines

Risk Analysis – a Basis for Disaster Risk Management

Deutsche Gesellschaft für
Technische Zusammenarbeit (GTZ) GmbH

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Deutsche Gesellschaft für Technische Zusammenarbeit
(GTZ) GmbH

Guidelines

Risk Analysis – a Basis for Disaster Risk Management

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Foreword

With increasing frequency, the developing countries and the people living there are being affected by disasters. More and more often, development efforts are being destroyed. The reason for this trend is their growing vulnerability, which in turn is the result of economic and social development processes, such as the expansion of settlements and agricultural land in risk areas. The economic and social consequences of these disasters for the people in our partner countries last for years.

To break and, if possible, reverse this trend, international organisations, governments and NGOs in the developing countries are increasingly upgrading the priority of disaster risk management for policy, and taking concrete preventive measures to reduce the risk to the population. For the GTZ, disaster risk management is an important aspect of its work in Latin America, Africa and Asia. It is accordingly producing concepts, methods and instruments for disaster risk reduction in these regions. One of the most important instruments is risk analysis, as a basis for effective disaster risk management.

The BMZ commissioned the GTZ to produce the present guidelines. Their goal is to help integrate risk analysis into projects and programmes in jeopardised regions, e.g. rural development, promotion of local communities or sustainable resource conservation. Equally important is the use of risk analysis in reconstruction programmes to ensure sustainability in designing a fresh start, e.g. after a flood or an earthquake. In this respect, these guidelines meet the goal of the German Federal government of embedding disaster risk management in development cooperation as a cross-cutting responsibility.

In the present publication the GTZ presents implementation-oriented concepts, instruments and methods for risk analysis which have been tested in projects funded by the BMZ and the German Foreign Office. It is part of GTZ services for disaster risk management, and is aimed primarily at the staff of the GTZ and its partner experts, and experts in national and international institutions and organisations.

We wish to thank particularly the authors Alois Kohler, Sebastian Jülich and Lena Bloemertz for developing the concepts and instruments presented in these guidelines, and Christina Bollin and Mario Donga at the GTZ for producing the present publication. We also wish to thank the staff of the GTZ, partner institutions and other organisations for their cooperation in reviewing experience and their suggestions.

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Acknowledgements

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We also wish to thank the following individuals, whose ideas, comments and expert contributions enriched and even made possible the present document. Christina Bollin, Alberto Aquino, Ralf Kaltofen, Claudia Maier, Eberhard Goll, Elisabeth Mausolf, Wolfgang Stiebens, Rolf Wachholtz, Wolfgang Weinmann, Rosa Sanchez, Ali Neumann, Peter Asmussen and Mario Donga.

The present publication contains the main part of the risk analysis. A CD containing 11 extensive appendices is **available in German** to interested users on request from the sector project "Disaster Risk Management in Development Cooperation" (GTZ Eschborn, disaster-reduction@gtz.de):

The appendices cover the following topics:

1) Remote sensing and geographical information systems in disaster risk management;
2) The "Sustainable Livelihood Approach" (SLA – analysis at household level);
3) ENSO – El Niño Southern Oscillation;
4) Soil and Water Assessment Tool (SWAT);
5) The NAXOS-Praedict early warning system for flood protection;
6) Methods for recording erosion (USLE etc);
7) NOAA approaches (National Oceanic and Atmospheric Administration);
8) Tasks and activities in carrying out a risk analysis;
9) Selected organisations and contact persons for risk analysis;
10) Risk analysis – methods for assigning relative values, using the example of landslides, PGRSAP-GTZ-Wachholtz Survey Ltd, 2003;
11) Interactive CD-ROM "Digital information pool on natural disasters and disaster risk management".

The guidelines were started within the framework of a BMZ-funded study and expert fund and completed in the sector project "Disaster Risk Management in Development Cooperation".

We hope that our readers and users will find these guidelines interesting and helpful, and we look forward to your feedback.

The authors

Contents

List of abbreviations

AA	German Foreign Office
APELL	Awareness and Preparedness for Emergencies on a Local Level (UNEP)
BMZ	Federal German Ministry for Economic Cooperation and Development
CREAMS	Chemicals, Runoff and Erosion from Agricultural Management Systems
DC	Development Cooperation
DG	GTZ International Services
DKKV	German Committee for Disaster Reduction
DEA	Development-Oriented Emergency Aid
DR	Disaster Reduction (=DRM)
DRM	Disaster Risk Management (=DR)
ECHO	European Community Humanitarian Office
ENSO	El Niño Southern Oscillation
EPC	Emergency Preparedness Canada
FC	Financial Cooperation
FEMA	Federal Emergency Management Agency, USA
FSP	Food Security Programme
GIS	Geographical Information System
GL	Guideline
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit GmbH
HIRV	Hazard, Impact, Risk, and Vulnerability (Model)
IDNDR	International Decade of Natural Disaster Risk Management
IFSP	Integrated Food Security Programme
IFRC	The International Federation of Red Cross and Red Crescent Societies
ISDR	International Strategy for Disaster Risk Management
LUP	Land Use Planning
MAMUCA	Mancomunidad de los Municipios del Centro de Atlántida (Honduras)
MUSLE	Modified Universal Soil Loss Equation
NAXOS	Precipitation-Runoff Model for X Operations Systems, TU Braunschweig
NDVI	Normalised Difference Vegetation Index
NGO	Non-Government Organisation
NOAA	National Oceanic and Atmospheric Administration (U.S. Department of Commerce)
OT	Ordenamiento Territorial (= spatial planning)
PRA	Participatory (Rapid) Rural Appraisal
P-RA	Participative Risk Analysis
RA	Risk Analysis
RRA	Rapid Rural Appraisal
RM	Resource Management
SLA	Sustainable Livelihood Approach
SP	Spatial Planning
STC	U.N. Scientific and Technical Committee, responsible for operationalising the International Decade of Natural Disaster Reduction
SWAT	Soil and Water Assessment Tool
TC	Technical Cooperation
UN	United Nations
UNEP	United Nations Environment Programme
UNHCR	United Nations High Commissioner for Refugees
USLE	Universal Soil Loss Equation
WEPP	Water Erosion Prediction Project
WFP	World Food Programme

1 Introduction

1.1 The approach

The present guidelines are based on cooperation with staff at GTZ Eschborn, and particularly the section "International cooperation in the context of conflicts and disasters" and with various projects of bilateral German development cooperation in partner countries in Latin America, Africa and Asia. In addition, an extensive body of literature in German, English and Spanish was reviewed and consulted, together with relevant documentation from projects, workshops and meetings. In developing the methodology, we incorporated both concrete experience from practice and the information from our review of the literature. Technical Cooperation (TC) projects also provided important feedback from practice at the workshops in Piura (Peru, 3 – 5.6.03) and Cochabamba (Bolivia, 22 – 23.9.03)

The approaches, concepts, methods and terminology for disaster risk management and risk analysis found in the reports and other literature are very diverse, in some cases contradictory[1], mostly lacking in precision and often very academic in their presentation. In the case of risk analysis in particular there are virtually no documents with clear presentations at the level of concrete implementation. The present guidelines on risk analysis were developed for this reason, and to meet the needs of the projects of (German) development cooperation.

The guidelines are based on the GTZ working concept "Disaster Risk Management", which has been available at the GTZ since December 2001.

1.2 What and who is it for?

These guidelines on risk analysis became necessary as a result of the new demands posed by the increasing number of disasters and resulting increase and change in requirements in DC. These requirements include specifically

- more elaborate and complex coordination due to the increase in number and diversity of donors and organisations;
- closer links between humanitarian aid, emergency aid, reconstruction and development (TC) and securing the transition from emergency aid to reconstruction and TC;
- given the growing scarcity of resources, increasing pressure to show that a) emergency aid measures restore the conditions for sustainable development and b) investment in disaster risk management leads to reduced vulnerability.

[1] For example, the name "risk maps" is applied to maps showing different information, and the same goes for hazard maps.

The GTZ has responded to these new requirements by developing the concept of **“development-oriented emergency aid (DEA)”** which includes and links the components of emergency aid, rehabilitation and reconstruction, disaster risk management and crisis prevention, laying the basis for structural development (TC). Methods and instruments are needed to make this linkage possible. One of these basic instruments is risk analysis, which lays the foundation for developing the strategies for deploying the various components of DEA. Risk analysis shows whether there is a need for reconstruction and TC after a brief period of emergency aid, and if so, how these can be configured.

The guidelines are intended to be useful and applicable in the case of not only **emergency aid** and humanitarian aid, which generally have a planning horizon of 6–12 months, but also the other components of **DEA**, such as reconstruction measures and food security programmes in the context of disasters.They are also intended to be useful for **TC projects** which are being implemented in regions threatened by natural hazards or which contain components of disaster risk management.

These TC projects (rural development, community promotion, resource management, etc) and projects following the DEA concept have so far had different experience with various approaches to **disaster risk management** (DRM). Risk analysis as an element of these is often treated as a secondary priority, or even neglected altogether. Alternatively, it is developed and carried out within a specific project, requiring extensive inputs.

The context for the present guidelines is **bilateral and multilateral development cooperation** which assists and advices projects in disaster risk management (DRM) and disaster response as well as projects in various sectors with components of DRM. Due to their economic situation and sociopolitical conditions, the developing and transition countries do not have the financial strength or knowledge to prepare appropriately for individual hazards and plan and implement fundamental social measures to reduce and cope with disasters (early warning systems, protective structures, disaster protection organisations, insurance systems).

These guidelines are also intended to provide assistance where the **basic data** required for the use of hi-tech models in geographical information systems (GIS) is not available. This is generally the case in projects operating in the context of poverty, where there are no qualified experts and institutions, but where it is still necessary to develop solutions for the population affected.

The use of risk analysis is intended to enhance the importance and priority of disaster prevention and preparedness and make them more effective, as a way of reducing damage and losses from extreme natural disasters and reducing the need for emergency aid.

1.3 Some definitions

A **hazard** is a natural physical phenomenon which can lead to a loss of life or damage to objects, buildings and the environment. The hazard is measured and defined by its nature (type of hazard), location and extent, scope and intensity (damage potential) and its probability of occurrence, duration and frequency (repetition cycles). Examples: floods, earthquakes, droughts, landslides, etc.

Vulnerability expresses the level of possible loss or injury or damage to humans, objects, buildings and the environment which can result from the natural hazard. Vulnerability expresses the susceptibility and predisposition to be affected or suffer injury or damage. It also captures people’s inadequate options or ability to protect themselves against possible damage or recover from the consequences of natural phenomena without outside help. Vulnerability always relates to a concrete hazard. It arises out of the interaction of social, economic, physical and environmental factors.

The level of vulnerability of a society to a specific extreme natural phenomenon (hazard) is determined by the potential damage caused by the natural phenomenon.

There is just **one vulnerability**, which depends on and is influenced by various factors, and not specific sectoral vulnerabilities, such as economic, political or institutional vulnerability, as described in numerous publications. In addition to these “specific vulnerabilities”, the specialist literature also often uses the term **“ecological vulnerability”**. This refers to the vulnerability of the environment (soil, water). However, “ecology” covers more than just the environment. Ecology in these guidelines is used to refer to the science dealing with the relationship between nature and society, and not just one of these two components.

Vulnerability factors: vulnerability and its severity depend on a range of factors. In these guidelines, vulnerability factors are allocated to the following four categories: physical, environmental, economic and social. The vulnerability factors to be identified and researched depend on the particular **hazard type** and **location**. They are explained in detail in sections 3 and 7.

Risk is defined as the product of hazard and vulnerability (R=HxV), or – to put it another way – risk as the probability of an encounter between a specific hazard and an element vulnerable to this is interpreted as the probability of occurrence of loss of life or damage to objects, buildings and the environment as the result of an extreme natural phenomenon with a specific strength or intensity.

Disaster risk management (DRM): the terms **disaster reduction** (DR) and **disaster risk management** (DRM) are used as synonyms in the present guidelines. However, DRM is preferred, as this conveys a stronger sense of direct local initiative. In addition to risk analysis, DRM also includes prevention and preparedness for disaster. By contrast, disaster management (DM) consists of DRM as well as disaster response.

Risk analysis is used here as a synonym for **risk assessment**. However, many authors and documents distinguish between these. Where this is done, risk assessment is taken as also including risk evaluation, socioeconomic cost-benefit analysis, prioritisation of measures, establishing acceptable risk levels, developing scenarios and measures[2]. **Risk analysis** (RA) is used in these guidelines to refer to a method of determining the quantitative or qualitative degree of risk. The term "risk analysis" has the underlying concept of **"participative risk analysis"** (P-RA). This means that the affected target population are involved in the various stages of a risk analysis, and adopt the DRM as their own.

[2] From: ISDR (2002): Living with Risk: A global review of disaster reduction initiatives. Preliminary version July 2002, p.66

2 Growing disasters and new demands on development cooperation

2.1 From emergency aid to prevention

In development cooperation (DC), more and more money is being spent on disaster and emergency aid, in both absolute terms and as a share of DC financing. Given the general shortage of funding, this is at the expense of spending on Technical Cooperation (TC), which aims at sustainable structural measures. This is a result on the one hand of the increase in extreme natural events and phenomena, primarily of climatic or meteorological origin (such as floods, storms and droughts) and on the other hand of the dramatic increase in vulnerability due to population growth, weak institutions, poverty, and inadequate and uncontrolled use of natural resources.

To a considerable extent, the increase in vulnerability is due to the growth in poverty in many countries and regions, which leads to settlements and productive activities increasingly relocating to and expanding in areas which are at risk (traditional flood areas, steep and unstable hillsides, wet areas, forest areas with vulnerable ecosystems, etc). Other causes are dysfunctional disaster protection, missing or inaccurate precautionary planning (risk analysis, disaster prevention) and a lack of strategies for water catchment area management and rural development.

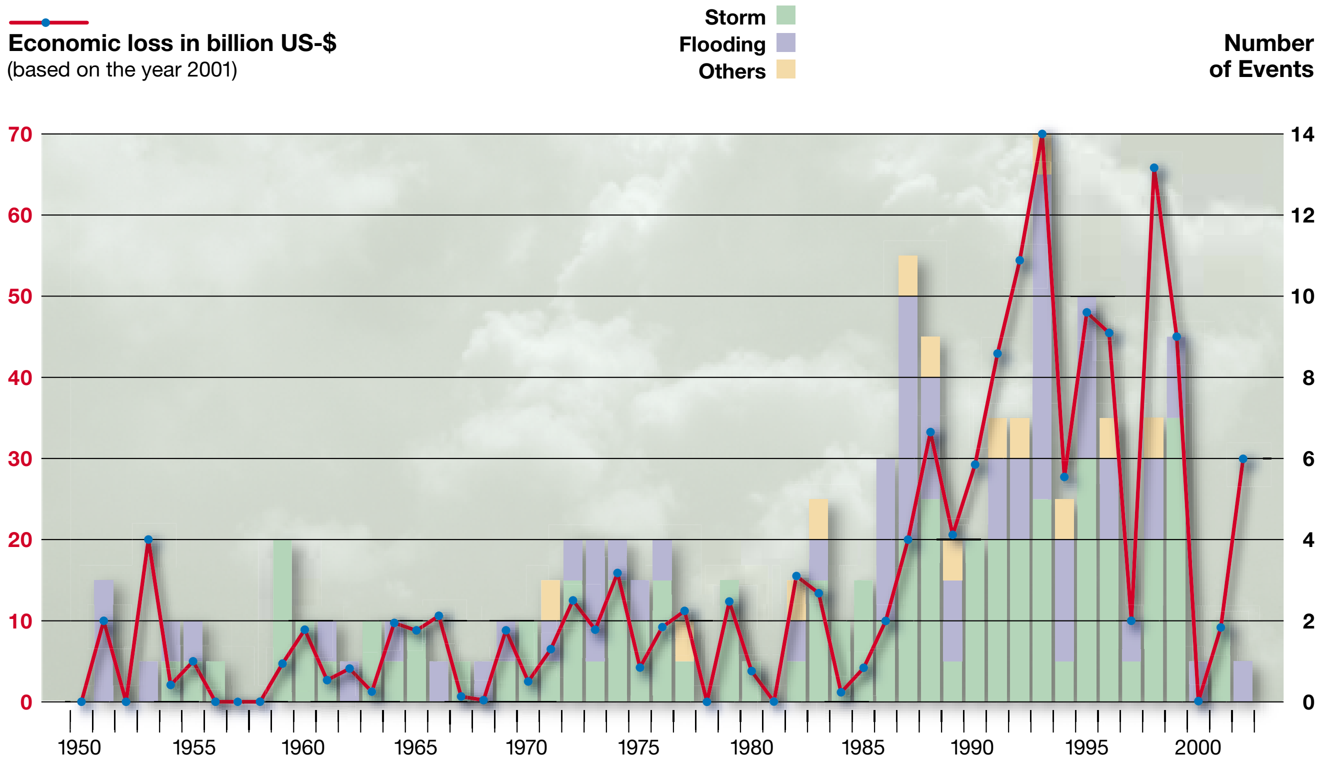
The extensive neglect of rural development is one of the most important reasons for the rapid and uncontrolled growth of urban population centres which are particularly vulnerable to extreme natural events.

Disasters lead to increased poverty. In many hazardous regions, there has been a dramatic rise in the number of starving people after natural disasters, e.g. in Honduras and Nicaragua after Hurricane Mitch and in El Salvador after the earthquake. The German Federal Government and the GTZ are trying to counter this trend towards growing demand for emergency aid through increased efforts aimed primarily at strengthening disaster prevention and preparedness. This includes improved coordination and linkage between the various components of DEA and with TC. However, emergency aid has also been faced by changing demands in recent years as a result of these developments. New coordination mechanisms were needed to coordinate the large number of organisations involved in supplying aid. Planning has to include the interfaces with other aid services and must facilitate the transition to reconstruction and structural DC, to ensure that emergency aid has lasting positive effects. Another important quality criterion is the contribution towards conflict reduction.

The German Federal Ministry for Economic Cooperation and Development (BMZ) is responding to the growing number of conflicts and disasters by redirecting budget item 68708[3] "Food security programmes

[3] Primarily used in the past to combat structural hazards to nutrition.

Figure 1: **Major weather-induced natural disasters, 1950–2002** (source: Münchener Rück)



(FSP)", which is used specifically to finance programmes directly related to the rising number of crises, conflicts and natural disasters. This item is supplemented by item 69725 "Food, emergency and refugee aid". The "emergency aid budget item" is used more for short-term interventions, while the '08 item supports measures with medium-term, multiyear orientation towards reduction, reconstruction and emergency aid following the "continuum" concept (emergency aid, reconstruction and development as elements of an overall strategy covering elements of both time and space) FSP bridges emergency aid and DC. In future, it is intended to use it (among other purposes) in increased preventive work for disaster risk management.

Improved disaster risk management (DRM) is being used to help reduce the impacts of extreme natural events and phenomena.

As the subject of various areas of policy and work (domestic policy, environment protection, agriculture, rural and regional planning, construction, land use planning, etc), **disaster risk management** (DRM) is recognised today as an important **cross-cutting task** in DC. **For this reason the BMZ has commissioned the GTZ to carry out the sector project "Disaster Risk Management in Development Cooperation": this started work in October 2003 on developing instruments and methods needed in disaster risk management.** In addition, the project has the job of formulating clear *implementation strategies* for integrating DRM more closely and definitively in the various sectors of DC.

The focus in promoting DRM within DC is on promoting local disaster protection structures (as part of decentralisation) in developing and transition countries, and integrating DRM into the various sectors of DC. Other priorities – as elements of the *implementation strategies referred* to earlier – are the development and formulation of instruments, methods and guidelines, in order to ensure efficient implementation of DRM and disaster response measures within the framework of DC.

2.2 Project types and linking short term and long term measures

Where natural disasters pose an acute hazard to the survival of the population and TC measures are not (yet) possible because of the urgency and lack of basis, the GTZ executes projects in "development-oriented emergency aid (DEA)". Emergency aid measures are an important element in DEA. They ensure supplies to people in acute emergencies and lay the foundation for subsequent reconstruction and structural development measures based on recommendations derived from risk analyses. For emergency aid measures lasting one year or less, risk analysis is carried out in parallel with the emergency aid or reconstruction measures. The results provide a basis for the decision whether support should be continued, and for which measures (reconstruction, TC), in order to reduce vulnerability – e.g. during reconstruction – and to secure DRM measures sustainably. These short-term measures are often carried out in a context of existing bilateral projects, in order to respond quickly while ensuring long-term assistance to the affected population.

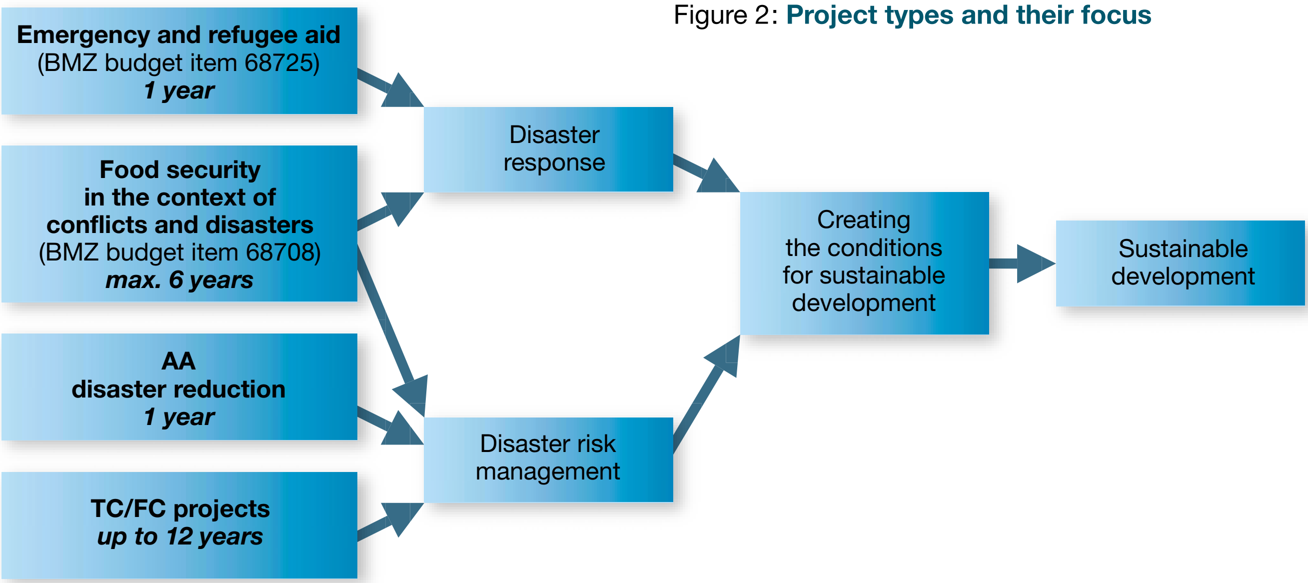
Risk analyses also help with project identification, providing information on whether under certain circumstances short-term activities under emergency aid measures are more efficient and effective, whether aid measures should be aimed more at longer term structural (TC) measures, or whether a combination of the two is needed.

In practice, many different possible combinations are conceivable – often, the follow-up to disasters is an emergency aid measure, as this can provide a faster and more flexible response than normal TC[4]. Often, these disaster risk management measures (generally lasting one year) by the BMZ, German Foreign Office (AA) or European Union (EU/ECHO) are repeated once or more (examples: FAM-Amdecruz, Bolivia; La Masica/MAMUCA, Honduras) or are replaced by food security measures (FSP) or technical and financial cooperation measures (TC, FC). Another possibility is to start aid measures with FSP (examples: San Pedro, Bolivia; Arequipa, Peru), starting with risk analysis and concentrating on reduction and preparatory measures. In other cases measures are also carried out in cooperation with nongovernmental organisations (NGOs) and international organisations (UNHCR, WPF, IVRC, etc).

In regions threatened by disasters, disaster risk management measures are often integrated into TC measures (programmes or projects) as cross-cutting themes, e.g. in projects of rural regional development, rural development, resource and water catchment area management or decentralisation and community promotion. Risk analysis is then part of project preparedness and planning, and is carried out in the framework of instruments such as problem analysis, organisation or potential analysis, ROPP (Regionally Oriented Programme Planning) or land use planning.

[4] Emergency aid and FSP measures are not tied to country quotas, government negotiations and exchanges of notes, and can accordingly be used at short notice.

Figure 2: **Project types and their focus**



Depending on the constellation and the course of the project, risk analysis can also be carried out in such projects during other phases of the project cycle. A distinction needs to be made here between normal TC, where projects can have a duration up to c. twelve years, FSP with terms of at most six years, and the emergency aid or disaster risk management projects (BMZ, AA) referred to above, which normally have terms of a year or less. In the latter case, there is no preparatory phase, and the conditions and time for a detailed risk analysis are lacking. In this case, risk analysis must be seen as a rough estimate, with the analysis focusing on general conditions in order to arrive at an assessment of the value, usefulness and type of follow-up measures.

Development oriented emergency aid (DEA) with its interlinked components of emergency aid, rehabilitation and reconstruction, disaster risk management and crisis prevention is intended (among other things) to prepare the way for structural development (TC). **Risk analyses** are essential in making possible this interlinkage and also in creating a bridge to structural TC. Risk analyses are a necessary basis for developing adequate and efficient strategies for implementing the various components of DEA and moving on from both emergency aid and reconstruction measures to less vulnerable and more sustainable development measures. Risk analysis can show whether reconstruction and TC are useful and necessary after a brief period of emergency aid.

Typical phases in a disaster:
emergency aid (medical services, tents, water, waste water disposal, medication) ➜ food aid ➜ rehabilitation and reconstruction based on risk analysis ➜ disaster risk management (risk analysis, prevention, spatial planning and preparedness) ➜ rural regional development, promotion of agriculture and employment, community development and decentralisation.

The nature and scope of risk analyses and the measures based on these can vary extensively, depending on the hazard and whether they are concerned with the national, regional, village or household level.

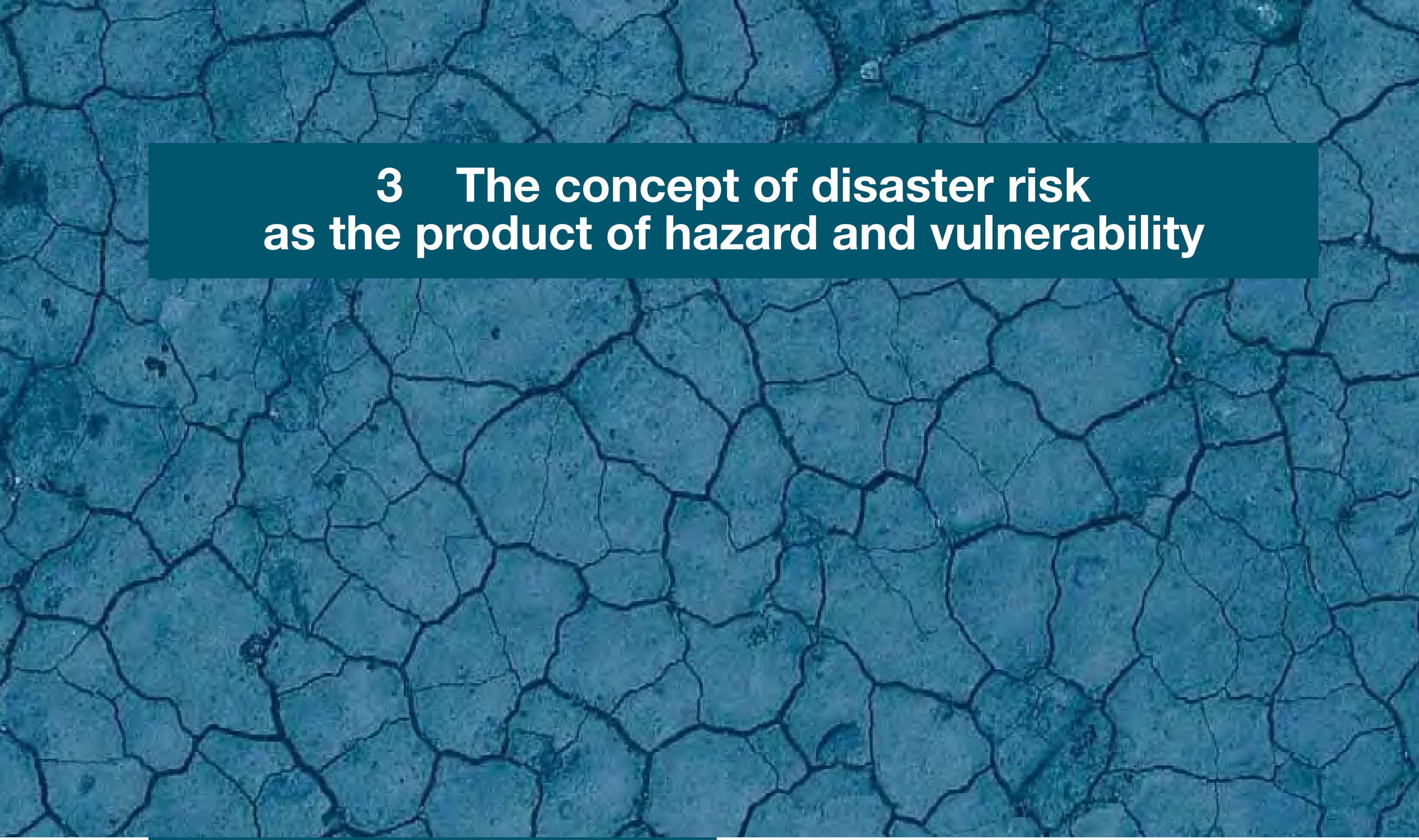
2.3 Disaster risk management as part of other planning

The projects supported by the GTZ are the result of processes of negotiation and the expression of both international and binational agreements and national policies. Since "Rio 92" the Federal Republic of Germany has been just as committed to the **paradigm of sustainable development** as the governments of the partner countries (Rio Declaration, Agenda 21, Convention on Biological Diversity, Framework Convention on Climate Change) which the German Federal Government cooperates with.

One of the GTZ's goals is accordingly *"to promote the formation of viable partnerships for sustainable development by supporting learning and negotiations processes which lead to a balance between the economic, social and ecological dimensions of development in the interests of present and future generations"*[5].

The specific anchoring of the projects supported by the GTZ a) in the paradigm of sustainable development and the development policy principles of the German Federal Government, b) in the development efforts of the partner countries, and c) in the mostly short-term expectations and needs of the target groups leads to a situation where the diverse interests, necessities and needs have to be coordinated and negotiated. This process of negotiation is often charged with conflict, and risk analysis is the only way to provide competent support and advice. Risk analysis also supplies a foundation for a) detailed formulation of an efficient DRM and b) concrete linkage of the DRM with other planning or integration into a national development strategy. The DRM must be or become an element of a national development strategy in order to be successful and contribute to sustainable development.

[5] From: Burger/Happel: "Das Leitbild nachhaltiger Entwicklung – handlungsleitende Orientierung der GTZ?" Diskussionspapier 3/97.



3 The concept of disaster risk as the product of hazard and vulnerability

3.1 The concept of disaster

Natural disasters are the result of the impact of an extreme natural event on people and their vulnerable goods and infrastructure, and cause loss of life and damage to goods and the environment. A disaster is the disruption of the functioning of a society to an extent which exceeds the ability of the society to cope with it from its own resources. The extent of the disaster depends on both the intensity of the event and the degree of vulnerability of the society[6]. A natural disaster always consists of two elements, an (external) event (the hazard) and the impacts of this hazard on a vulnerable social group exposed to this hazard.

A powerful earthquake in an unpopulated area is not a disaster, while a weak earthquake which hits an urban area with buildings not constructed to withstand earthquakes, can cause great misery. Extreme natural events only become disasters if they impact vulnerable people, who often expose themselves to natural hazards through carelessness or poverty, or who contribute to or aggravate the events by intervening in nature.

Although reducing the risk of disaster can be done by both restricting the hazard and reducing vulnerability, DC mainly tries to reduce vulnerability, since reducing the hazard is usually very difficult or even impossible. Vulnerability, by contrast, is easier to influence by strengthening human response, planning and protective capabilities.

Disasters can be seen differently in other cultures. Whether those affected see an event as a risk or as a disaster, or whether they assess the risk as high or low depends on the value system they feel bound by. Perception of risk – or, more accurately, lack of perception of risk – is the most important factor in vulnerability.

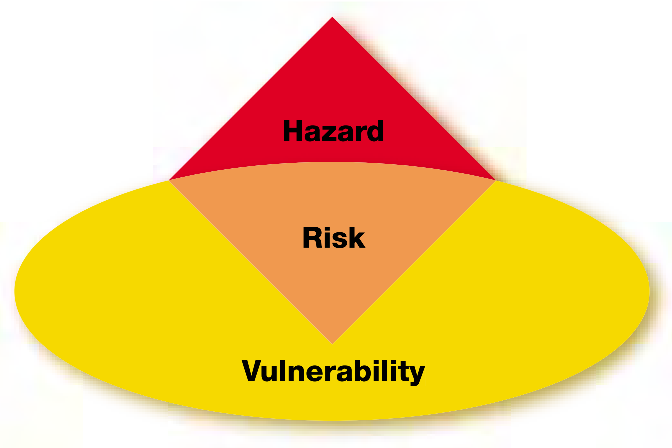
3.2 The nature of risk

Risks have always been part of daily life for humans. Life without risk is neither possible nor conceivable. However, both the level of acceptance and the perception of risk varies from one individual to another. One person will take a sharp bend at 50 km/h, another at 80 km/h, depending on their assessment of risk. Perception also varies between regions, societies and cultures. For example, there are countries who support nuclear power plants without reservation, while others see the risk as too great.

There is no universally valid definition of risk, precisely because perceptions differ between individuals

[6] From: BMZ Spezial Nr. 082/Juni '97: Entwicklungspolitik zur Vorbeugung und Bewältigung von Katastrophen und Konflikten – Konzeptionelle Aspekte und deren entwicklungspolitische Implikationen.

Figure 3: **The concept of risk**



Explanation of fig. 3: Locations and populations in the yellow region are characterised by certain types of vulnerability, those in the red and orange regions are threatened by natural events. However, risk only arises in the orange area, where hazard and vulnerability coexist.

and cultures. In the context of disaster risk management, the following definition has been "agreed":

Risk is the probability of a harmful occurrence with a specific force at a specific location and at a specific time. Risk relates to humans or objects at risk from natural events.

To perceive, understand and assess risk requires experience with or knowledge about risks, i.e. experience of something in the past.

Risk is something which has not happened yet, something which is projected into the future. If a risk is perceived as too great, there are two possibilities: eliminate the risk, or reduce it as far as possible.

However, with growing poverty there are more and more situations in which the affected population accept a high level of risks and locate in urban population centres, steep slopes or flood areas. There are also those who e.g. live near industrial zones or atomic power plants, and do not want to move away because they would lose their job or other benefits. How high the risk is judged to be also depends on the available information about possible hazards. Adequate provision of information relating to hazards helps increase awareness and perception of risks.

3.3 The elements of hazard and vulnerability

These two elements – hazard and vulnerability – are essential in risk assessment: hazard, as the probability of occurrence of a harmful natural event, and vulnerability as susceptibility to injury or damage if the event occurs, and the ability to protect yourself against it. This leads to risk as the product of the two, expressing the probability of occurrence and the magnitude of the possible damage – in other words, the probable loss or injury.

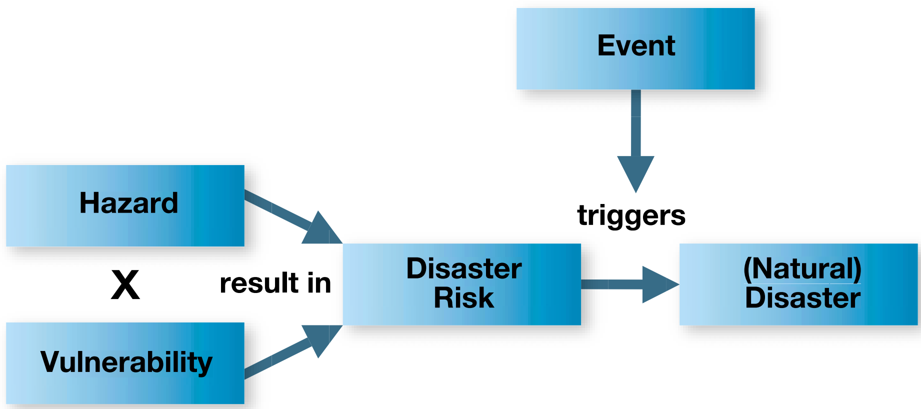
The BMZ and GTZ use the basic equation

risk = hazard x vulnerability.

However, it is important to remember that a large part of the vulnerability can be reduced through human

Figure 4: **Disaster risk as the product of hazard and vulnerability**

(revised following "Working Concept Disaster Risk Management", GTZ)



capability for prevention or self-protection ("coping strategies"). The absence of coping strategies is part of vulnerability, and has to be taken into account in the vulnerability analysis.

Hazard and vulnerability must be simultaneously present at the same location to give rise to risk, which then becomes a disaster if the event actually occurs. A society may be vulnerable to floods, but not to earthquakes (and vice versa). Vulnerability can only be identified and studied with reference to a concrete hazard. Vulnerability to a specific type of hazard varies, depending on the sector and context: for example, in housing areas, vulnerability arises out of the poor quality of buildings and basic infrastructure, in health it arises out of a lack of reserves of medication and first aid equipment, in economic activities like agriculture it arises out of a shortage of stockpiles, etc.

The vulnerability of a population or an ecosystem involves very different and often interdependent factors, which have to be taken into account in determining the vulnerability of a family, a village or a country. It is like a spider web in which physical factors are linked to economic, cultural, political, institutional, ecological and other factors.

Hazards have impact chains which can vary in length. Torrential rain as an extreme natural event can, for example, cause damage to poorly constructed (and hence vulnerable) roofs (direct impact), but for the most part the direct physical hazards and causes of damage are the consequences of the torrential rain, i.e. floods, landslides, erosion etc (longer impact chain).

The subject of hazard analysis comprises the direct physical hazards as part of what may be a longer impact chain. A direct physical hazard is the hazard which the affected population group perceive as such. In the above example, it would not be the torrential rain, but the floods, landslides and erosion.

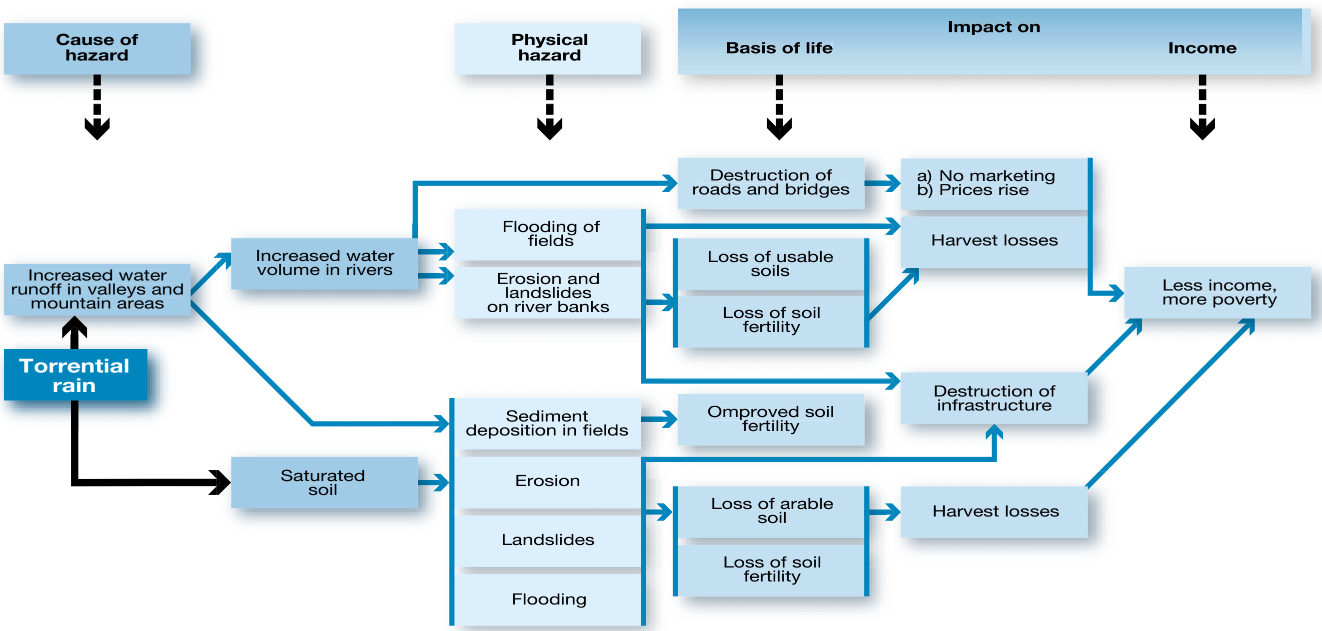
However, this depends in turn on whether the torrential rain actually leads to such secondary extreme events as floods, landslides and erosion as a result of the given characteristics of the location (water catchment area, steep slopes, lack of vegetation cover, soil infiltration rate) and vulnerability factors, and whether there are elements present which are vulnerable to these secondary hazards, e.g. roads or fields on slopes, settlements in low-lying areas etc (= vulnerability factors).

How far a natural event represents a hazard also depends on the location under consideration: torrential rain in the mountains poses no hazard to a settlement in the lower lying areas – at worst, the hazard comes from the flooding which can result from the rain, and even then only if the settlement is vulnerable to floods. In the case of an unprotected road on a slope, the hazard comes from landslides caused by the heavy rain.

Whether the torrential rain poses a hazard in the higher lying region where it falls depends on whether there are elements vulnerable to it there, e.g. the early stages of salad and vegetable cultivation.

How much damage e.g. agriculture as an important source of income suffers from torrential rain depends

Figure 5: **Impact chain for agriculture and income of torrential rain**



on a series of processes, impacts and vulnerability factors, as illustrated in figure 5, showing the **impact chain** of torrential rain for agriculture. Here, the impacts of torrential rain are transformed into physical hazards and thus causes of damage, such as landslides, flooding and erosion.

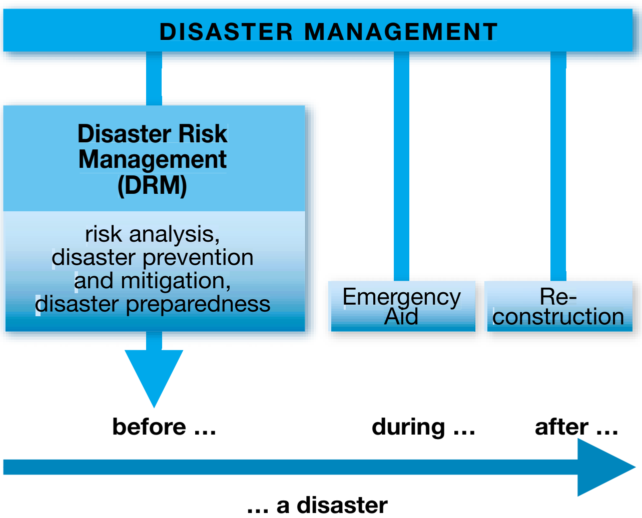
Extended impact chain:
torrential rain > floods > landslides, erosion, loss of soil fertility > diminished utility of soils > lower agricultural output > increasing poverty > clearing of new agricultural land which is often inappropriate for the location > inadequate land use > soil compacting > lower soil infiltration rate > greater surface water runoff during next torrential rain > more flooding > more landslides and erosion > etc.

4 Disaster risk management – concept, areas for action and components

4.1 Disaster risk management – concept and areas for action

Disaster management (DM) includes measures for **before** (prevention, preparedness, risk transfer), **during** (humanitarian aid, rehabilitation of the basic infrastructure, damage assessment) and **after** disaster (disaster response and reconstruction). Emergency aid is followed by longer term (development oriented) emergency aid, often summarised as disaster aid. Reconstruction measures form the third leg of disaster management, together with emergency aid and disaster risk management. Disaster **risk** management (DRM) in this context relates to reducing vulnerabilities as an area amenable to influence, and to developing risk transfer mechanisms.

Figure 6: **Disaster risk management as part of disaster management**



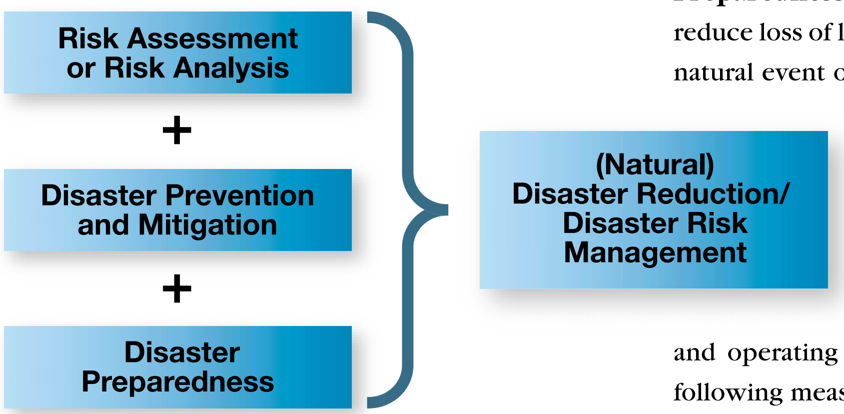
4.2 Disaster risk management (DRM) and its components

Disaster risk management (DRM) is part of disaster management, focusing on the *before* (risk analysis, prevention, preparedness) of the extreme natural event, and relating to the *during* and *after* of the disaster only through risk analysis. DRM is an instrument for reducing the risk of disaster primarily by reducing vulnerability, based on social agreements resulting from risk analysis.These social agreements are the result of a complex social process in which all social strata and interest groups participate.They are a necessary basis for resisting the future effects of extreme natural events (prevention, preparedness). The primary area of action of a DRM is reducing vulnerability and strengthening self-protection capabilities.

The DRM takes into account and links technical, social, political, socioeconomic, ecological and cultural

Figure 7: **Areas of action for disaster risk management**

(revised following "Working Concept Disaster Risk Management", GTZ)



aspects. This involves networking the various DRM components and the various aspects listed above to form an integrated system. This integration is what enables the DRM to reduce the risk to a level which a society can cope with. The components of the DRM are risk analysis, prevention and preparedness.

Risk analysis (RA) consists of hazard analysis and vulnerability analysis, together with analysis of protective capabilities. Some authors treat the analysis of the protective capabilities of the local population (coping strategies) as part of vulnerability analysis, others as a third component of RA, others see it as an additional chapter, and as such a component of risk assessment and not risk analysis. Here, the analysis of self-protection capabilities is treated as part of vulnerability analysis.

Disaster prevention includes those activities which prevent or reduce the negative effects of extreme natural events, primarily in the medium to long term. These include political, legal, administrative, planning and infrastructural measures.

The GTZ "Working Concept Disaster Risk Management" lists the following priorities:

1) Spatial and land use planning, urban development planning, building codes;
2) Sustainable resource management and river basin management;
3) Establishment of social organisational structures for preventive measures and to improve the response to extreme natural events (disaster risk management structures);
4) Training and upgrading for population and institutions;
5) Infrastructural improvements.

Preparedness for disasters is intended to avoid or reduce loss of life and damage to property if an extreme natural event occurs. The participating institutions and the population at hazard are prepared for the situation that might arise, and precautions are taken. In addition to increasing the alert level, mobilising the self-help resources of the population for the emergency and operating a monitoring system, this includes the following measures:

1) Participative formulation of emergency and evacuation plans;
2) Coordination and deployment planning;
3) Training and upgrading:
4) Infrastructural and logistical measures, such as emergency accommodation, etc and stockpiling food and drugs;
5) Establishing and/or strengthening local and national disaster protection structures and rescue services;
6) Disaster protection exercises;
7) Early warning systems.

Preparedness and prevention measures also include designing and implementing risk transfer concepts.

Figure 8: **Measures to reduce the risk of disaster, using flooding as an example**

	Hazard reduction	**Vulnerability reduction**
Prevention (to reduce risk)	spatial planning (e.g. to protect against landslides); settlement planning sustainable resource management; polders dams protective/containment walls drainage to reduce landslide impact; afforestation	spatial and settlement planning: sustainable agriculture; diversification of seed and economic activities; consciousness raising, training and advanced training, building codes; organisational promotion; dams integrate DR into sectors; risk transfer; insurance; promotion of local economy; drainage to preserve roads; information management; capacity building;
DRM **Preparedness** (residual risk)	DRM dam reinforcement and raising establishing flood protection brigades (e.g. logistical planning, etc)	DRM early warning systems; evacuation plans; organisation for emergency situations; training and upgrading for emergency situations; bridge building for evacuations

Explanation of figure 8:
The diagram is an attempt to assign the various measures for reducing disaster risk to the DRM categories of "prevention" and "preparedness" and to reducing hazard and vulnerability. The arrows pointing from preparation to prevention are meant to show that DRM can help strengthen prevention, which in turn reduces the burden on preparedness.

5 Risk analysis: concept, goal and products

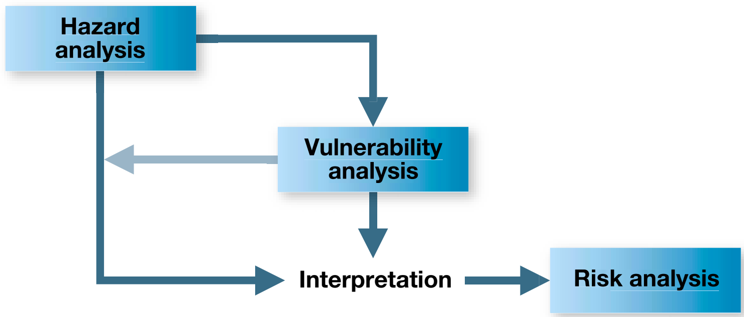
Risk analysis is based on the recognition that risk is the result of the link between hazard and vulnerability of elements affected by the hazard. The goal of risk analysis is to use this link to estimate and evaluate the possible **consequences and impacts** of extreme natural events on a population group and their basis for life. This involves impacts at the social, economic and environmental levels. Hazard and vulnerability analyses are parts of risk analysis, and are inseparable activities – vulnerability analysis is not possible without hazard analysis, and vice versa.

Once it is established that the people and bases for life potentially impacted by an extreme natural event are vulnerable to this, making the extreme natural event a hazard, risk analysis investigates the potential loss.

5.1 The concept of risk analysis

Besides nature as the cause of disasters, increasing attention is being paid to analysing the role of societies, their mode of production and living, and their development model as possible causes, and integrating the results of this analysis into the various protective strategies. In most parts of the world, disasters are no longer accepted simply as acts of god or nature. This means that vulnerability is increasingly understood as the result of economic and social development processes, which needs to be documented and reduced on the basis of comprehensive analysis. **Risk analysis** is a basic instrument of disaster risk management which is used to study the factors of disaster risk and provides the basis for planning and implementing measures to reduce risks and impacts of disasters.

Figur 9: **The concept of risk analysis**

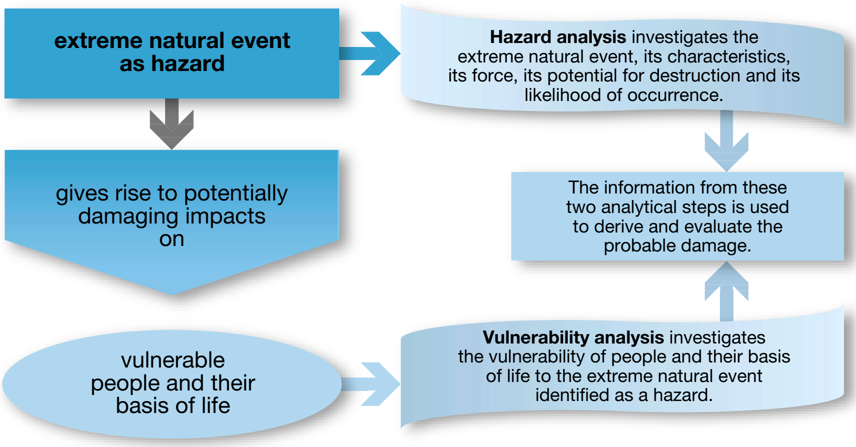


Hazard analysis

A hazard analysis investigates, identifies and documents natural hazards (drought, floods, landslides, earthquakes, etc.), their causes and impact chains. In hazard analysis, natural disasters (droughts, floods, landslides, earthquakes etc) and their causes and the resulting impact chains are identified, analysed and documented. Knowledge of the types of hazard is essential for analysing and assessing risks. The resources required for an analysis depend on the situation. A simple analysis with modest data input may be sufficient, or comprehensive investigations and elaborate studies may be required to document hazard potentials.

To be able to estimate and evaluate the degree of risk and the characteristics and scale of possible loss from extreme natural events, it is necessary not only to estimate the probability of occurrence but also to investigate the force and duration of the event. However, before this detailed study it is necessary to establish how far population groups and their bases for life are potentially affected by the event, i.e. how susceptible they are to the event and how vulnerable they are to this hazard. If there are no vulnerable populations or elements at the site of the hazard, no hazard analysis is required, as in this case the extreme natural event does not constitute a hazard. These are the first steps in vulnerability analysis, and they are needed before any detailed hazard analysis. Hazard analysis is not a linear sequence of analytical steps relating to the hazard: it is constantly being interrupted by steps in the vulnerability analysis, and supplemented by the learning loops and results generated by this. This leads to the procedure presented in figure 10.

Figure 10: **Assessment of impacts as the goal of risk analysis**



The most important tasks and steps in hazard analysis are:

1) The first stage in hazard analysis is to identify the types of hazards. There are many ways to classify hazard types, e.g. natural events occurring suddenly or gradually, of an atmospheric, seismic, geological, volcanic, biological and hydrological nature[7] while others summarise mass movements under the heading of "geomorphological hazards"[8]. In these guidelines, we use the classification shown in the box below.

Main hazard types

A. Meteorological causes and origins

a) Floods caused by torrential rain and tropical storms
b) Storms and torrential rain > damage caused by storms, e.g. damage caused by tropical storms, tornados and cyclones, hurricanes and tidal bores
c) Droughts have a particularly high damage potential if they cause extensive crop destruction and famine or forest/bush fires
d) Hail and frost, if they lead to extensive crop destruction; lightning
e) Mass movements (e.g. landslides as a result of heavy and intensive rainfall) caused among other things by 1) flooding in mountainous regions 2) heavy and intensive rain 3) rivers changing courses
f) Erosion, soil degradation caused by water and wind
g) Forest fires

B. Geological causes

h) Earthquakes and the secondary consequences such as tsunamis, tidal waves and mass movements
i) Volcanoes and the secondary consequences such as lava and mudflows
j) Mass movements caused by large-scale tectonic movements, slow mountain building and shifting. The resultant changes to the angles of slopes can cause mass movements

C. Other

k) Epidemics, animal and plant diseases and pests

2) Depending on the types of hazard identified, the process may need to be continued on a separate basis for each type of hazard or group of hazard types. Earthquakes, for example, require different instruments and specialisations for analysis than e.g. landslides or floods. The analytical methodology must be adapted for the hazard types and data available.
3) Identification and characterisation of hazard prone locations.
4) Identification and determination of the probabilities of occurrence on an ordinal scale (high – medium – low).
5) Estimate or calculate the scale (strength, magnitude) of the hazardous event, also on an ordinal scale.
6) Identify the factors influencing the hazards, e.g. climatic change[9], environmental destruction and resource degradation, major infrastructural facilities such as dams etc.

In the case of hydrometeorological hazards, there is a close connection between weather and floods. The weather determines the precipitation, which in turn determines the runoff of the waters. Floods are determined by the specific characteristics of the catchment area, and also by regional climatic factors. If these climatic factors change, the vegetation also changes, which modifies the runoff behaviour of the waters and ultimately the scale of flooding.

Hazard analysis describes and assesses the probability of occurrence of an extreme natural event at a specific place, at a specific time, and with a specific intensity and duration, for a vulnerable population and their vulnerable basis for life. It describes and evaluates the degree to which the population, animals, structures and goods would be at risk.[10]

Analysis of vulnerability[11] and self-protection capability

Vulnerability analysis studies the ability of a system (or element) to withstand, avoid, neutralise or absorb the impacts of hazardous natural events.

Before starting an analysis of the vulnerability of a population group and its bases for living, the extreme natural events and the locations they threaten must be identified and studied. Without extreme natural events as a hazard, there are no vulnerable elements, and hence no hazard. Conversely, without threatened locations with vulnerable elements, there is no risk, and hence no need for either hazard or vulnerability analysis.

The vulnerability of a group of people or region is inseparably linked to the social, cultural and economic processes developing there and the agricultural and ecological transformation of the region. Vulnerabilities are created, they are the product of social development or faulty development; they reflect deficits, shortages or disruptions within social development.

Vulnerability is assessed by the potential loss resulting from a natural event. It expresses the degree of possible loss or damage to an element threatened by a natural event of specific force. Damage can be to the population (life, health, wellbeing), material assets (buildings, infrastructure) or natural assets (woods, forest, agricultural land).

The most important tasks and steps in vulnerability analysis are:

1) Identification of potentially vulnerable individuals or elements (e.g. agricultural production, buildings, health, agricultural land and waters). In this, basic data is collected on population (age, density, gender, ethnic structure, socioeconomic status), location (buildings, important facilities such as schools, hospitals, emergency centres, environment, economy, structures, history), self-protection capability in terms of capacities for disaster preparedness – emergency response capability, training, prevention programme, early warning systems[12].
2) Identification and analysis of factors influencing or resulting in vulnerability = vulnerability factors for

[7] Guidelines "Katastrophenvorsorge und Ländliche Entwicklung", GTZ 2002 (draft)
[8] Zschau, J., A. N. Küppers (2003) "Early Warning Systems for Natural Disaster Reduction", Hans Kienholz "Early Warning Systems related to mountain hazards", p. 556.
[9] Climatic data studies for 1961–1990 in Switzerland, for example, showed a rise in temperature of just under one degree. Even if this period is too short for reliable interpretation of secular climatic changes, we can nevertheless expect a general warming with more extremely hot days and fewer extremely cold days. This warming reinforces the hydrological cycle, and various models indicate more intensive rainfall and more extreme events involving rain. The German Federal Government's Council of Scientific Advisers on Climate (1996) expects a rise in sea level in German coastal regions of c. 1 m by the end of the century, caused by global climate change. Worldwide, c. 15% of the world population is threatened by a rise in sea level. However, overall the increase in strength and frequency of extreme events is seen as more serious.
[10] Hazard analysis is defined as follows in ISDR's "Living with Risk": "Identification, studies and monitoring of any hazard to determine its potential, origin, characteristics and behaviour".
[11] Vulnerability or susceptibility is understood here as possible damage or loss from the occurrence of an extreme event. Damage, on the other hand, is something actually suffered.
[12] Modified classification from Pearce, Laurence Dominique Renée (2000), "An Integrated Approach for Community Hazard, Impact, Risk and Vulnerability Analysis", HIRV, University of British Columbia, Vancouver.

each hazard type. Analysis of risk perception and the factors determining this (e.g. education, access to information, poverty) and investigation of the vulnerability factors and their linkage and interdependencies.

- **Physical vulnerability factors:** location, technical construction type and quality of the settlements and buildings, population growth and density.
- **Social factors:** education, legal reliability, human rights, participation of civil society, social organisations and institutions, legal framework, statutes, politics, corruption, gender aspects, minorities, dependent population (old, young, sick), traditional knowledge systems, power structures, access to information and social networks.
- **Economic factors:** socioeconomic status, poverty, food insecurity, lack of diversity of seed and economic activities (e.g. monoculture in agriculture), lack of access to basic infrastructure (water, energy, health, transport), lack of reserves and financing.
- **Environmental factors:** arable soil, usable water, vegetation, biodiversity, land under forest (logging, land degradation), stability of the ecosystems.

3) Development and identification of indicators for identifying vulnerabilities and estimating the degree of vulnerability (quality and location of buildings and basic infrastructure, education, access to information, diversity of agriculture and seed, preventive infrastructure etc).

4) Analysis of self-protection capabilities: identification of indicators to show or measure capacity for preparedness (protective and preventive infrastructure, early warning and forecasting systems, etc). Here, strategies and measures are identified and investigated at the various levels (family, village, community, district, province, country). The following indicators provide information on the existence or degree of strength of coping strategies:

- monitoring and early warning systems
- traditional forecasting and early warning systems
- plans for disaster reduction
- plans and fund for disaster protection
- insurance policies
- construction standards
- maintenance of basic infrastructure
- preventive structures, protective infrastructure
- land use planning, spatial planning, zoning
- organisation and communication (emergency committees)
- stability of settlement, social structures
- local knowledge (of hazards)

5) Estimate of accepted risk (risk level) and hence residual risk. Preventive measures are taken to reduce the risk to a socially and culturally accepted risk.

Examples of vulnerability factors

Economic factors force poor population groups to settle at threatened locations (steep slopes, flood areas), mostly on the edge of major cities. Others settle close to volcanoes because of the fertile soil. Besides location as a risk factor, poverty and the lack of diversification of income are vulnerability factors. • A well informed and organised population (**social factors**) is less vulnerable to extreme events than a poorly organised one. • **Political factors** which make a society more vulnerable include lack of disaster protection, corruption, lack of participation of civil society in (spatial planning) decisions. • Examples of **environmental factors** which result in increased vulnerability are logging and overgrazing on steep slopes or destroyed water catchment areas.

Risk analysis as a combination of the two analytical stages

Risk is understood here as the expected value of the loss of human life or damage to objects, infrastructure and the environment. Determining the disaster risk as a result of the risk analysis is analytically based on documenting and assessing the hazard, followed by valuation of the vulnerability of a population or region to this hazard. In determining the overall risk, all the elements at risk (e.g. population, property, infrastructure, economic activities, etc) are taken into account with their specific vulnerability.

Risk analysis involves estimating damage, loss and consequences arising out of one or more disaster scenarios. It attempts to estimate the probability and magnitude of damage and loss caused by extreme natural events. Its results are conventionally presented in risk maps created manually or using geographical information systems (GIS).

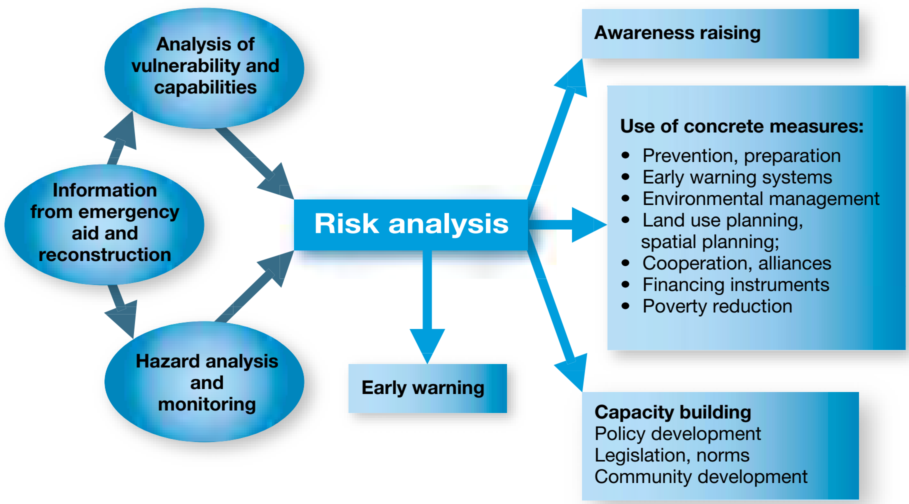
As already indicated at the beginning of this section, the two analytical stages are not separate procedures, but rather interactive steps. At theend we get the products described in the next section – risk maps, scenarios, forecasts, risk assessment tables, etc.

5.2 Goal and products of risk analysis

Risk analysis consists of hazard analysis and vulnerability analysis, together with analysis of self-protection capabilities. This also takes into account knowledge from prior emergency aid measures.

Risk analysis is not a static one-time process, but rather a dynamic process which is constantly adjusting to changing vulnerabilities, hazards and risks.

Figure 11: **"Inputs" and "outputs" in risk analysis**



The goal of risk analysis:

- To identify participative possible hazards and vulnerabilities of population groups to natural events, to analyse these and to estimate and assess both the probability of occurrence and the possible potential damage of such natural events; to identify and study possible weaknesses and gaps in existing protective and adaptive strategies.
- To formulate realistic recommendations for measures to overcome weaknesses and reduce the identified and assessed disaster risks, and to agree these with those affected. It is particularly important here to identify and improve existing capacities as well as protective strategies.
- To ensure and enhance the feasibility, effect and efficiency of protective measures by working from the risk analysis to a) balance the various interests, b) consider the reasonability of measures and c) make possible social agreements on strategies and measures to reduce disaster risks.
- To contribute to meeting the recommendations of the "World Conference on Natural Disaster Reduction" (Yokahama, 1994) and realising the goals of Agenda 21. In the latter, the following sections are specifically addressed: section 7 "Promoting sustainable human settlement development", Programme Area F; section 13, "Managing frail ecosystems: sustainable mountain development", Programme Areas A and B; section 17 "Protection of the oceans, all kinds of seas, ..." Programme Areas A and G.

Risk analysis is also expected to contribute to the following:

- Other planning, and specifically spatial and land use planning.This makes it possible to take into account the risks of natural hazards in land use and other activities with spatial impact, including development and zoning plans of communities, agencies and specialist institutions which are formulated using the information from risk analysis and whose implementation contributes to reducing disaster risks.
- Planning for emergency aid measures, by making it possible to create the conditions for sustainable reconstruction work and development measures.
- Efforts to improve coordination and linkage between the various components of DEA and with TC.
- Efforts to integrate DRM into the various areas of development.

Expected products of risk analysis

In the context of risk analysis, highly advanced technologies for remote sensing and geographical information systems (GIS) have in recent years led to the development and improvement of numerous instruments and methods for hazard mapping and analysing the physical aspects of vulnerability. By contrast, the integration of social, economic and environmental variables into GIS models, risk maps and risk analysis generally still remains a challenge.

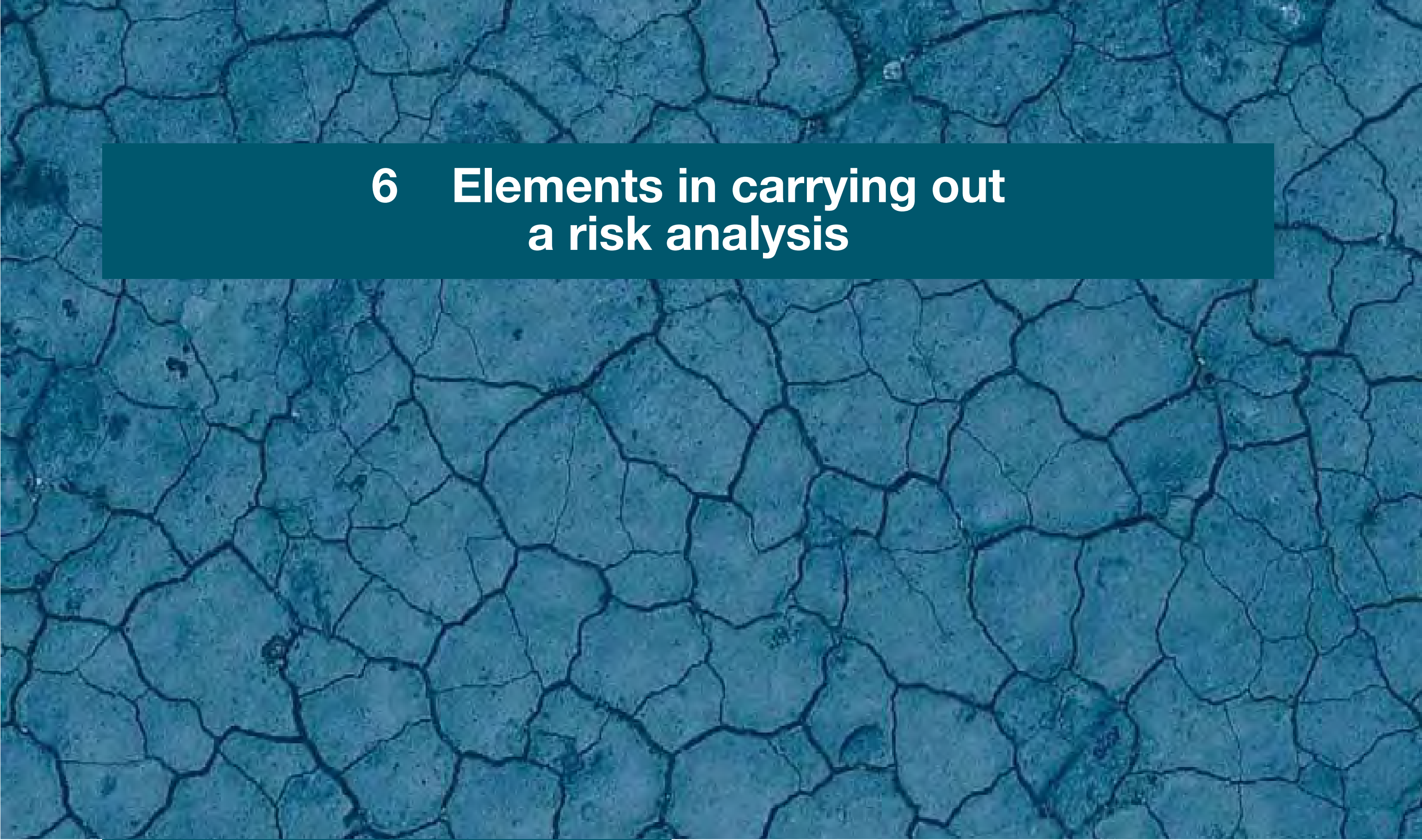
The products most frequently created in risk analyses include hazard maps and so-called risk maps. Different authors and regions use different names for risk or hazard maps. They also have different levels of data accuracy, and can be subdivided into three categories:

- Hazard maps: these are maps which give qualitative and quantitative information on natural hazards, e.g. by presenting the expected danger or maximum level of danger or the event, e.g. slopes at risk from landslides.
- Risk zone maps: these provide information on the probability of occurrence (in the case of earthquakes, the contain the building standards needed for disaster reduction). They are generally the result or product of a hazard analysis.
- Risk maps are risk zone maps which also contain quantitative information on the risk and the impacts on people, property, environment, etc. Typically, they take into account the physical aspects of vulnerability, but not the social, economic and political aspects.

Other products:

- Information from various analytical methods and techniques (e.g. "Livelihood analyses", FEMA) and simulation models (e.g. NAXOS, SWAT, USLE) is presented in text and diagrams. Generally, this information is allocated to either the hazard or vulnerability analysis or both. References on the methods and models cited are contained in the appendices to these guidelines, available from the sector project "Disaster Risk Management in Development Cooperation".
- Assessment tables and risk assessment matrix.

6 Elements in carrying out a risk analysis



6.1 Criteria for determining the methods and instruments in applying risk analysis

In carrying out a risk analysis and determining the methods and techniques to be used in this, certain *conditions* must be met and the following *criteria* must be taken into account.

Before carrying out a RA, the following questions should be explored or settled.

- Is there the political commitment to DRM? Are preventive measures politically acknowledged? Or do emergency aid measures do more for the institutional image and political career?
- Is there financing for implementing the measures derived from the risk analysis.
- Does a cost-benefit assessment indicate a positive social benefit? Or is RA more expensive than possible damage from a natural event?
- Is the starting point an emergency aid measure, are there follow-up measures (DEA,TC)?
- Is there an institutional and statutory basis for DRM and RA? Are there developing and/or poverty reduction strategies which take into account disaster risks?
- Is the affected population motivated and interested in self-help?

1) The existence of **political commitment** to active DRM is an absolute prerequisite. Just as important is the existence of defined institutional responsibilities for disaster reduction and disaster response. The political framework should permit democratic consultation processes and cooperation between and with institutions.
2) There must be a realistic chance that the **results of the RA** can be implemented and applied, i.e. there must be resources available or capable of mobilisation. The results must be taken into account e.g. in spatial and land use planning.
3) **Cultural acceptability** of the innovations (e.g. methods and techniques) must be taken into account in the interests of project sustainability. In addition, promotion of self-organisation by the affected population and consideration of traditional and local knowledge are of fundamental importance for sustainability.
4) Besides the problems already referred to in the transition from emergency aid to normal TC, there is often a further difficulty in the fact that experience shows that the emergency aid instruments used (aid shipments, food aid) often hinder **"ownership" and personal initiative** among those affected. However, both of these are basic elements of TC, which primarily works with participative analysis and planning instruments. To deal with this problem, a dual

strategy should be pursued during emergency aid which combines aid contributions with promotion of "ownership" and personal initiative.

5) Experience in DC has shown that it is easier to reach a consensus between technicians, politicians and the local population if highly visible protective measures are involved (which are often expensive and do not always do much for disaster reduction) than if less spectacular but possibly more effective measures are involved. One example of this is ineffective protective walls against landslides instead of adequate water management in uplying regions. This is a question not only of **different interests** but also of **different perceptions** of hazards. To achieve optimal solutions in consensus with all participants, measures such as transparent information management, disclosure and discussion of the various interests and clarification of the various roles are important and useful.
6) Risk analyses can be applied at **various levels and in different contexts**. When deciding on the approach, it is necessary first to investigate or clarify a) whether the aim is to reduce disaster risk at local, regional or national level, and b) whether the product is intended for a community (implementation), technical agency (research, analysis), financial institution (cost-benefit analyses, profitability) or insurance company (tariffs). The comments in the present guidelines focus on the local level for strengthening local structures, and are oriented towards implementation.
7) Even with experienced planners and specialists, there is still a tendency apparent to give too much emphasis to **inputs for data collection** and analysis, leaving too little time and resources for evaluation of data and formulation of solidly-based planning statements, and particularly for their agreement with actors and subsequent implementation. Often, vast quantities of data are collected which cannot be used later or have to be aggregated after being collected in too much detail, and which cannot be used to derive any direct statements for planning. It is accordingly important to clearly define and agree the concrete goals for the risk analysis and the data required.

Based on analysis of these questions and criteria, the methods and instruments for the risk analysis must be identified, modified or developed.

Because the data available differs very widely in quantity and quality in the various countries and project locations, methods always have to be adapted.

Participative approach

German TC has extensive and varied experience with participative approaches and the use of participative instruments for analysis and planning. These participative instruments are mostly based on the RRA[13]/PRA[14] approaches and further developments of these methods. RRA is a sociological approach developed in DC at the start of the 80s in which a multidisciplinary team uses nonstandardised simple methods and incorporates the knowledge of the local population in order to rapidly collect, analyse and evaluate information about rural life and rural resources which is relevant for action. PRA methods are indicated if it is a question of a rapid, action-oriented assessment of local knowledge, needs and potentials. PRA stresses a proactive role in problem analysis and planning for those affected, with outsiders playing the role of "facilitators". Today, the emphasis in these approaches is on "participatory", while "rapid" is less important. PRA as an internationally established term and concept is understand here in the sense of "participatory appraisal", with the emphasis shifted from "analysis" and "rural" to *planning* and active *problem solving*, both in a rural context and elsewhere.

The basis for the increased importance of participative instruments and thinking, which has set the tone in many projects, is the acknowledgment that the conventional (top-down) planning approaches have produced little success, despite high costs. The participatory approach is tied to the goal of enhancing the planning competence, autonomy and organisational capacity of previously disadvantaged (target) groups, and to integrating excluded and marginalised groups. A central aspect of applying participative planning methods is mutual learning on the part of those involved.

In developing countries, the weak public structures for disaster protection mean that people are particularly dependent on self-help. This gives rise to the challenge of meshing state-organised disaster protection with private aid organisations and self-help activities by the citizens. Disaster protection and prevention measures – where present at all – are mostly managed at

13 RRA = Rapid Rural Appraisal
14 PRA = Participatory Rural Appraisal

community level from remote head offices with external labour.

It goes without saying that risk analysis is carried out with the participation of the affected target groups and in cooperation with the responsible institutions and political decision-makers. The term “risk analysis” as used in the present guidelines has the underlying concept of **“participative risk analysis”** (P-RA).

Participative risk analysis is viewed here as a socio-technical method which takes into account sociocultural values, integrates subjective perceptions and sensitivities, helps evolve existing knowledge and potentials, builds capacity and promotes self-help. Wherever possible and expedient, it gives priority to participatory working methods and the use of participative instruments, and promotes access to information and knowledge for the affected population.

It is a process of negotiation between partners, which actively includes those affected in the solutions to problem and which practises teamwork. It supports the development of the social and institutional basis for successful disaster risk management.

6.2 Elements in implementation

In carrying out RA, the structures and elements shown in figure 12 are the basis:

Figure 12: **From risk analysis to DRM measures**

DISASTER RISK MANAGEMENT (DRM)

Risk analysis → **DRM measures**

Hazard analysis	**Vulnerability analysis**		**Disaster prevention and mitigation**	**Preparedness for disaster**
Geographical analysis: • Location • Extent **Temporal analysis:** • frequency • duration • probability of occurrence **Dimensional analysis:** • scale • intensity	**Identification of elements and people potentially at risk** **Identification of vulnerability factors and analysis of causes:** • physical • economic • social • environmental **Assessment of possible damage/loss**	**Analysis of self-protection capabilities** **Development of strategies and measures at different levels:** • family • village • community	**Planning measures** **Physical preventive measures** **Capacity building, creating institutional arrangements**	**Emergency plans** **Early warning systems** **Evacuation plans**