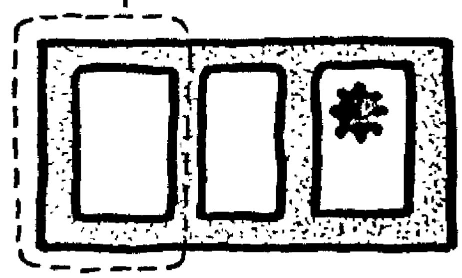
1 RISK ASSESSMENT

3: RISK ASSESSMENT



POLICY GUIDELINES

Five main policy guidelines are important for risk assessment. These will determine the way that risk assessment is approached, the personnel involved, the sequence of data collection programmes, and the links between the risk assessment and settlement planning.

* **National governments need to develop their risk assessment capability.**

  Therefore, it is necessary to set up research and development organisations, where these are not already established, to undertake all the necessary stages in risk assessment.

* **Data is necessary on hazard and disaster occurrence.**

  Therefore, collect information in a systematic manner on the frequency, magnitude and location of the relevant hazards.

* **Data is also necessary on vulnerability.**

  Therefore, collect information in a systematic manner on the vulnerability of communities, buildings and economic activities to the effects of natural hazards and disasters.

* **Prediction of future hazards and disasters is a key to effective mitigation planning.**

  Therefore, develop the predictive abilities of the research and development organisations responsible for risk assessment.

* **Risk assessment should not be undertaken in isolation from planning and decision-making.**

  Therefore, establish, maintain and develop links between the geo-scientists working in risk assessment organisations and the land use planning and other organisations, so that the results of risk assessment programmes can be useful and used.

RISK ASSESSMENT CAPABILITY: ESTABLISHING MULTIDISCIPLINARY TASK FORCES

For meaningful risk assessment, specialist multi-disciplinary task force groups are needed, to include geoscientists, engineers, planners, environmentalists, economists and sociologists/anthropologists. These groups need to identify hazardous land in and around centres of population and to make a detailed analysis of these hazard prone zones.

The task force groups should initially be organised (i.e. for 1 year) on an ad hoc basis, with their own funding, temporary staff and equipment. Full use of maps. aerial photographs, satellite images and statistical data of all settled land should be guaranteed without restriction.

In the **medium term** these ad hoc task force groups should be converted into more established forms of co-operation between the settlement planning teams, and the organisations responsible for geo-scientific and environmental assessments. The regional administration should play an important role in drafting regionally applicable policy guidelines within a national policy on disaster mitigation.

In the **longer term** a more regular form of co-operation between planning teams and Institutes responsible for geo-scientific and environmental studies should be institutionalised as a fully integrated section in settelement planning teams.

SEQUENCE OF DATA COLLECTION AND ANALYSIS

There are three basic stages in the sequence of risk assessment:

- **Definition of causes.** The causes of hazards and disasters must be established before other data is collected;

- **Assembling the historical record.** This data is the baseline for predicting future hazard and disaster events.

- **Predicting future hazards and vulnerability.** These predictions are the baseline for planning and decision-making for hazard mitigation.

Following these stages carefully and systematically should result in data useful to those making plans and taking decisions about hazard mitigation.

HAZARD DATA COLLECTION AND DATA MANAGEMENT

The rapid growth of settlements in hazard prone areas calls for careful studies of the environment, terrain configuration, and sub-soil conditions, particularly in the sub-urban zones.

It is therefore essential, to indicate clearly with which variables to describe the different aspects of environment, terrain configuration, and sub-soil conditions; the form in which they should be presented; the type and form of data needed, and how this information should be communicated to the various professions involved in its use (Table 3.1).

Table 3.1

Types of hazards and disasters discussed
in this Executive Summary and Manual

PRINCIPAL FLOOD HAZARDS

The main hazards, posed by floods, can be summarized as follows:

- Rain falling in the flood-susceptible areas and their immediate surroundings;
- Heavy rains and/or snowmelt in the upper catchment;
- Incursions of sea water along exposed coasts and particularly where an important tidal range exists and strong on-shore winds occur.

The main parameters for flood assessment include:

- Location and size of flood plain areas;
- Meteorological data on rainfall amounts and intensities
- Hydrological data on magnitude and frequency of floods;
- Hydraulic data on flood flows.

PRINCIPAL EARTHQUAKE HAZARDS

Earthquake damage may be caused by various types of earthquake:

- Ground shaking of different severities;
- Differential ground settlement; soil liquifaction;
- Land and mudslides, ground lurching and avalanches,
- Ground displacements along faults;
- Flood from dam failure, tsunamis and seiches;
- Fires resulting from earthquakes;
- Pollution from chemical and similar plants resulting from damage of plants due to earthquakes.

The other earthquake hazards are related to water, fire and pollution, as a secondary effect of the above mentioned primary earthquake hazards. Secondary effects sometimes could be of much larger scale than those caused by ground shaking and soil instabilities.

The main parameters for earthquake hazard assessment include:

- Location and size of known hazard zones;
- The number and magnitude of earthquakes experienced in each zone;
- The geological, geomorphological and hydrological characteristics of each zone;
- Threshold magnitudes;
- The correlation between seizmic intensity and distance;
- Tectonic maps;
- Peak ground acceleration data.

Table 3.1 continued

PRINCIPAL HAZARDS FROM HIGH WINDS

The main causes include:

- Tropical cyclones;
- Tornadoes;
- Thunderstorms;

The main parameters for assessment include;

- Wind speed records;
- wind direction data;
- Associated pressure conditions and rainfall.

PRINCIPAL LANDSLIDING HAZARDS

The basic causes of slope instability include:

- Those inherent in the rock or soil, in its composition or structure;
- Those, like inclination of undisturbed slopes, that are relatively constant;
- Those that are variable, such as groundwater levels;
- Those which are transient (seismic vibration) and some are imposed by new events, such as construction activity
- Those landslides which are triggered by rainfall or earthquakes (or both).

The basic parameters for landslide assessment include:

- Geological data (lithology);
- Geomorphological data (slope angles, etc);
- Hydrological data (especially groundwater);
- Seismicity.

Type and form of data

The complexity and interdisciplinary character of urban planning and implementation require clear concepts. A key question is which maps, data, and decision-making tools are required for the various project phases and sub-phases in order to implement plans at regional and local level in accordance with timing and budgets fixed in development plans.

Apart from different types of geo-scientific data, different forms of land use, socio-economic and demographic data will also be required at the various stages of decision making, planning and implementation. The form of information, including the level of accuracy, speed of data collection required and the scale, all need to be in line with the requirements of each project phase.

Sources of information

Many sources of hazard information exist. Aerial photographs and satellite images, intensively used by geo-scientists but still much less by planners, are a very useful source of information. They reduce the cost and time of geo-scientific assessments since a rational and cost-effective programme can be devised for minimal field research, drillings, and/or geo-physical measurements.

However, this data is of only marginal use for information dissemination to and communication with the prime users of numerical information: economists, sociologists, administrators, and other groups involved in decision making. Therefore spatial and statistical data need to be combined.

The combination of remote sensing techniques (aerial photographs and satellite images) and microcomputers can, if fully integrated in the whole assessment and planning team, improve information dissemination and communication between the various professionals involved in both planning and economic evaluation.

This facility will enable the teams to propose alternative plans, with different scenarios, as a basis for socio-economic and political decision making provided that uniform data collection and mapping techniques are applied.

Creation of data banks

Disasters should be viewed as a problem of economic development and that, as with all such problems, they should be resolved in a systematic manner by concerted action beginning at the level of national data collection.

Therefore data banks on disaster-related topics should be established at local, as well as at regional and national level. The data should be assembled in a uniform way, including all location and severity data, and data regarding the expected hazard return periods. They should also include land use, socio-economic and cultural data of all elements at risk in the hazard prone land.

The data for the data bank should be collected and analysed in such a manner that economic evaluations can be made for the various scenarios as a basis for plan formulation and decision making.

Information dissemination and communication

Communication of information between experts in different disciplines often causes immense problems. The most commonly practised form of information dissemination and communication between geoscientists, environmentalists and settlement planners, occurs when the engineer requests specific maps and data from these disciplines.

The problem of communication between the geoscientist and the environmental planner on the one hand, and the land use planner, on the other, should not be ignored. It gradually increases with the increasing and more complex role of the environmental sciences in urban development.

Bringing the geoscientist, environmentalist and land use planner more closely together at an early stage of settelement development planning and disaster mitigation should therefore be encouraged and actively stimulated. This is the pre-planning phase, prior to socio-economic and political decision-making on future settlement extensions and improvements. It is best pursued as a learning process using the task force approach.

Presentation of data

The form and content of geoscientific and environmental assessments for settled land, and particularly the manner of presentation, should be appropriate to the needs and capabilities of the user.

Virtually all natural phenomena liable to cause disasters share one common feature. This is that although it may not be possible at the present stage of scientific knowledge to forecast ***when*** they are going to happen, it is often possible to predict with a reasonable accuracy ***where*** they are likely to occur, for example in flood plains, seismic areas or slopes liable to landslides.

Hazard maps are therefore basic to both risk assessment and data presentation and communication between professionals. A hazard zoning map is a means of the presenting hazard levels together with the probable associated intensity of magnitude of each hazard zone. The map consists of a series of defined areas of particular magnitude or risk level. Besides dividing the area to be studied into zones, having different hazard probabilities, the map may provide other relevant data such as the extent of damage where the hazard occurs, hazard duration, erosion, sedimentation etc.

Other products of risk assessment should be directly applicable to decisive action concerning practical preventive or corrective measures, land use planning, proposed construction, legislation, insurance or whatever purpose is involved. These actual needs must be determined, and the less that intermediate interpretation of the scientific results is required, the more direct and effective the results will be.

This does not mean that the final product should only consist of a greatly simplified presentations, readily grasped by the layman, but the data presented should be sufficiently user-orientated.

LOSS ASSESSMENT AND VULNERABILITY ANALYSIS

In effective risk assessment, hazard assessment - and associated mapping - is followed by vulnerability analysis to determine the communities, buildings and economic activities that are at risk from natural disasters.

Vulnerability analysis Vulnerability analysis is basically an inventory and analysis of elements at risk, including all relevent socio-economic and cultural data in the area identified as hazardous Based on hazard assessment and the identification of hazard zones, the vulnerability analysis is intended to examine and evaluate risk, and to estimate the level of acceptable risks in connection with socio-economic conditions and political interests.

For existing situations, the risk is probably stable. But vulnerability analysis and risk assessment in existing situations is only half way to solving the problem. Proposals for improvement are necessary. Otherwise only the status quo is given to decision makers, which is probably already known, or expected.

For new developments, the risk aspect is flexible. Changes in land use can be combined with improvement of the existing conditions. Then an analysis can be made in respect to economic benefit and safety level.

Vulnerability analysis is not a purely technical matter. It is a multidisciplinary problem involving socio-economic and even political judgement because disasters affect not only the physical environment, but the whole social and ecological system, political structures and economic activities.

The level of acceptable risk can determine the policy for reduction of the hazard, integrated into the general development planning processes. Such a policy would estimate the technological and economic capacity to absorb the difference between "high risk" and "optimum risk" in relation to the costs of risk reduction It would establish a body for inspection and control, and it would set up criteria for risk evaluation and for estimating acceptable risk levels.

Risk and loss assessment — Risk assessment means the integrated analysis of the risk of a hazardous system of activity and their significance in an appropriate context. It incorporates risk estimation and risk evaluation. Risk assessment can be made on the basis of both empirical and theoretical data. Full inventories (i.e. by structural type and presented by number and floor area) are needed for risk assessement calculations. Loss assessements can be made, based upon empirical data in the field, after a disaster has occurred.

In order to reduce costs and time for these risk and loss inventories, existing statistical and spatial technical data banks from various government bodies should be used. Only those data which are needed in addition to available data should be collected, either in the field or through remote sensing techniques.

These new data should be incorporated in the total "knowledge-bank" of the government, for balanced decision making for settlement and planning, thereby including the reduction of risks as one of the elements in comprehensive development.

The reliability of risk assessments is closely related to the quality and quantity of the existing data, such as available geological, hydrological and land use data, maps, aerial photographs, satellite images and statistical data.

RESULTS AND OUTPUTS

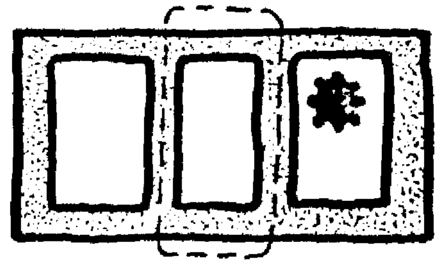
One of the most important results of an efficiently managed risk assessement programme will be the continuing development of organisations, Institutes or a team of professionals with the capability to undertake risk assessments. This should be coupled with an active research and development programme to contine to develop skills and expertise in this areas.

A continuing record will also be established of hazards and disasters that have occured in the past. What also will result is an increasing predictive capability by the relevant experts that will help to forecast the location and severity of hazard events in the future.

In addition the hazard assessment programmes undertaken by these organisations and teams will produce maps and other data, for planners and decision-makers, which define hazard risk zones. Vulnerability data and maps will also define the populations and buildings at risk in these zones, and the economic activities that could suffer from future hazards and disasters. This data then forms the baseline from which planning and decision-making can begin.

2 PLANNING AND DECISION MAKING

4. PLANNING AND DECISION-MAKING



THE NEED FOR A SYSTEMATIC APPROACH

Countries, regions and communities need to respond as systematically as possible to the natural disasters that they face. If they do not do this, their scarce resources will be wasted, and their communities will face unnecessary loss of both life and property.

The need to indentify **plans** to mitigate disasters follows directly on from the accurate **assessment of risks**: that assessment indicates the scale of planned response that is necessary. Planning then leads to the adoption and implementation of **measures and strategies** to reduce these risks, or to reduce the vulnerability of communities to the damage and loss of life that would otherwise occur.

However, even if risks cannot be assessed accurately, and reliance has to be put on intuitive risk assessments based perhaps only on local anecdotal knowledge, a systematic and planned response is nevertheless still more efficient than "crisis response" following disasters.

Care has to be taken, however, not to 'over-plan': over-preparedness is expensive and may mean that disaster mitigation itself is subsequently discredited when disasters do not occur. Planning and decision-making is not a mechanistic science but involves judgement requiring skills in many disciplines, rather than the simple application of rule-books.

Three issues are important: first, **policy guidelines and strategies**,, second, **planning and decision-making techniques**, and, thirdly, **expected outputs**.

POLICY GUIDELINES

Disaster mitigation involves complex decisions, not least because it is concerned with events that may have a low probability of occurrence. Investment in disaster mitigation may also be expensive. Therefore it is necessary to consider carefully the efficiency with which these scarce resources are used.

A number of decision-making techniques can assist this choice of disaster mitigation policies, plans and projects. These techniques are founded on a number of policy guidelines, including the following:

* **Efficient allocation of resources.** Expenditure on disaster mitigation means that other uses of the scarce resources cannot be made: the opportunity for other expenditure must be forgone.

The economic health of the country in question is affected by decisions concerning disaster mitigation.

Therefore, the efficiency of expenditure on disaster mitigation must be maximised, and the resources allocated to disaster mitigation should be valued at their 'opportunity cost' (the value to society of the next best alternative use of those resources).

* **Comprehensive planning and decision-making**. Decision-making for disaster mitigation can easily be dominated by short-term considerations, especially immediately after a disaster or the threat of a disaster which will create a 'window of opportunity'. However, policies, plans and projects developed in this way without due care are liable to be ineffective or inefficient, and to have unintended consequences.

  Therefore, decision-making for disaster mitigation should be as comprehensive as possible, and review a range of alternative strategies against clear criteria (such as economic efficiency, or social equity) so that objectives are met and the performance is evaluated to ensure the spread and continuation of best practices.

* **Planning and decision making is a continuous process**. It is not something that is only undertaken occasionally, when it appears necessary, or by particular agencies which have 'planning' in their titles Disaster mitigation planning should occur in virtually all agencies, all of the time, at a level proportionate to the risks being faced.

  Therefore adoption of more systematic approaches can be initiated at any stage and not just with the definition of a new problem or the occurrence of a disaster: it is advisable not to wait until everything is in place before beginning the disaster mitigation planning process.

Adopting these policy guidelines means that a wider range of appraisal is necessary than is often used in evaluating disaster mitigation plans. This wider range is reflected, first, in the decision making techniques discussed below. It is also reflected, secondly, in the appraisal framework discussed in the section of this Executive Summary on the role of government, which demonstrates the need for careful analysis of both government policies and disaster mitigation projects (page XX).

PLANNING: A MULTI-LEVEL APPROACH

Planning should take place at all levels of government and the community. Particularly important are the following levels:

National master plan.	Where the scale of disasters facing a country warrants a national approach, a national master plan will give a framework within which

	regional and local community planning can take place;
Regional planning.	A regional approach is necessary to ensure that all sectors are taken into account when making decisions and when allocating disaster mitigation resources. It should also ensure that local communities work together to maximise the effectiveness of safety measures, especially when coordinated action covering whole river catchments or other large geographical areas is necessary.
Community-level planning.	The community needs to harness its limited resources in the most efficient way, with a systematic or planned approach to using its energies to the maximum effect. Such community plans need not be written statements, but should be the subject of community debate and agreement on a chosen plan of action 'on the ground'.

A national-level organisation with disaster mitigation responsibilities should monitor the activities of other planning organisations at lower levels of government.

DECISION-MAKING STRATEGIES AND TECHNIQUES

Decision-making

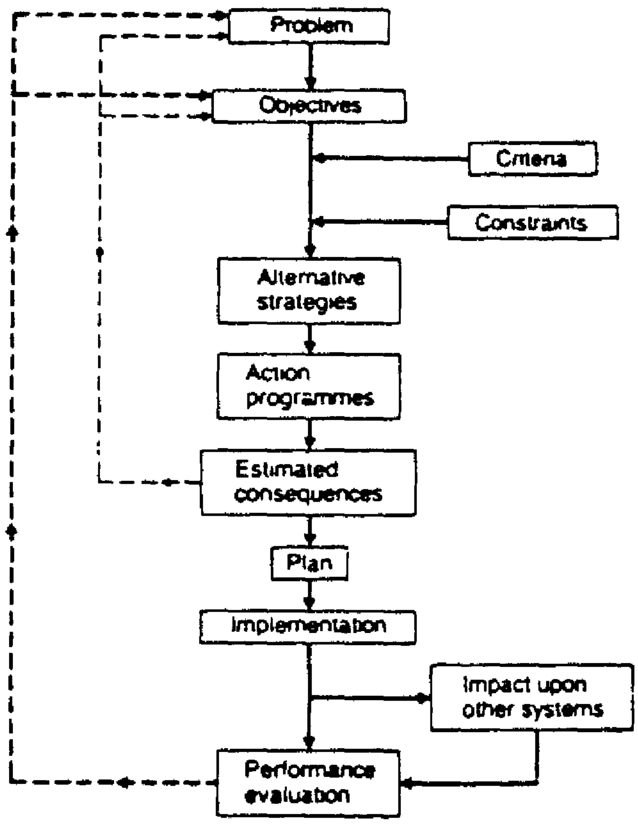
A number of ideas about systematic decision-making exist but it is generally recognised that decisions should be made in a logical sequence rather than in a random or disjointed manner.

This logical sequence is characterised in Figure 1, which shows that a number of steps are required between the definition of the problem - the risk assessment - and its solution. Implementation is followed by the analysis of the performance of the measures adopted, so that lessons learnt are reflected in future decisions:

Problem	This is a risk assessed as being serious enough to warrant concerted action to protect vulnerable property and lives. This information arises out of an efficiently executed risk assessment programme, as discussed

Figure 4.1

Systematic decision making (from Mitchell, 1971)



in the previous Section of this Executive Summary. It takes the form of maps, data and other information on hazards and on vulnerable communities, buildings and economic activties.

Goals/objectives	Goals set standards of disaster mitigation, in the form of levels of protection, such as the number of buildings or people protected within a given time scale, or at a certain overall cost.
Criteria	Criteria are 'benchmarks' against which decisions are made, and are set in relation to the problem identified and the objectives set. They can include technical, economic, political and other criteria and they need to be ranked in order of importance. Economic criteria might include prescribed levels of cost-effectiveness, or the relation between benefits and costs, or simply cost limits. Technical criteria might include a specified design life, a certain given standard of safety, while social/cultural criteria might involve protecting certain heritage sites, cultural monuments, or particular minority communities, or equity of treatment for all people affected.
Alternative strategies	A range of strategies must be evaluated against the criteria adopted, to determine which most easily or successfully meets the objectives set in relation to that criteria. Thus structural solutions should be compared with non-structural alternatives, and short term solutions compared with longer term investment. The range of choice of alternatives should be wide enough to encompass all policies, plans and projects that are technically, economically,

	politically and environmentally feasible.
Plan	The plan adopted will be a strategy (or a number of strategies) to be implemented in a given timescale at a given cost. It should be an agreed statement or understanding of how the goals and objectives are to be met, perhaps as a series of projects, and include arrangements for plan implementation.
Implementation	This involves putting the plan into action, through the investment of resources in completing projects designed to meet the objectives as outlined in the plan.
Performance evaluation	The performance of the projects that constitute the plan should be evaluated in a systematic manner to determine the extent to which the objectives are met and the problem solved. Performance evaluation should begin at the initiation of implementation, so that correctives can be applied to the projects and plan at an early stage if feedback indicates that alternative decisions would better meet the objectives that have been set The real test of performance of mitigation measures will come when disaster next strikes, but planners and government should not wait for this disaster event but should be continually monitoring the efficiency of mitigation measures ahead of that disaster occurrance

The 'ideal' decision making sequence above is not always achievable.

In reality, planning and decision-making is a continuous process and the adoption of more systematic approaches can be initiated at any stage and not just with the definition of a new problem or the occurrence of a disaster. Thus, the evaluation of past disaster mitigation strategies or projects may indicate better strategies, or the emergence of new criteria can create alternative objectives.

Furthermore, as stressed throughout this Summary and the accompanying Manual, decisions cannot be separated from their economic and political context. Therefore the 'ideal' decision-making sequence in Figure 1 has been modified, and made more complex, to give the situation shown in Figure 2. Here the decision-making sequence begins with any catalyst (not just a disaster) and is distorted by national economic influences, sectional interests, post-rationalisation of decisions already made, and lack of adequate technical inputs including risk and vulnerability data.

Nevertheless, adopting the systematic steps involved in good decision making and shown in Figure 1 should be the ***aim*** of all concerned with disaster mitigation, so that the objectives in terms of vulnerability reduction can be achieved in the most efficient manner possible.

Economic appraisal techniques

Efficient allocation of a disaster-prone nation's scarce resources is assisted if projects and policies are subject to some form of economic analysis to determine whether the investment in the proposed policies, plans and projects would yield a higher return to the nation or the community if spent in some other way. In this respect it should not be forgotten that disaster mitigation is both expensive and risky.

Many techniques have been devised to quantify the worthwhileness of this type of expenditure. These techniques, however, have many problems and unthinking application of, for example, benefit-cost analysis will lead to considerable problems, not least when attempting to evaluate loss of life. Nevetheless ***some*** form of comparison of the costs of disaster mitigation with the outcomes of that investment should begin to suggest that decision-makers ask whether that expenditure is useful, worthwhile or the best use of those scarce resources.

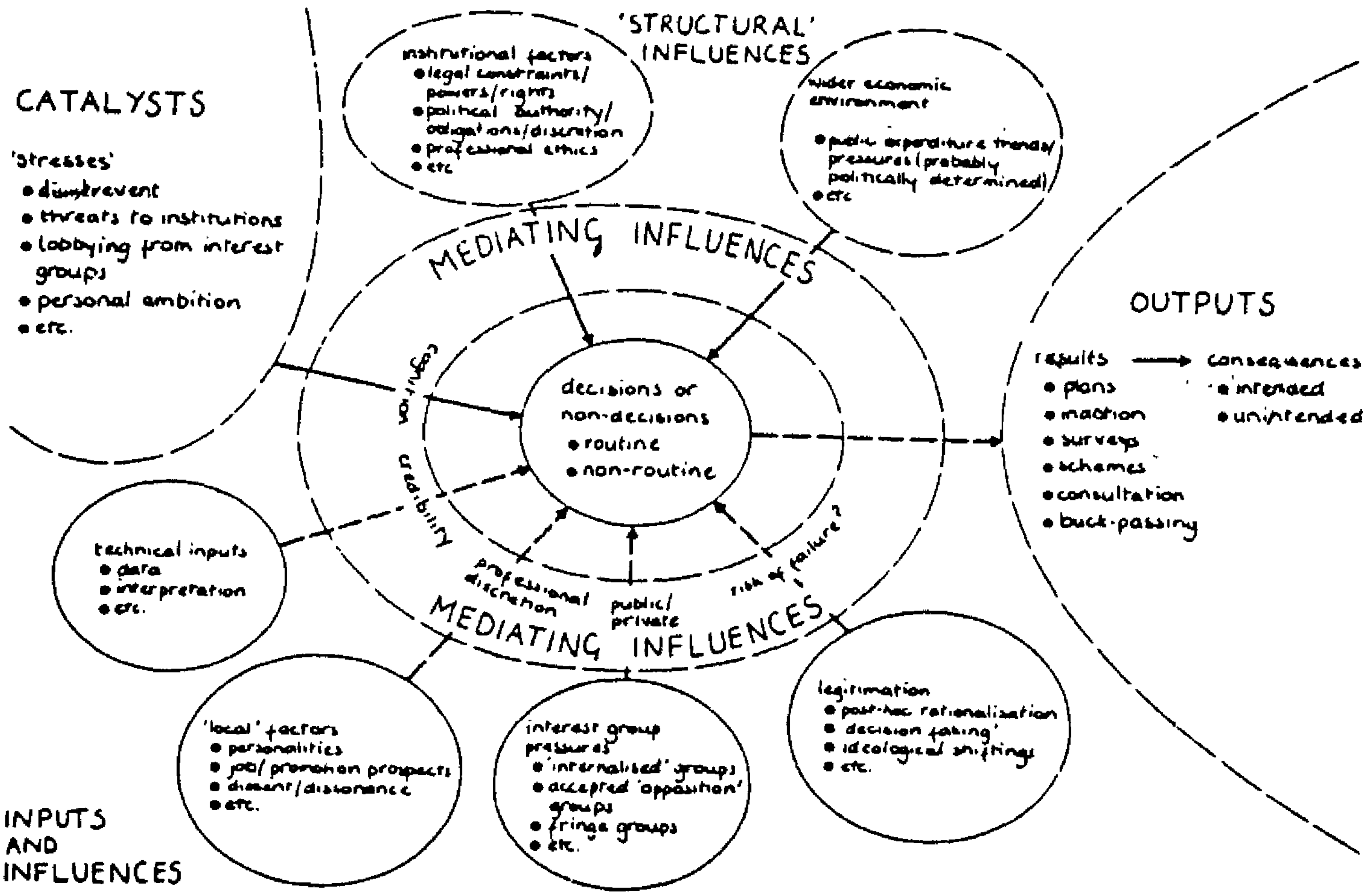
Many different approaches are available, and the techniques chosen will vary with the perspective of the user and the degree of sophistication possible in the particular circumstances. In addition to financial appraisal, which judges the returns to those investing in disaster mitigation, there is a range of economic analysis methods. Two basic alternatives are as follows:

- Cost effectiveness analysis — This attempts to produce the most effective solution to a particular problem at a given, set, cost. It relegates economic efficiency to a second order of importance, in relation to technical or other considerations. The approach is also often used where many of the benefits of investment are 'intangible' and therefore cannot be quantified in any comprehensive benefit-cost analysis.

  Cost effectiveness analysis of disaster mitigation plans and projects would ***assess the lowest***

Figure 4.2

Decision making in a political context
(from Penning-Rowsell et al 1986)



cost methods of achieving the chosen strategy for minimising damage and loss of life from natural disasters.

This approach should be used when the benefits arising from disaster mitigation are unclear, or where there is a given amount of money for disaster mitigation that could not be increased even if it could be shown to be worthwhile to spend more. The drawbacks of this approach are that some of the money spent may not be wisely used, and that either more or less resources could be the better solution for the country and communities concerned.

* Benefit-cost analysis This attempts to maximise the economic efficiency of investment decisions by comparing the costs of plans and projects with their anticipated benefits. These benefits and costs are measured at their opportunity costs - that is the value of the next-best opportunities for those resources - and uses indices such as the benefit-cost ratio or net present worth to rank projects in terms of their economic efficiency.

"Extended" benefit-cost analysis and Environmental Impact Assessment are techniques for attempting to incoporate non-market products of investment in this kind of analysis, such as social equity or environmental and cultural resources.

In disaster mitigation, some form of benefit cost analysis (fully quantified or otherwise) would ***assess the costs of mitigation plans and projects (in terms of capital expenditure or revenue costs) and compare this with the likely economic outcomes, ultimately in terms of increased gross national product of the country concerned.***

This approach requires more data than cost-effectiveness analysis, and is more time-consuming. However it should mean that the scarce resources available for disaster mitigation are used in the wisest possible way, and that the intended effects of that investment (that is, the benefits) are clearly identified for subsequent monitoring during the implementation stages of disaster mitigation.

Nevertheless, economic appraisal of disaster mitigation cannot be complete, or an answer in itself, because many non-economic aspects of hazards and disasters need close attention in decision-making. The approach does, however, provide a ***framework*** for identifying which decisions are most economically efficient, and a systematic approach to the allocation of scarce resources.

Many different levels of analysis are possible, from the ***simple and intuitive*** to the ***sophisticated and computer-based***. The Manual includes examples and recommendations of all of these, and recommendations about how to make quick decisions in circumstances of limited data. The prime importance is to give decision-makers the benefits of a systematic framework within which to make their decisions.

These decisions may ultimately be political or dominated by other constraints which over-ride the economic analysis, but at least the decision maker will appreciate the economic costs of those political decisions.

OUTPUTS FROM PLANNING AND DECISION-MAKING

The outputs from systematic planning and decision-making will be clear-cut decisions that link economic considerations and safety to factors such as protecting hunan life and cultural issues.

The mitigation projects will have considered all available alternative strategies, including 'doing nothing', and will have involved a wide range of consultations with those affected so that the approaches adopted will have the support of local communities and political leaders.

The plans will be more realistic in that their implementation will have been considered as part of the plan-making process, and the solutions adopted should link as closely as possible to the risks identified and the vulnerability of the population affected.

As part of the appraisal process both government policies and institutions will have been evaluated. In the former case this will ensure that there are not contradictory but unintended policies in related spheres of government that are exacerbating risks and increasing vulnerability. In the latter case, a systematic approach will evaluate whether the structure and powers of government systems are appropriately tailored to the required disaster mitigation tasks.

Plans and projects resulting from good decision making and adequate appraisal should ensure that the scarce resources of disaster-prone countries are not wasted on schemes that are not cost-effective or economically efficient.

In this way disaster mitigation can assist the development process by ensuring that wise decisions are taken and that investment in disaster mitigation gives the country concerned the best return from all available resources and helps thereby to promote self-sufficiency and resilience to disasters that might occur in the future.