Chapter 8
Participation

8.1 Introduction and rationale

Popular or community participation can be broadly understood as the 'active involvement of people in making decisions about the implementation of processes, programmes and projects which affect them'.[1] Community participation is being encouraged in many areas of development, including disaster management, but practical guidance remains relatively limited.[2] In humanitarian circles, though, the relevance of participation is more questionable – at least in some contexts (see Section 8.3).

Participatory approaches are valuable in disaster management for the following reasons:

- They enable people to explain their vulnerabilities and priorities, allowing problems to be defined correctly and responsive measures to be designed and implemented (see Case Study 8.1).
- The principal resource available for mitigating or responding to disasters is people themselves and their local knowledge and expertise.
- Participatory work takes a multi-track approach, combining different activities, hazards and disaster phases. It is therefore well placed for dealing with the complexity of disasters and the diversity of factors affecting people's vulnerability to them.
- The process of working and achieving things together can strengthen communities. It reinforces local organisation, building up confidence, skills, capacity to cooperate, awareness and critical appraisal. In this way, it increases people's potential for reducing their vulnerability. It empowers people more generally by enabling them to tackle other challenges, individually and collectively.
- Participatory risk reduction initiatives are likely to be sustainable because they build on local capacity, the participants have 'ownership' of them, and they are more likely to be compatible with long-term development plans.
- Community participation in planning and implementing projects accords with people's right to participate in decisions that affect their lives. It is therefore an important part of democratisation in society, and is increasingly demanded by the public.
- Participatory approaches may be more cost-effective, in the long term, than externally-driven initiatives, partly because they are more likely to

Case Study 8.1
Revealing the socio-economic context

A study of disaster threats and coping strategies in a village in the Philippines tried to create a forum that would allow the most vulnerable residents of the village – typically the poor and least articulate – to explain their own situation and express their opinions.

One of the methods used by the researchers was three-dimensional mapping. A map was made on a sheet of plywood (plywood is a popular building material, so it was easy to find). The village street plan was drawn first; then the surrounding hills that form the local watershed were modelled in dough (made from flour and water). The river and seasonal streams were marked, and every house in the village was plotted on the map.

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

ITDG/Nick Hall

Making the village map

(continued)

Case Study 8.1 *(continued)*

The mapping gave people a chance to identify the most vulnerable, and it led into workshop sessions that described how the situation had changed in recent years, and to explore 'what-if' scenarios. It seemed to give many people the chance to express concerns about their own vulnerability, and it spelt out in a matter-of-fact, non-confrontational way the hidden structures of power and patronage (e.g. between landlords and tenants, landowners and wage labourers, and those in debt and those earning interest from others).

Community members observed that the information was familiar to them, but the map had given them an overview that would be invaluable for preparing a disaster plan.

N. Hall, 'Incorporating Local Level Mitigation Strategies into National and International Disaster Response', in J. Scobie (ed.), *Mitigating the Millennium: Proceedings of a Seminar on Community Participation and Impact Measurement in Disaster Preparedness and Mitigation Programmes* (Rugby: Intermediate Technology Development Group, 1997), pp. 35–45.

be sustainable and because the process allows ideas to be tested and refined before adoption.

- External agents cannot cope alone with the enormous risks facing vulnerable populations. Local people can bring a wealth of resources, especially knowledge and skills, to help reduce risk.
- Working closely with local people can help professionals to gain a greater insight into the communities they seek to serve, enabling them to work more effectively and produce better results.

8.2 Approaches

Approaches to participation can be grouped into two main categories:

1. Guided participation (also known as instrumental participation)
2. People-centred participation (also known as transformative participation)

This is admittedly an oversimplification. Furthermore, individual approaches may contain elements of guided and people-centred participation.

8.2.1 Guided participation

Guided participation seeks to include people in improvement projects, mostly in implementation and sometimes planning, but the projects are still initiated, funded and ultimately controlled by professional planners from outside the community. The planners determine the level of popular participation. The outside agents involved range from international agencies through different tiers of government to NGOs. Guided participation covers a wide range of interventions, from work that is essentially community-focused to government-centred programmes.

Early-warning and response systems to rapid-onset hazards such as cyclones are one example of guided participation in the disaster reduction context. These require community participation in their operation and local-level targeting (e.g. transmitting warnings, organising evacuations, handing out relief supplies), but usually are designed by disaster managers and based on centralised decision-making.

Another example is housing programmes introducing safe building techniques (e.g. against earthquakes or cyclones) where technologies are developed externally in laboratories or test sites before being handed over to communities by training local builders and producing public information materials. In this case, community participation is limited to builders receiving training, who are then expected to take the programme forward.

Within the category of guided participation, a distinction should be made between participation solely in implementing project activities, and participation in planning. In the former, community participation may be limited to undertaking prescribed tasks (e.g. a food-for-work programme following a disaster).

8.2.2 People-centred participation

People-centred participation addresses issues of power and control. Its view is much wider than the technical and managerial aspects of programmes and projects. It is concerned with the nature of the society in which these programmes and projects are developed. It aims at the empowerment of communities. People-centred participation is founded on the belief that ordinary people are capable of critical reflection and analysis, and that their knowledge is relevant and necessary. In countries where ordinary people are excluded from decision-making and political discussion, or are discouraged from taking part, the importance of participation in giving them a voice may be magnified.

Participation should empower individuals and communities by involving them in:

- defining problems and needs;
- deciding solutions to them;
- implementing agreed activities to achieve those solutions; and
- evaluating the results.

They must also share the benefits of the initiatives. Participation should enable those who are usually the most vulnerable and marginalised within their community to be heard and have their due influence on decision-making.

Disaster specialists have been slower to take to participatory approaches than their colleagues in development. This is largely due to the history, character and culture of disaster work, with its command-and-control mentality, blueprint planning, technocratic bias and disregard for vulnerable communities' knowledge and expertise. Literature on disasters can conceal this, especially where it is produced by those involved in disaster reduction activities. After the earthquake in Maharashtra in 1993, it seemed that nearly every agency involved in reconstruction claimed that local communities were participants in the reconstruction programmes. However, off the record some of the people working there challenged this. The tendency to use the label, but not the substance, of 'participation' is widespread, in development as well as disaster work.

8.3 Operational issues

Participation is difficult to manage, by its very nature. Indeed, to attempt to 'manage' the process may defeat the purpose of participation and undermine its practice. Nor, for the same reason, should it be seen as a single, coherent ideology. It is rather a package of disparate theories, methods and experiences guided by only a very few, very broad principles. Above all, it must not be regarded as some kind of magic wand that will instantly solve all the problems of planning and implementing disaster reduction activities. Participation is difficult in theory and in practice.

This section sets out some of the main issues to be considered in planning and implementing participatory approaches. It also identifies some of the likely problems, under two main headings:

1. Who participates, and why?
2. Facilitating the process.

8.3.1 Who participates, and why?

In disaster reduction, the aim is to enable communities to protect themselves more effectively against hazards. Participation is a means to this end. To the extent that it can empower and thereby mobilise the community *collectively*, it will succeed. If only some parts of the community are involved in a participatory programme, its impact will be limited at best, it is likely to overlook those most in need, and in some circumstances it may lead to community fragmentation and hence to failure.

To avoid these dangers, it is essential to acquire a thorough understanding of the community. Who is in it? How are they vulnerable to disaster? How can they be mobilised collectively to reduce the risks they face? Such knowledge is not easily won. The main reasons for this, and the main challenges in gaining understanding, include the following.

Complex communities

Communities are not single, homogeneous, entities. There will be differences in wealth, social status and labour activity, and divisions according to gender, ethnicity, age, religion and caste. Tensions always exist. Divergence in needs and priorities can create or worsen divisions within communities. Moreover, groups are not always fixed in isolation. They can join together to work for common goals and then separate again once these have been achieved. All of these dimensions must be considered in participatory work. This is difficult. It requires skill, insight, patience and flexibility.

Power relationships

Participation must be based on an understanding of power relations within a community's culture and social structure. Social relations are not equal. In any society or community, some groups will be weaker than others, or even marginalised. As a result, their voices are less likely to be heard, and more effort is needed to ensure that they become involved in participatory initiatives. As the most marginal groups in society tend to be the most vulnerable, this is an important issue for disaster reduction work. In humanitarian action, however, a degree of tension has arisen between the desire to protect the vulnerable (and, hence, to address the causes of their vulnerability, which may include socio-political structures) and the need to maintain the fundamental humanitarian principles of impartiality and neutrality.[3] This debate is largely driven by experiences in complex political emergencies, but it is also relevant to natural disasters.

Facilitators need to be careful, when choosing their local partners to organise and plan activities, and when identifying whom to include in those activities. Local authorities, political leaders and business people are often keen to be involved, but may have little understanding of the needs and circumstances of the most marginal and vulnerable groups; or they may have their own agendas. On the other hand, members of local élites cannot be disregarded as they have the power to disrupt community-based initiatives. Deciding how to acknowledge and include local leaders is one of the most difficult challenges in participation.

Where people-centred participation involves real social change, it leads inevitably to the possibility of confrontation and conflict with those accustomed to holding power and influence and used to controlling resources. For example, attempts to challenge restrictions on women's or other groups' access to decision-making power are often criticised and challenged, usually on the grounds of respect for cultural norms.

Community organisations and capacity

In developing countries, where the capacity of the state to protect its citizens may be limited, communities have to rely on their own knowledge and coping mechanisms to mitigate against disasters, as they have done for generations (see Chapter 9). Customary support structures can also play a significant role in disaster response and recovery. Although few communities are likely to have disaster preparedness committees, many will have their own formal and informal groups to deal with common issues, for instance water management or the regulation of disputes. Such groups can provide an entrance point for outside facilitators, and a basis for establishing sustainable local-level structures to assess and counter risk.

In developed countries, traditional community systems have been abandoned for more individual lifestyles and forms of association. This has been accompanied by a massive extension of the role and functions of the state. One consequence of these developments is that people rely heavily on the state to support and protect them. Their capacity for independent action may be limited. This may leave them more vulnerable to hazards when formal protective systems prove inadequate.

But in both developed and developing countries, at times of emergency there will be a variety of *ad hoc*, largely informal responses by loosely-knit groups from within communities before formal organisations are able to mobilise. These 'emergent' groups carry out activities such as search and rescue,

damage assessment, handling the dead, distributing relief supplies and presenting survivors' grievances. For example, during the first three days after the Mexico City earthquake in 1985, the organisational response was dominated by extensive independent actions. Ten years later in Kobe, Japan, a strong contingent of volunteers emerged to assist in response to another earthquake even though there was little tradition of voluntary organisation or community self-help in the city.[4]

Change

Communities are always undergoing change. So are their needs and resources. The relationship between the different actors is also dynamic, changing as a result of new knowledge and shifts in attitudes, resources and political power. Participation must therefore be a dynamic process, which implies constant readjustment of understanding, planning and implementation in order to adapt to such changes. This is not easy, and may be particularly difficult for external actors who have to work to less flexible schedules and targets set down by their managers or donors (see Case Study 7.3, page 110). Understanding of what participation implies must reach right up the management chain.

Conflict and social breakdown

Conflict uproots people from their homes, leaving them without assets and means of livelihood, vulnerable, frightened, susceptible to intimidation, and living in dislocated communities characterised by an absence of traditional authority and social structure, kinship affiliation and reciprocity. Many professionals question if a participatory approach (to both development and disaster reduction) is appropriate or even possible in such conditions of social breakdown. Moreover, local civil society organisations often find it difficult to remain neutral in conditions of conflict. This presents a considerable challenge when it comes to identifying suitable NGO and CBO partners in community-level work.

External forces

Communities do not exist in isolation from one another, or from the other actors in human development, such as governments, political parties, private-sector companies, the military and international agencies. External actors can have a decisive impact on community-level initiatives. In an authoritarian state, participation may well be considered subversive (see Case Study 6.7, page 100). In a state where government responsibilities are

being decentralised – which is now happening in many developing countries – there may in consequence be new opportunities for more equal dialogue between communities and officials (see Chapter 5.2.3, page 66). With the retreat of the state from many aspects of socio-economic development, the need for active and influential civil society organisations has grown rapidly and massively, extending the scope for community-level work (see Chapter 5.2.4, page 69).

Community initiatives can arise in response to threats from external forces – for example, to challenge development plans or environmental damage. This is important in the context of disaster reduction, for many hazards to people are made worse, or even generated, by unsustainable development processes. Community participation must be underpinned by recognition of these external forces and their implications.

8.3.2 Facilitating the process

Participation involves a number of operational choices – about the time and scope of the process, and the methods to be used. The following paragraphs highlight a few of the main issues (appropriate communications methods, which are vitally important, are discussed in more detail in Chapter 11).

When to participate

Risk reduction is a long process involving several steps from identification and analysis of problems, through decision-making and planning to action and evaluation. Participation should take place throughout this process, at each of these steps.

Choice of methods

Those wishing to facilitate participatory processes are faced by a huge choice of methods. There are too many of these to be listed here, and so practitioners are advised to consult the literature on participatory methods and to talk to those with experience of this kind of work.[5]

Participatory activities can be grouped, very roughly, into six main kinds:[6]

1. *Spatial – mapping and modelling*. This is particularly useful in risk and vulnerability assessment. For example, it can be used to identify hazards and dangerous locations, map water systems and rainfall, and identify areas affected by erosion, loss of vegetation or pest infestation.

2. *Nominal – collecting, naming or listing*. These activities can collect information about communities and their environment: for example, naming and sequencing coping strategies used in times of food crisis, listing health problems in order of frequency or importance, and identifying the causes and consequences of deforestation.
3. *Temporal – putting events in sequence*. This could be through personal and ecological histories, seasonal calendars, community time-lines or re-enacting events. In disaster work, such methods can reveal the changing nature of vulnerability and the effectiveness of previous preparedness or response measures.
4. *Ordinal – sorting, comparing and ranking*. In disaster work, such methods can be used to identify the most vulnerable individuals and households.
5. *Numerical – counting, estimating, comparing, scoring*. Methods of this kind could be used in assessing disaster losses or quantifying the value of some kinds of livelihood asset.
6. *Relational – linking, relating*. This can help facilitators to understand how different parts of the community relate to each other and to identify power structures. It also allows people to show how their problems relate to one another: for example, how the effects of drought might be linked to land tenure arrangements, or to gender-based divisions of labour.

Entrance points

One of the greatest problems facing facilitators is that of finding an 'entrance point' to the community with which they wish to work. The notion of the entrance point is very important, as it allows facilitators to enter into the social life of the community and start to build participatory processes from the inside.

The choice of entrance point will depend on the nature of the community concerned. In some cases, it might be through traditional local authorities such as village elders, clan leaders or religious leaders, or through traditional forms of association such as forums for regulating water, funeral societies or occupational groups. In other cases, it might be directly through the poorest and most vulnerable – for instance, women-headed households or homeless families.

Decisions of this kind require careful calculation of the likely consequences for the future of the intended initiative. Such calculation must be based on an understanding of the structure of that community, the different needs of its sub-groups, and the likelihood of increasing competition and conflict within the community. Will working through a particular entrance point enable the initiative to reach the most vulnerable, or does it run the risk of the project

being 'captured' by local élites? Will some sections of the community (e.g. traditional leaders) be alienated if the process begins with other, traditionally marginal or disempowered, groups? It is not easy for facilitators to maintain neutrality if it appears to some members of the community that they have taken sides.

In regions affected by political instability and conflict, traditional authority may have broken down completely. In addition, people may distrust outsiders. This can also happen in the aftermath of major natural disasters, to some extent, although the capacity of emergent organisations (see above) should not be underestimated.

Where indigenous social structures are weak or lacking, it is sometimes possible to create new groups to work with. However, a great deal of time, patience and effort is required. In some circumstances, external supporting agencies may need to take a leading role that challenges power structures. This has happened in some initiatives to support women after disasters (see Case Study 6.3, page 87).

Insiders and outsiders

Although participation is community-centred, outsiders do have a role to play. As long as they remain facilitators, and their work is guided by people's needs and aspirations, they can be genuine partners in transformation.

This sounds easy enough in principle, but the practice is much harder. The relationship between outside disaster specialists and local people involves differences in outlook, power and resources. Outsiders have different educational, social and cultural backgrounds, and they work for organisations that may have considerable financial, technical and other resources at their disposal.

The possession of resources, especially funding, conveys enormous power. Because of this power, and the assumption that all participatory efforts are good in themselves, outside disaster specialists may be tempted to intervene without waiting to find out if they are really needed – or wanted – by the community. In such circumstances, the participatory process is likely to be directed by outsiders, and aimed towards seeking confirmation of decisions made externally. This often happens unconsciously. If funds are made available too widely, or easily, this can undermine local initiatives and organisations.

Case Study 8.2
Reshaping local knowledge

PRA methods were used with a community of Bhutanese refugees living in a camp in Nepal. School students were among those trained in the methods. During an early stage of the training, one group of students returned with a neatly copied chart of their work. They proudly claimed that they had listened to a group of illiterate women who were not part of any of the formal programmes within the camp and whose voice, they felt, was often unheard.

However, when the students displayed their diagram, it was in a neat bar chart form, using the Western not the Nepali calendar. Discussion revealed that the students had reinterpreted the information provided by the women, regrouping and relabelling, and presenting it in what they considered a more prestigious manner, which they had learned at school.

R. Hinton, 'Trades in Different Worlds: Listening to Refugee Voices', *PLA Notes*, 24, 1995, pp. 21–26.

Even where there is dialogue, outsiders find it difficult to understand the community's environment, needs and points of view. To be sure, some of this can be blamed on the attitudes and approaches of the outsiders themselves, which are the product of their education, institutional culture and so on. But there is a more fundamental factor too: the impossibility of ever being able to put oneself fully into somebody else's position and see things through their eyes. Trying to fit others' views into frameworks of understanding, filtering the knowledge gained and reshaping it, can have the effect of imposing a kind of conceptual uniformity on the diversity of people and their experiences (see Case Study 8.2).

Reaching the most vulnerable

In development, organisations aim to work with the poorest of the poor. In disasters, they aim to work with the most vulnerable. These two groups are not identical, but will often contain many of the same people, and the

problems in reaching them are similar. They are nearly always the most difficult to see and to hear. They tend to be the most disenfranchised, the least likely to have a long-term vision and to take chances, the least accustomed to expressing and asserting themselves.

The importance of giving the most vulnerable and the victims of disasters a voice cannot be overemphasised. This raises the question of accountability, which is addressed in Chapter 12. Methods that give a voice to the vulnerable are described there.

Reconciliation of aims and priorities

From the point of view both of communities and of those who support them, it is essential to be explicit about the objectives of the participatory process. Different groups may have different objectives. Indeed, relationships between outsiders and local communities usually involve different ends. The process can then be developed to reconcile those objectives. Where objectives are unstated, or unclear, misunderstandings will arise that may prove damaging.

Facilitators of participatory processes will find that the groups involved are often unwilling to declare all their intentions, especially if these involve capturing resources from other sections of the community or from the outside agency. Participation cannot always uncover such hidden objectives and unstated agendas, but those involved must remain alert for indications (see Case Study 8.3).

Information and openness

The more open the process, the greater the likelihood of success. This implies sharing information and knowledge, which does not always happen. For instance, many participatory research processes simply extract information from people, to be used by others for their own research aims. Ownership of the information remains with those who planned the research.

An example of this in the disaster context is the approach sometimes used to carry out community-level vulnerability analysis, in which information about different aspects of the community's social and economic vulnerability is acquired from community members by means of participatory techniques, but the analysis and subsequent disaster management planning is carried out by external agents.

Case Study 8.3
Revealing and reconciling different views

An earthquake in the state of Maharashtra in India in September 1993 affected 67 villages and left 53,000 houses either totally destroyed or seriously damaged: about 10,000 people were killed. Since some of the villages had been reduced to rubble and had become burial grounds, the government decided to relocate 49 villages to safer sites, and promised to provide a plot of land and a basic house to every household that had to move.

This involved designing layouts for the new villages and houses. Official designs produced for both, based on town planning, were different from those of traditional villages and showed no understanding of villagers' needs. Attempts at construction ended in failure, and it was finally agreed to involve people more actively in planning.

In one village of 110 households, facilitators explored how space had been used. Meetings were held with villagers to identify what features they wanted to see in the new village and its housing; this included preparing maps. The groups also visited the new site.

There were heated arguments when the different groups' ideas were shared in a common village meeting. The grid layout prepared by officials was strongly supported by the younger, literate men who had studied in towns, who felt that features derived from town designs would make the village look better. The older men, younger non-literate men and most of the women felt that this design was not suited to their way of life and daily activities. The main reason for not liking the grid design was that houses would not be clustered. Women felt that this would lead to a disintegration of social and cultural ties and of support networks based on kinship and caste groups. One man pointed out how difficult it was to turn a bullock cart in a grid design where roads turn at right angles. When it came to discussing public facilities, the women's plan focused on water points, which had been overlooked by the men.

Despite these problems, the process arrived at a commonly agreed solution, based on a mixture of the cluster and grid plans – and it took only three days.

M. K. Shah, 'Participatory Planning with Disaster Victims: Experience from Earthquake-hit Areas of Maharashtra, India', *Refugee Participation Network*, 21, 1996, pp. 15–17.

The outcomes of participatory appraisal exercises should therefore be shared publicly with all those who take part. This allows knowledge gained from different groups within the community to be shared between those groups, leading to better mutual understanding of each other's views and needs. It also gives community members a chance to challenge the conclusions of the appraisal – and the appraisers. The community may insist on such sharing as a precondition of its involvement in participatory work.

Participation versus implementation

In some cases, participation is an end in itself, enabling men and women to learn, organise, decide, plan and take action without other specific goals in mind. More normally, it is geared to some kind of formal project or programme supported by outside agencies, usually with external funding. Those responsible for such projects and programmes have to make tricky operational decisions about when to stop analysing and start planning and implementation. The process is not crudely linear: good participatory processes involve ongoing reappraisal and willingness to change project design and activity in response to new insights. Nevertheless, the shift from appraisal to operations is significant within the project cycle, and must be managed carefully.

Timetables

The timetable for analysis of problems and opportunities, for methods of research and action and for planning new activities should be based upon a careful consideration of the local context, the specific concerns to be addressed, the institutions involved in collaborative efforts, and the objectives of local and outside actors.

Collaborative actions may be limited to specific initiatives for the immediate future (a few months, one or two years) or they might be viewed as a genuinely long-term programme (ten years or more). Participation works best as a process over long periods of time, allowing for reflection and modification in the light of experience and contextual changes. However, participatory approaches are just as valid in short-term projects. They have been used in post-emergency phases, as well as pre-disaster work.

Monitoring and evaluation

In a participatory project geared towards community action, it follows that the community must be involved in selecting indicators of achievement, and

in collecting and gathering evidence. This works very well in some disaster contexts, for instance in food insecurity and famine early warning, where a number of NGOs have established viable systems to alert communities and outside agencies to deteriorating food and livelihood security, and to generate appropriate responses. Sales of animals, sightings of certain insects and birds, and failure to carry out funeral ceremonies are among the indicators identified and applied by local people in such initiatives.

Nevertheless, it should be borne in mind that the needs of communities in this regard may differ from those of outside agencies – especially their senior management – and of donors, who expect more conventional indicators of success, often emphasising the quantitative at the expense of the qualitative. This problem should also be set against the more fundamental problem of how to monitor the impact of pre-disaster mitigation initiatives, where the result is that something – the disaster – does not take place (see Chapter 18 for detailed discussion of monitoring and evaluation).

8.4 Chapter summary

- Participatory approaches are valuable, helping to identify vulnerabilities and build local capacities.
- Participation should be 'people-centred': it should seek to empower communities by involving them in defining problems, deciding solutions, implementing activities and evaluating the results.
- In practice, participation is difficult to manage and may not produce quick results.
- To be effective, participation must empower and mobilise a community collectively, avoiding dominance by some groups and the exclusion of others.
- A number of operational choices must be made about the time and scope of the process and the choice of participatory methods.

Notes

1 R. Slocum et al. (eds), *Power, Process and Participation: Tools for Change* (London: Intermediate Technology Publications, 1995), p. 3.

2 This chapter is based on J. Twigg et al., 'Guidance Notes on Participation and Accountability in Disaster Reduction', Benfield Hazard Research Centre, London, 2001, http://benfieldhrc.org.

3 N. Leader, *The Politics of Principle: The Principles of Humanitarian Action in Practice*, HPG Report 2 (London: ODI, 2000); M. Herson, 'Putting the "H" Back into Humanitarian Accountability', *Humanitarian Exchange*, no. 24, 2003, pp. 4–6.

4 E. L. Quarantelli, 'Organizational Response to the Mexico City Earthquake of 1985: Characteristics and Implications', *Natural Hazards*, 8, 1993, pp. 19–38; L. K. Comfort, *Self Organization in Disaster Response: The Great Hanshin, Japan, Earthquake of January 17, 1995* (Boulder, CO: Natural Hazards Research and Information Center, Quick Response Report 78, 1996), www.colorado.edu/hazards/qr/qr78.html.

5 For example, R. Chambers, *Whose Reality Counts? Putting the First Last* (London: Intermediate Technology Publications, 1997); N. Wates (ed.), *The Community Planning Handbook* (London: Earthscan, 2000).

6 Chambers, *Whose Reality Counts?*, pp. 130–61.

Chapter 9
Indigenous knowledge and coping strategies

A greatly respected international expert once commented to me that 'the farmers in Bangladesh are fifteen years ahead of the PhDs' – Brian Ward, former Director of the Asian Disaster Preparedness Center.

Even within the Save the Children Fund, we sometimes read reports which say people cannot exist in these places, when obviously they do – Julius Holt, food security consultant, Save the Children Fund.

9.1 Introduction

Knowledge of how vulnerable people respond to a threat is essential. Outside interventions can then be built on these strategies.

Natural hazards are not new and people have been living in hazard-prone areas for centuries – in some cases for thousands of years. They have, inevitably, devised their own methods for protecting themselves and their livelihoods. These methods are based on their own skills and resources, as well as their experiences. Their knowledge systems, skills and technologies are usually referred to under the heading of 'indigenous knowledge'. There are now many studies of this in particular contexts. There are also some useful more general discussions, which this chapter draws on.[1]

The application of indigenous knowledge in the face of hazards and other threats is referred to as a 'coping mechanism' or 'coping strategy' (also sometimes known as an 'adjustment' mechanism or strategy, and in some circumstances as a 'survival' strategy). The choice of skills and resources to be applied varies according to the nature of the hazard threat, the capacities available to deal with it, and to a variety of community and individual priorities that can change during the course of a disaster.

Indigenous knowledge is wide-ranging. It includes technical expertise in seed selection and house-building, knowing where to find certain wild foods, economic knowledge of where to buy or sell essential items or find paid work, and knowledge of whom to call upon for assistance. People's resources also include labour, land, tools, seeds, food stocks, animals, cash, jewellery and other items of value. These can be used up, bought, sold, or

requested by calling upon obligations from family, kin, friends or neighbours, according to circumstances.

The enthusiasm for sophisticated technological methods of overcoming disasters has led specialists to overlook and undervalue the effectiveness of local coping strategies and technologies. Conventional wisdom in disaster management pays little attention to local knowledge as a basis for prevention and mitigation. Now, although there is a better appreciation of their merits in some quarters, they are still under-utilised by agencies, including many NGOs.

Coping strategies have been studied most in the case of food security, drought and famine, where disaster specialists have come to appreciate their value. This came about in part from recognition that agencies' orthodox approaches to fighting famine were less than fully effective in Africa in the mid-1980s. Strategies for coping with other natural hazards have not received so much attention, but there is a growing body of evidence to demonstrate the value of these and the circumstances that affect their adoption.

It is important for development and relief/recovery workers to appreciate the extent of such indigenous skills and practices, and to build upon them as far as possible in order to maximise their value. This approach helps to make communities partners in the risk management process. It can also be cost-effective because it reduces the need for expensive external interventions. It is more likely to lead to sustainable projects, because the work is based on local expertise and resources.

Old skills, knowledge and technologies are not inherently inadequate. New technical approaches are not automatically superior. This lesson has now been learnt by many in the development arena, notably in agricultural and food security work, although it has taken many years. However, the opposite, romantic, trap of assuming that the older ways are always better than the modern must also be avoided. Instead, one must look for what is appropriate in given conditions.

9.2 Forms of coping

It is possible to develop quite complex systems for categorising coping strategies and indigenous knowledge. For operational purposes, a simpler typology should be sufficient.[2]

This divides coping strategies into four broad categories:

- economic/material;
- technological;
- social/organisational; and
- cultural.

Most coping strategies involve elements of all of these, so the typology should not be used artificially to place particular strategies under particular headings. Rather, field workers should regard it as a framework for viewing coping strategies and indigenous knowledge as a whole, thereby ensuring that key elements are not overlooked.

It is also important to remember that coping mechanisms are often used in sequence to respond to different stages of adversity or crisis. This is most apparent during famines, when the emergency is likely to be prolonged (see Case Study 9.2), but it can also be observed in more rapid-onset disasters such as floods (Case Study 9.3). External agency response to slow-onset disasters such as drought often comes too late, when communities have already used up most of their strategies and resources.

Using the four-type categorisation above, the following paragraphs show some features of coping strategies and indigenous knowledge in a range of disaster contexts. This should give some idea of the variety of methods that vulnerable people have been using and refining for generations. In the light of such knowledge, which can be gained from participatory vulnerability and capacity analysis, interventions can be designed that reinforce existing coping strategies and prioritise areas where these are weak or under threat.

9.2.1 Economic/material

One of the principal elements in this category is economic diversification. Having more than one source of income (or food) is invaluable during times of stress, when some economic activities become impossible. Members of a rural household engaged in agriculture may undertake other work, such as making and selling handicrafts, carpentry, building or blacksmithing. With urbanisation and globalisation, a growing number of rural communities are coming to depend on cash remittances from family members who have gone to work in towns and cities, or even in other countries.

Vulnerable households try to store up a ‘buffer’ of food, grain, livestock and cash that they can draw on in difficult times. During periods of food shortage, they will eat food of poorer quality or eat less food, and look for ‘wild foods’,

such as seeds, nuts, roots and berries. If a crisis becomes acute, they will begin to sell their assets, but sale of livelihood assets (e.g. animals, tools, seeds for planting next year's crop or even land) is seen as a last resort.

Even having a large family can be seen as part of an economic coping strategy because it gives a household additional labour. Savings and credit schemes are often an important component of economic coping strategies (see Chapter 13).

9.2.2 Technological

Chapter 10 addresses this subject in more detail. This category is quite broad, including land management systems as well as what is more usually thought of as technology, such as building materials and construction methods.

Management of land for food production is an important element. Poor farmers, especially those working marginal or drought-prone lands, prefer mixed cropping, intercropping, kitchen gardens and other practices that reduce the risk of poor harvests by widening the range of individual crops grown. Traditional seed varieties are selected for drought or flood resistance, and for particular locations. Alternative crops may be kept in reserve to plant where others are ruined by floods. Pesticides made from local plants are applied to crops.

Land use strategies also include avoiding flood- or landslide-prone locations when building a home, and keeping away from hazardous places at certain times of year, such as not taking livestock to pasture up mountain valleys during the spring floods. To check erosion and flooding during the monsoon, villagers in the hills of Nepal convert hillsides into level terraces, create outlets to manage water overflow from one terrace into another, make networks of ponds to slow rainwater run-off and save it for the dry season, and build stone-works and plant trees to stabilise slopes and prevent erosion of gullies.[3]

An obviously technological approach is the way that housing is adapted to repeated floods. Common adaptations include building houses on stilts so that floodwaters can pass underneath, building them on plinths or platforms of mud or concrete so that they remain above flood levels, and building escape areas under or on top of roofs.

Bangladeshis have a range of methods for dealing with abnormally high or prolonged monsoon floods. These are based on accommodating themselves

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Village house on a mud plinth in Bangladesh

to the flooding rather than trying to prevent it. They include building on mounds or mud plinths, having homes of light-weight materials that can be dismantled and moved, building false roofs where goods can be stored and people can live, using beds as a living area when water enters the house, hanging belongings from the roof in jute nets, and investing in movable assets such as animals and boats.[4]

9.2.3 Social/organisational

This heading includes indigenous organisations that provide support in countering disasters: kinship networks, mutual aid and self-help groups. Systems of mutual rights and obligations are part of every household and community's social structure, forming what is sometimes called a 'moral economy'. People who are suffering – from shortage of food for instance – often call upon kin, neighbours, or patrons for help. Labour and food sharing during crises is standard in many societies. Work parties (*mingas*) are called up by certain indigenous communities in Latin America to rebuild after floods.[5]

The family is a fundamental social mechanism for reducing risk. Extended kin relations are networks for exchange, mutual assistance and social contact. In times of stress, relatives living outside the immediate community can become particularly important. For instance, some families living on islands in Bangladesh's Jamuna River try to marry their children into families on the mainland so that they will have somewhere to move to should they lose their homes to erosion when the river changes course.[6]

Disaster-affected people may also appeal to the wider community for charity. In many communities, gifts or alms are expected at times of hardship.

9.2.4 Cultural

Cultural factors include risk perception and religious views, which are frequently connected.

Case Study 9.1
Human actions, acts of God

Anthropologists' studies have revealed how people's statements of their views can disguise their actual risk perception and risk-avoidance behaviour.

People who live on the banks and islands of the Jamuna River in Bangladesh are very vulnerable to floods and erosion. Researchers in the late 1980s and early 1990s who asked them about their views of these risks found that a significant proportion explained them as the will of God, and saw prayer as the best response. The researchers concluded that the people were largely fatalistic and that their strategies for managing risk were limited.

An anthropologist on the mid-river islands obtained a similar response when using a standard questionnaire a few years later. However, indigenous knowledge is often not easily expressed in words, and the anthropologist observed something quite different when she lived on the islands during the 1998 floods.

Then, she observed that people were following a variety of strategies that had been used on the islands for generations. They built platforms out of reeds and banana stalks for their animals, fixed beds below the roof, cooked on portable ovens, lived off stocks of food saved from the winter harvest, switched temporarily to other sources of income and referred to their wide networks of relatives.

At the same time, the people expressed their faith in God, interpreting the high floods as his way of showing his power and testing their belief. God was thought to have sent the floods, but he also gave believers the strength to survive them.

H. Schmuck, '"An Act of Allah": Religious Explanations for Floods in Bangladesh as Survival Strategy', *International Journal of Mass Emergencies and Disasters*, vol. 18, no. 1, 2000, pp. 85–95.

Understanding how people view risk is particularly important. The accumulation and application of knowledge are directed by vulnerable people's perceptions of the risks they face. As we have seen, vulnerability is made up of multiple risks, not just the threat of hazards.

Case Study 9.2
Coping with famine in Ethiopia

A survey of a community in Ethiopia's Rift Valley to find out how it had coped during the famine of 1984–85 discovered a variety of coping strategies, deployed progressively as the crisis worsened.

First, normal hungry season strategies were brought into play. Grain consumption was cut back before family grain stores became empty. The men travelled to Addis Ababa to look for seasonal work, returning in the rainy season to plough. Women and some men went to distant markets where grain was cheaper. Women gathered wild plants to supplement family diets.

When these standard techniques were no longer sufficient, more drastic steps were taken. Cattle were sold, then oxen, then household goods and finally houses themselves, piece by piece. If these efforts were not enough, people migrated in search of relatives who could give them food. Some families split up. Finally, members of the community moved into the towns to beg and search for work.

It was not until this final stage, when the people were on the move, that relief operations started to bring food in. The community felt that the food aid brought in at the end did not play a decisive role in controlling the famine; their own efforts were seen as the backbone of the response.

World Disasters Report 1993 (Dordrecht/Geneva: Martinus Nijhoff/International Federation of Red Cross and Red Crescent Societies, 1993), pp. 45–48.

Risk perceptions will vary greatly between and within communities according to culture, experience and (for poor people especially) the pressure to secure their livelihood. It is very difficult to gain understanding of local views of risk. Simply asking questions about how risk is perceived does not always produce useful insights, because outsiders and local communities are likely to think about and describe risk in very different ways. It is often more constructive to talk to communities about what they do to manage a particular hazard than to discuss risks in general, provided that the full range of risks facing a community is covered in this way. But even this method is likely to miss a great deal.

Case Study 9.3
Living with floods in urban slums

Technological flood coping strategies used by slum dwellers in the Indian city of Indore include:

- high internal shelving;
- raised storage platforms;
- electric connections at head height;
- metal floor-level storage and furniture (more durable and resistant to immersion in water);
- storing grain in metal containers on high shelves;
- ceiling platforms (for valuables, food and mattresses); and
- attaching corrugated iron roofing with rocks not nails, for easy removal.

In severe floods people and possessions are moved to higher ground, in the following order:

- first, the elderly, children and animals;
- second, electrical goods;
- third, lighter valuables and cooking utensils;
- finally, clothes and mattresses.

Some families own trunks so that they can carry valuables away more easily.

Water levels are watched carefully and constantly when flood threatens. Houses may be built of wood and mud plaster rather than mud brick, since these are less likely to be severely damaged, yet they may also *appear* to have suffered greater damage, which may help their owners to secure compensation from the authorities.

There are sophisticated community support networks for the most serious times. Wealthy residents, local (religious) welfare organisations, and local businesses may provide food, blankets, clothes and medicines. The slum dwellers are also skilled in using the media and community leaders to press for state compensation.

C. Stephens, R. Patnaik and S. Lewin, *'This Is My Beautiful Home': Risk Perceptions towards Flooding and Environment in Low-Income Urban Communities: A Case Study in Indore, India* (London: London School of Hygiene and Tropical Medicine, 1995), pp. 31–43.

By spending long periods in communities, talking about and observing their daily lives, anthropologists can sometimes acquire a good understanding of the subject. Observation is valuable, as people's statements of their views

can sometimes give a misleading impression of their actual risk perception and risk-avoiding behaviour.

There is a common assumption among disaster management professionals that many people are fatalistic, regarding disasters as acts of God that cannot be prevented. In many cases, this may not be true. Statements of belief in divine power are not incompatible with taking actions to reduce risk (see Case Study 9.1).

Case Study 9.4
Effectiveness and limitations of traditional practices

More than 75% of the land in Nicaragua, Honduras and Guatemala is hilly or mountainous and ecologically fragile. The extensive clearing of forests for timber, ranching and farming, combined with widespread burning, has left much of the region's mountainous terrain in a degraded state.

Hurricane Mitch in October 1998 dropped over 50 inches of rainfall in one week. Barren hillsides could not retain or absorb water, and massive run-off carried away tons of topsoil, rocks and vegetation.

Members of the Farmer to Farmer network, a grassroots movement for sustainable agriculture in Central America, observed that damage to agricultural land was uneven. The network approached the NGO World Neighbors, which agreed to sponsor and facilitate a research project looking at the hurricane's impact on different kinds of farming system.

The study was carried out by 96 local research teams in Nicaragua, Honduras and Guatemala. It compared 'conventional' and 'agro-ecological' farms that were otherwise similar in terms of topography, angle of slope, location, crops grown and the intensity of the storm.

Conventional farming involves clearing and burning before the planting season, ploughing with the slope, and planting extensively. It also involves high levels of artificial fertilizers, pesticides, herbicides and hybrid seeds. By contrast, agro-ecological farming involves working with nature to regenerate and conserve nutrients and other natural resources. It uses such measures as:

- soil and water conservation (including contour barriers, terraces and ditches);
- cover crops (plants grown between crop cycles to fix

(continued)

Case Study 9.4 *(continued)*

nitrogen and protect the soil from the elements);
- agro-forestry (trees on farmland to provide compost, food, fodder);
- in-row tillage (cultivating only in areas immediately around the plants in order to reduce soil run-off);
- organic fertilizers;
- integrated pest management (rotating crops, cultivating beneficial plants and insects, using natural repellents and traps to protect crops from harmful insects); and
- reduced or zero grazing.

A total of 1,804 plots were surveyed in 360 communities. The research was carried out through a participatory process, directly involving nearly 2,000 farmers and promoters and 40 institutions. Data were processed for each of the three countries and the results were confirmed and validated in workshops with participants at the local, regional and national levels.

The main findings of the study were that:

- The sustainably-farmed plots had 28–38% more topsoil than their conventional neighbours. This difference was more pronounced in areas of more intense rainfall and storm damage.
- They also had 3–15% more soil moisture.
- Surface erosion was two to three times greater on conventional plots. Agro-ecological plots suffered 58% less surface erosion in Honduras, 70% less in Nicaragua and 99% less in Guatemala.
- The fact of being members of the Farmer to Farmer network helped individuals work together to resist and recover from the hurricane.
- Overall, the damage from landslides and eroding gullies seems to have been equally severe on both types of plot, indicating that agro-ecological methods may not contribute to resilience in all conditions.

The research concluded that agro-ecological methods increase resilience in most cases, but in some conditions – particularly a storm of Mitch's severity – damage from gullies and landslides is very difficult to withstand. Much of the damage originated uphill from the test sites, on poorly managed, degraded or deforested slopes.

Investigating Agricultural Resilience to Hurricane Mitch (London: British Red Cross Society NGO Initiatives in Risk Reduction Case Study 7, 2001), www.redcross.org.uk/riskreduction.

Communities have their own way of defining when conditions have worsened so much that they constitute a crisis or disaster. This threshold varies between communities, according to their vulnerabilities and the threats they face. Seasonal flooding is not necessarily seen as a disaster in some places. Crop growing may depend on it, and poor families may supplement their diets with fish that are more readily caught as flood water spreads from the rivers over the fields. The Bengali language has two words for flood: one meaning normal seasonal flooding, the other meaning excessive flooding.

9.3 Problems and challenges

9.3.1 Limitations of coping strategies

Coping strategies and indigenous knowledge are important in reducing risk. But like any knowledge system, they have their strengths and weaknesses in different contexts and at different times. Local knowledge, skills and coping strategies must be assessed rationally and scientifically on the basis of their effectiveness. This is not a debate between indigenous/traditional and external/scientific/modern systems in themselves, but a question of finding the most appropriate approach for each situation.

For example, in farming systems work, the value of local knowledge (of crops, soils, food preservation, climate, and protection against pests) is now widely recognised, and successful projects build on this. Similarly, local knowledge of indicators of drought and famine is now used effectively as a component of some famine early-warning systems (see Chapter 15). Research on communities living by the Jamuna River in Bangladesh has revealed the extent, complexity and robustness of indigenous understanding of the river and its behaviour.[7]

However, geological mapping and monitoring are needed to identify fault lines and areas liable to seismic activity – local knowledge cannot manage this. Scientific monitoring and forecasting of cyclones offer a far more reliable basis for planning evacuation than local understanding of precursors (see also Chapter 16.3). It is also unrealistic to expect indigenous strategies to be able to cope with extreme events. A massive earthquake will overwhelm most indigenous construction techniques, for example, just as repeated years of drought will exhaust communities' food and cash reserves, while social support structures can break down under the pressure of the struggle for scarce resources. Traditional coping mechanisms may also be inadequate for events that were not anticipated, and of which there is no previous experience, such as the HIV/AIDS epidemic.

9.3.2 Change

Indigenous knowledge and coping strategies are also affected by wider developments in the economy and society, such as changes in land use caused by population expansion or shifts in patterns of land ownership.

In many parts of the world, farmers are forced onto poor-quality lands or unstable hillsides and, for the sake of economic survival, compelled to use agricultural methods that are unsustainable or increase hazard risk. In Honduras, where the expansion of commercial plantations and ranches has forced peasant farmers onto marginal lands in hills and valleys, trees and other vegetation that stabilise slopes and retain water have been cut back for smallholdings, thereby increasing the risk of flash floods and landslides – as happened when Hurricane Mitch struck in October 1998. In Peru's Rimac Valley, overgrazing, deforestation and the abandonment of traditional terraces and water management systems began centuries ago, with the Spanish conquest, but worsened in more recent times as peasant farmers, struggling to survive in a market economy, left to work in the

Case Study 9.5
Understanding typhoon-resistant housing in the Philippines

A study among a rural community of 5,000 people in the Philippines found that traditional methods of building bamboo houses enabled them to stand up well to typhoons even though the methods were very different from those prescribed in modern textbooks for building timber-framed houses. When questioned on their techniques for countering typhoons, the builders were unable to provide an answer. Only by careful observation of builders actually putting up a demonstration house over two days were the researchers able to see how the structure worked and appreciate its strength.

N. Hall, 'Incorporating Local Level Mitigation Strategies into National and International Disaster Response', in J. Scobie (ed.), *Mitigating the Millennium: Proceedings of a Seminar on Community Participation and Impact Measurement in Disaster Preparedness and Mitigation Programmes* (Rugby: Intermediate Technology Development Group, 1997), pp. 35–45.

towns and their land was turned over to commercial meat and dairy production.[8]

In many places, traditional knowledge of biodiversity, of seed varieties that are resistant to drought and other climatic pressures, has been lost because of the promotion of new 'improved' varieties or even alternative crops by government agricultural extension agents.[9]

Such changes are most obvious in farming, but there are other ways in which socio-economic development can undermine coping strategies and skills. In the 1980s, researchers in the mountains of northern Pakistan discovered that the opening of the Karakoram highway was taking local builders, who were skilled in putting up secure housing, off to the cities of the plains in search of better-paid work.[10] Traditional social support networks and moral obligations also appear to be breaking down under the pressure of market forces and rapid social change.

In addition, governments' systems for dealing with crisis can marginalise or damage local coping mechanisms. It has been argued that this happened in Turkana, Kenya, during the drought of the early 1990s, when government set up a drought monitoring and contingency planning structure in parallel to that of local pastoralists.[11]

9.3.3 Invisibility

It is a major challenge to identify which coping strategies are effective or do not work well, and why. Local knowledge and coping mechanisms are often invisible to outsiders. As with local perceptions of risk, considerable effort may be needed on the part of outsiders to identify and understand them (see Case Study 9.5). This is often difficult for those whose class, upbringing and education have taught them to denigrate indigenous and traditional knowledge as 'primitive'.

It is also important to find out who in the community possesses indigenous knowledge of this kind, and who does not. Where the holders of such knowledge are themselves marginal or less visible within communities – for instance, women or older people – this can be challenging.

Where people are changing or adapting coping strategies rapidly in response to changing events, it may be even harder for outsiders to spot what is going on. This is all the more reason for building up a close relationship with communities during normal times in order to gain a full understanding of how they cope with crises.

But there is also a potential for conflict between traditional and modern knowledge systems and cultures, which is clearly linked to power relationships in society. 'Experts' in positions of authority do not like to be challenged. For instance, the revival of traditional water conservation methods in India has come into conflict with local officials' efforts to demolish unauthorised water-harvesting structures built by communities and NGOs.[12]

9.4 Chapter summary

- People in hazard-prone areas have acquired considerable knowledge and technical expertise for managing risk.
- Indigenous knowledge and coping strategies are often overlooked and undervalued by agencies.
- Coping strategies are very diverse, comprising economic, technological, social and cultural elements.
- It is important to look objectively at all forms of knowledge – indigenous and external – to identify the most suitable approaches for each situation.
- Indigenous knowledge is affected by changes in the economy and society at large, and often undermined by these changes.

Notes

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2 This is adapted from Clarke Guarnizo, 'Living with Hazards'.

3 N. Dahal, 'Coping with Climatic Disasters in Isolated Hill Communities of Nepal: The Case of Rampur Village in Okhaldhunga', in J. Twigg and M. R. Bhatt (eds), *Understanding Vulnerability: South Asian Perspectives* (London: Intermediate Technology Publications/Duryog Nivaran, 1998), pp. 47–67.

4 R. Hughes, S. Adnan and B. Dalal-Clayton, *Flood Plains or Flood Plans? A Review of Approaches to Water Management in Bangladesh* (London: International Institute for Environment and Development/Research and Advisory Services, 1994), pp. 29–30; R. Shaw, '"Nature", "Culture" and Disasters: Floods and Gender in Bangladesh', in E. Croll and D. Parkin (eds), *Bush Base, Forest Farm: Culture, Environment and Development* (London: Routledge, 1992), p. 204.

5 Clarke Guarnizo, 'Living with Hazards', p. 97.

6 H. Schmuck, *Living with the Floods: Survival Strategies of Char-Dwellers in Bangladesh* (Berlin: ASA-Programm of the Carl-Duisberg-Gesellschaft, 1996), p. 68.

7 H. Schmuck-Widmann, *Facing the Jamuna River: Indigenous and Engineering Knowledge in Bangladesh* (Dhaka: Bangladesh Resource Centre for Indigenous Knowledge, 2001).

8 M. Rodgers, *In Debt to Disaster: What Happened to Honduras after Hurricane Mitch* (London: Christian Aid, 1999), www.christian-aid.org.uk/reports/indebt/indebt.html; A. Maskrey, *Disaster Mitigation: A Community Based Approach* (Oxford: Oxfam, 1989), pp. 13–24.

9 D. Cooper, R. Vellvé and H. Hobbelink (eds), *Growing Diversity: Genetic Resources and Local Food Security* (London: IT Publications, 1992).

10 A. Wijkman and L. Timberlake, *Natural Disasters: Acts of God or Acts of Man?* (London: Earthscan, 1984), p. 88; Blaikie et al., *At Risk*, pp. 28–29.

11 D. Karenga, 'Putting Decision Making Back Into the Hands of the People', *Appropriate Technology*, vol. 19, no. 3, 1992, pp. 5–7.

12 I. Khurana, 'Rainwater Rights', *Down To Earth*, 10(6), 15 August 2001, www.downtoearth.org.in; anon, 'Who Owns the River?, *ibid*., 9(5), 31 July 2001, www.downtoearth.org.in.

Chapter 10
Choosing technologies for disaster reduction

10.1 Introduction

Structural, engineering and related technical measures are used for three main purposes:

1. To control hazards (e.g. building embankments and dykes to protect against floods, terraces to control rapid water run-off on steep hillsides, or dams to provide water reserves during droughts).
2. To protect private and public facilities (e.g. safe construction or strengthening of homes, public buildings and infrastructure).
3. To provide people with places of safety at times of disaster (e.g. flood and cyclone shelters).

Technologies used in risk and vulnerability assessment, communicating information about risk and disaster preparedness are referred to in chapters 4, 11 and 16.

Many different approaches are available, offering planners and project managers a range of technology choices (this issue of *choice* is a fundamental one). How to make such choices is the main theme of this chapter. A simplified view of this question groups risk reduction technologies into two categories:

1. High-tech, large-scale technologies. These include embankments, dams and dykes for flood control, advanced methods of securing buildings against earthquakes and cyclones, irrigation systems that deliver large quantities of water, and walls and banks to restrain volcanic debris such as lava and lahars (mud formed from volcanic ash). They are typically applied in wealthy countries and societies, or in large projects financed by international aid agencies.
2. A contrasting approach encourages the development and use of 'alternative', 'appropriate' or 'intermediate' technologies, principally for the following reasons:
   - they are small-scale, and hence suitable for local-level application;
   - they are low in cost, and hence more affordable by poor households and communities, as well as by technical assistance programmes;
   - they are suited to local people's technical and managerial capacities;
   - they draw on indigenous knowledge and skills;
   - they are owned and controlled by local people; and

- use of such technologies offers poor and vulnerable communities a wider range of choice than do expensive, complex, high-tech solutions.

Appropriate technology has long featured in development programming, so there is a great deal of experience to draw upon.[1] It has been less apparent in disaster mitigation and preparedness projects, although even here there is a growing body of knowledge.

10.2 Technology choice: contexts, applications and issues

The range of technologies that can be applied to disaster reduction is enormous. For this reason, they cannot be covered here in detail. The rest of this section considers some cross-cutting issues in technology choice and application, looking at contexts where technology has a particularly significant role to play, giving examples of practice and drawing wider lessons. Because this Good Practice Review focuses on local-level initiatives, the emphasis of this discussion is on technologies that can be applied by communities, NGOs and other local-level agencies.

10.2.1 Applications

There are many potential applications of appropriate technologies. These include:

- making housing more secure (against a variety of hazards such as floods, earthquakes and high winds);
- building local-level infrastructure (e.g. footbridges and tracks); and
- constructing small-scale hazard mitigation structures (e.g. flood or landslide defences, or rainwater harvesting structures).

Many of the best-known examples of appropriate, community-based technologies for reducing risk come from the fields of food security and housing, where there is an extensive literature, but it is important for project managers to take a very broad view of the opportunities for alternative technologies. The examples in the following paragraphs illustrate the range of possibilities in more detail.

10.2.2 Cost and materials

In developing countries, and especially among poor communities, appropriate-technology approaches are likely to be more viable than high-tech, large-scale technologies. While high-tech measures have helped to protect

many people in wealthier societies, their high cost means that they are not applied or are even inapplicable to poor and vulnerable communities in the developing world.

For instance, ensuring the construction industry follows state-of-the-art standards for earthquake-resistant buildings might be relatively simple in the US. Here there is wealth enough to cover the cost of new designs and additional measures to strengthen existing structures, and there are strong institutions to monitor and enforce compliance. But it is much harder in poorer countries, where government institutions are already stretched to the full to address other social and economic problems.

Smaller-scale technological inputs are more likely to be affordable by households and communities. The materials that are used can often be found locally: stone, for example, is used in a wide variety of hazard-mitigating structures, including dams and water tanks, bunds that hold back water on fields, and retaining walls and gabions (wire cages filled with rocks) to support unstable hillsides or prevent gullies from being eroded by flash floods. In Bangladesh, earth mounds provide shelter for people and animals as the water rises. These can be built cheaply in most villages, using local labour.[2] Hazard-resistant houses can be built from locally-grown wood, bamboo, reeds and other vegetable matter – there are examples of this below.

Recycled materials can also be used. In parts of the Caribbean and South America, old car tyres have been used to stabilise slopes that are vulnerable to landslides. In Rio de Janeiro, tests showed that a particular design of tyre wall filled with compacted earth was as effective as conventional concrete walls at stopping rainy-season landslides. They could easily be made locally – three million tyres are disposed of each year in Rio – at only one-third of the cost of concrete walls.[3]

The photo on page 149 shows simple, low-cost stone-and-timber constructions used in flood and mudslide defences in Peru.

The value of natural features and eco-systems in mitigating hazards should be recognised. In Europe and North America, conventional attempts to control river flooding by building embankments are being abandoned in some places in favour of restoring natural flood plains that absorb surplus water more effectively.[4]

So-called ‘bio-engineering’ solutions based on living trees and plants are often highly effective. Planting trees and grass is a well-established method

ITDG Peru

of preventing rapid water run-off and stabilising hillsides. In Nepal, 'green roads' are being promoted in mountainous rural areas. These minimise soil erosion and landslides by avoiding heavy construction equipment; widening the road in phases to allow for compaction by monsoon rain and exposing it to at least two monsoons before it is opened to traffic; planting trees and other vegetation; and constructing drainage systems that disperse water across the mountain slopes.[5] Section 10.2.9 and Case Study 10.7 (below) illustrate other applications of bio-engineering technology.

However, outsiders often fail to appreciate that many poor people, who may rely on day wages and have little or no savings, cannot afford even relatively simple technical improvements that will make them safer. This is notably the case with 'safe housing' projects, where there are often alternative technologies and building methods available that can make homes more resistant to earthquakes, floods and cyclones, and the additional cost of strengthening existing houses or building new, improved ones is marginal compared to the cost of the house as a

whole – but even this marginal cost often puts the improvements beyond the reach of the intended beneficiaries (see Case Study 10.1).

This raises the question of how poor people are to pay for technical improvements that they cannot normally afford. Simply providing such things free of charge is ineffective, as development experience has proved. People are less likely to appreciate the usefulness of the donations, which means that they are less likely to use them efficiently; and they tend not to look after them properly. There are many stories from 'safe housing' projects of donated houses being adapted by their inhabitants in ways that reduce their structural stability, and of maintenance being neglected.

Case Study 10.1
Housing improvement in Bangladesh

A pilot project in Bangladesh organised a series of action-learning workshops in a village where participants could share ideas about low-cost technical improvements that would make their houses safer. The participants included professional builders, thatchers and homeowners. Care was taken to ensure that women, poor villagers and women-headed households were adequately represented.

The workshops discussed features of homes in the village, the advantages and limitations of particular materials, and alternative forms of design and construction. The final stage of the process was to erect a demonstration building that conformed to standard construction but incorporated a range of relatively simple technical improvements that added only 8% to the basic cost. Eighteen months after the workshops, a survey assessed the uptake of the technical alternatives. It found that 28 of the 38 workshop participants had since undertaken building work. However, only eight had used techniques developed at the workshops. The main reason for the limited uptake was financial: 20 of the 28 had carried out building work in response to damage to their property from natural hazards, but after disasters money is limited and material costs tend to rise.

R. Hodgson and M. Carter, 'Some Lessons for a National Approach to Building for Safety in Bangladesh', in J. Ingleton (ed.), *Natural Disaster Management* (Leicester: Tudor Rose, 1999), pp. 160–62.

Case Study 10.2
Failure to adopt risk-reducing technology

Household fires caused 466 deaths and 14,600 injuries in the United Kingdom in 1999. Installation of battery-operated smoke alarms on ceilings or high up on walls can greatly reduce this risk.

In two London boroughs, where more than half the residents live in council or other social housing and 18% are from ethnic minority groups, over 20,000 smoke alarms were given out free of charge, together with instructions and educational leaflets in English and minority languages. Free fitting of the alarms was available on request. However, a study two years later showed that this had not reduced deaths or injuries due to fire, nor had it reduced the number of fires. This was because few alarms had been installed or maintained.

There were several possible reasons for this. Recipients may not have understood installation instructions and leaflets about the benefits of fire alarms because of illiteracy or poor command of English. Tenants may have lacked installation skills or tools, or may have worried about their landlords objecting to installation. Incorrect siting or installation of devices may have increased false alarms, leading to removal of batteries or disconnection.

A connected study of over 2,000 households that had been fitted with alarms in two local authority housing estates found that nearly half were not working 15 months later; 40% were missing or had been disabled by tenants.

C. DiGuiseppi et al., 'Incidence of Fires and Related Injuries after Giving Out Free Smoke Alarms: Cluster Randomised Controlled Trial', *British Medical Journal*, 325, 2002, pp. 995–97; D. Rowland et al., 'Prevalance of Working Smoke Alarms in Local Authority Inner City Housing: Randomised Controlled Trial', *ibid*., pp. 998–1,001.

Some kind of financing mechanism is generally needed to enable the poor to purchase technical improvements. Soft loans and hire-purchase arrangements can be used, but such schemes have to be managed carefully if they are to be sustainable (see Case Study 10.3). The skills needed to manage them are most likely to be found in development agencies, not among disaster managers.

Case Study 10.3
Financing technology for vulnerability reduction

Moneragala District in the 'dry zone' of southern Sri Lanka has been badly affected by drought in recent years. In 1998, communities in the district approached the Colombo-based NGO ITDG South Asia for assistance. This led to a community-based initiative to build tanks to collect and store rainwater.

The approach taken in the village of Muthukandiya typified that of the project as a whole. Villagers discussed their problems, developed a plan and selected rainwater harvesting technologies. Two local masons were trained to build 5,000-litre household storage tanks: surface tanks of ferro-cement and underground tanks of brick.

The system, including tank, pipes, gutters and filters, cost between Rs 6,500 (underground) and Rs 8,500 (above ground) – equivalent to a month's income for many village families. Just over half the cost was provided by the community in the form of materials and unskilled labour. ITDG South Asia contributed the rest, including cement, transport and payment for the unskilled labour. Households learned how to use and maintain the tanks, and the whole community was trained to keep domestic water supplies clean. A village society was set up to run the initiative.

On a purely technical level, the project was clearly feasible, but financial sustainability proved more challenging. A revolving fund was set up, with the households that benefited first agreeing to contribute a small monthly amount to pay for maintenance, repairs and new tanks. However, the revolving fund concept was not fully understood and it was difficult to induce households to contribute.

M. M. Ariyabandu, 'Food and Water Security through Community-based Technology in Rural Sri Lanka', *Appropriate Technology*, vol. 26, no. 3, 1996, pp. 6–8; IFRC, *World Disasters Report 2002*, pp. 20–21.

It can be cost-effective to use cheaper materials or constructions that will be damaged and require replacement more often, if this can be done easily by local people. In Nepal, for instance, it has been argued that it is better to build stone and brushwood dams in rural irrigation systems than to install stronger steel and concrete structures. Monsoon rains and consequent land-

slides are likely to wreck the stone and brushwood dams every year, but they can be replaced within a few days using materials that are readily to hand. More sophisticated structures are unlikely to fail unless rainfall and landslides are exceptionally severe, but one never knows when exceptional weather will occur, and if they do collapse, money, materials and skills may not be available to rebuild them.

A similar argument is used elsewhere in South Asia to justify retaining seemingly flimsy bamboo and thatch housing. Although such houses are much more vulnerable to floods than houses made of more resilient material such as brick, they can be replaced more easily. Parts can even be dismantled and carried away to safety if sufficient warning is given.[6] In Bangladesh and Vietnam, simple low dykes are built to protect crops against early floods. It is accepted that they will be submerged later in the rainy season and will need repairing for the next year.[7]

10.2.3 Effectiveness

Disaster managers and many of their counterparts in development tend to feel that appropriate technologies are somehow second-rate: at best a compromise, at worst ineffective. Decades of development experience in poor and vulnerable communities have shown such views to be misguided.[8] Appropriate technologies take a wide variety of forms and approaches, drawing on old and new technical ideas as appropriate, and there is plenty of technical innovation in this area. Small-scale, low-cost alternative technologies can also be highly effective in risk reduction.

Like indigenous knowledge generally, of which they are part, traditional technologies are often well adapted to prevailing hazards. Housing illustrates the point particularly well, as in the examples below from Guatemala and Peru (page 154). Another example comes from French Polynesia, which was struck by six cyclones in 1983 that destroyed 10,000 houses. Those that stood up best were traditional island homes with thatched roofs and openings to let the wind through.[9]

10.2.4 Modern versus 'primitive'

Although the view that appropriate technology is second-best or 'primitive' is misguided, the attraction of what is thought to be 'modern' technology is very strong among poor communities. This can hinder the adoption of safe technologies that are perceived to be primitive. It can also lead to the adoption of unsafe technologies that are perceived to be modern.

Case Study 10.4
Participatory technology development in reconstruction

In May 1990, the Alto Mayo district in north-east Peru was hit by an earthquake, and over 3,000 houses were destroyed. Most damage was done to homes built with rammed earth that were poorly built or maintained.

On top of the relief efforts, community groups, local government and NGOs spent two months drawing up a long-term reconstruction plan for the region which covered economic and environmental aspects as well as disaster mitigation. As part of the plan, meetings were held between national and local organisations, and with communities, to identify and select a construction technology that was more earthquake-resistant.

Building a consensus over this took six months. The technology selected was a modified form of a traditional style based on light timber frames, with wall panels of bamboo plastered with mud, on concrete foundations.

In April 1991, when a second earthquake struck the area, only 70 of the new houses had been built. However, all stood up well to the shock, whereas 10,000 other houses were damaged. With this demonstration of its resilience the technology began to take off quickly. About a year later, it was estimated that as many as 2,000 houses had been built in this way, together with 13 community centres, classrooms and schools.

T. Schilderman, 'Disasters and Development: A Case Study from Peru', *Journal of International Development*, vol. 5, no. 4, 1993, pp. 415–23.

A study of the Guatemalan village of Santa Maria Cauque, which was devastated by an earthquake in February 1976, found that traditional timber-framed housing with cornstalk walls and mud-covered slats on the roofs had been progressively displaced by adobe housing modelled on Spanish homes in Guatemala City. Adobe is not well suited to earthquakes, but to the Indians of the highlands an adobe home represented status associated with Spanish culture, and by 1971 85% of the houses in the community of over 1,500 people were built of it. In the 1976 earthquake, all the community's buildings were destroyed except for four made of reinforced concrete. All of the 78 deaths and the serious injuries occurred in adobe homes,

where the heavy blocks used in the walls collapsed. The cornstalk and timber houses also collapsed, but there were no serious injuries: the lightweight walls fell down, but the roof and frame remained intact or only partially collapsed. Two weeks after the earthquake, a survey of the community revealed that only 1% of those surveyed wanted to live in an adobe structure.[10]

Sometimes, the problem can be overcome by creating an impression of modernity, like a reconstruction project in Peru promoting seismically resistant housing, based on a traditional building style of timber frames with mud-and-cane walls, which put cement render on the walls to enhance the houses' appearance and acceptability as well as giving protection against water.[11]

10.2.5 Ownership and control

Owing to their scale, cost and complexity, structural interventions are usually seen as the government's responsibility. In many societies, this means that vulnerable communities have little say when it comes to planning and implementing such projects. Where other actors such as NGOs do become involved, this is often in opposition to large-scale schemes on the grounds that they are ineffective or have adverse social and environmental consequences.

One of the most famous examples of this was the movement that grew up in opposition to the Flood Action Plan proposed for Bangladesh by international donors after severe flooding in 1988. The Plan was a massive collection of programmes to control the country's rivers through dykes, dams and embankments. Many people in Bangladesh and elsewhere believed that such measures were incapable of taming the natural forces involved – some of the world's greatest rivers – and were even likely to increase flood risk in many places. There was also great concern that the scheme's disruption of drainage, water flows and pathways for migrating fish would harm the many poor people who catch fish in floodplains during the monsoon.[12] After years of agitation, most of the plan was abandoned.

10.2.6 Participation

Even supposedly appropriate technologies may have little impact if local people have not been involved in choosing and developing them. The essentially participatory principle of *technology choice* should underpin any efforts to reduce vulnerability through technical measures.

This happens rarely. More usually, technical specialists from outside are deployed to identify problems, develop and test new or improved technologies and promote their use among communities – conventionally through training and public education programmes. Even though these technologies may be relatively cheap, use local materials and be suited to use by local people, they are still generated externally; they are not the result of a participatory process; the people do not 'own' them; they may not be what people want or need; and uptake may be limited.

This problem can be overcome by adopting the approach known as participatory technology development (PTD). PTD gives potential users the decisive role in selecting and developing alternatives.[13] Over the past ten years or so, PTD has been applied in a number of development contexts and also some hazard contexts, particularly food security. It can also be applied effectively to other disasters (e.g. Case Study 10.4).

One of the main characteristics of PTD is that it takes time, as the approach must be inclusive and allow for extensive discussion and testing of different technical options. Gaining the confidence of communities can be time-consuming and difficult. Where the working environment is tough, or there are problems with technical innovations, it may take several years before a project begins to make much impact. Even a project that runs relatively smoothly may take some years to reach a wide number of beneficiaries.

Disaster managers are often under pressure from funding agencies to produce quick results that can be measured easily, in numbers (e.g. the number of earthquake-resistant houses or rainwater harvesting structures built), and they are therefore drawn towards non-participatory approaches. PTD success stories should be used to inform and influence agencies and their donors. However, more case studies and critical appraisals of PTD work are needed to build up a fuller picture of its strengths and weaknesses in reducing risk.

10.2.7 Public facilities: infrastructure and lifelines

Because of the scale and cost involved, the protection of public infrastructure and lifeline facilities (hospitals, power and water supplies) is mostly a matter for national governments and international aid agencies rather than NGOs and local organisations. The Pan-American Health Organization (PAHO), for instance, has a long-running programme to make hospitals in Latin America and the Caribbean more secure. Governments also have an important role in setting design standards, building codes and performance specifications for buildings and engineered constructions – which must be enforced.

However, there are many ways in which local-level projects can protect local infrastructure. One of the most obvious is the protection of local water supplies – wells, irrigation channels and water pipes – which in rural areas at least are usually managed by community organisations.

Schools and other community buildings certainly need protecting. There may be high numbers of casualties if they fail, and they can be used as evacuation or relief shelters in times of disaster. Programmes to strengthen school buildings to withstand hazards have been undertaken in many parts of the world. This approach helps children in two ways. First, it gives them, and sometimes their families, a place of safety during a disaster. Second, it ensures that educational facilities are left intact and schooling can resume more rapidly once the emergency is over. The experience of the Orissa cyclone of October 1999 demonstrates the need for such measures. Estimates for the number of schools damaged or destroyed ranged between 11,000 and 27,000.[14]

Time and skills are needed to carry out vulnerability assessments of buildings, though methods for rapid visual screening do exist. However, the main obstacle for local organisations is the high cost of retrofitting what are often large buildings. The Quito School Earthquake Safety Project in Ecuador, which surveyed 60 schools and drew up plans to retrofit the 15 at greatest risk, using local materials and construction techniques, found that the cost per school ranged between $7,000 and $244,000.[15]

Such expenditure is often well beyond the resources of local governments and NGOs. Funding by national governments or international agencies is needed. International agencies can play a valuable role here. The Organization of American States (OAS) has been working on school strengthening in Latin America and the Caribbean, where one million classrooms are estimated to be vulnerable to natural hazards, promoting collaboration between governments, NGOs, community groups and the private sector. The outcomes of the programme's initial efforts in the Caribbean include national plans for reducing schools buildings' vulnerability, surveys of schools to produce vulnerability profiles, and development of building maintenance plans.[16]

It is commonly assumed that measures to protect transport infrastructure are also purely large-scale, to be taken on by government. This is true for the main lines of transportation, but in rural areas most journeys are off-road on tracks and paths which are important in maintaining livelihoods. Women in particular spend many hours daily fetching and carrying fuel and water. Small hazard events can have a disastrous impact on rural tracks and bridges. The importance

of local-level transport infrastructure in disaster mitigation is largely overlooked. Villages may be several hours' or even days' walk from the nearest road, which is a major obstacle to disaster response as well as economic development.

Such local-level infrastructure can be improved and protected by local institutions including communities, although external agencies sometimes need to provide funds, materials and machinery. For example, relatively simple techniques to protect hill and mountain paths can make these quite resilient to severe hazard impact (see Case Study 10.5). In urban areas, it is common to see raised footpaths that ensure that people can move around during the rainy season.

10.2.8 Scaling up

Another common criticism is that the small-scale character of appropriate technologies limits their outreach and effectiveness. In long-term development work, this argument can be countered with examples of technologies that have been replicated or adopted by governments and other major institutions, thereby achieving extensive outreach and impact; but of course it does not follow that appropriate technologies as characterised above are suitable for all situations.

A similar argument can be made regarding disasters. Small-scale technical interventions cannot address some kinds of hazard threat, for instance volcanic lahars. These bodies of volcanic ash and mud can be massive, laying waste to just about anything in their path. Low-cost technologies are not necessarily most suited to disaster work: remote sensing by satellites and high-tech communications systems are essential for effective forecasting and warning of hurricanes.

Yet community-managed technologies and techniques can be highly effective against a range of hazards, on their own and in conjunction with others, and they do not have to be small in scale (see Case Study 10.7). In addition, being well adapted to community resources and capacities, appropriate technologies are highly replicable and can spread over a very wide area (see Case Study 10.6).

10.2.9 Technology and livelihoods

The chances of short-term success and long-term sustainability are greatly enhanced if technical innovations can directly improve poor people's livelihoods, as this provides a strong incentive for communities to run and maintain them properly. This link is commonly seen in technical measures for

Case Study 10.5
Protecting hillside paths in Tanzania

FARM Africa began an agricultural development project in Babati District in Tanzania in 1992. After the project had been running for some time, communities approached the NGO for assistance in conserving sections of the Rift Valley escarpment, which passes through the project area.

Many years of overgrazing and deforestation had led to erosion, damaging the footpaths that linked the scattered villages at the top of the escarpment to the main trading centres at its base and to the local hospital and church. As a result, the footpaths were unsafe, especially in the rainy season.

FARM Africa sought technical assistance from the National Trust, a conservation NGO in the UK. A consultant was provided, but planning decisions were made by village committees, who allocated community workdays to rehabilitating paths. Stone was the main material used. It is freely and easily available, and durable, with no maintenance costs. Three methods were used:

1. Stone-lined drains, which outlast earth drains and provide a permanent hard surface.
2. Stone paths, created by burying stone to make a hard surface (with steps where needed to ease gradients).
3. Revetment walls to protect the bottoms of gullies from further erosion.

Between June 1996 and December 1997, more than 300 villagers were trained on the job and soon acquired the necessary skills so that they could continue after the consultant left. Four paths totalling 4.5km in length were repaired during the training process, including the busiest local path, used for trade and to take patients to hospital.

Surveys among villagers showed that journey times improved and paths were felt to be safer. Residents of one village at the base of the escarpment stated that the risk of flooding had diminished substantially. Subsequently, the area was affected by torrential rains caused by El Niño. Many bridges were destroyed and there were several major landslides, but the restored footpaths were virtually unaffected.

A. Carling, *Healing the Rift: Footpath Repair Work on the Dareda Section of the Rift Valley Escarpment for FARM Africa – Babati Agricultural Development Project, March 1996–December 1997* (Ambleside: Mountain Path Repair International, 1999), http://freespace.virgin.net/andy.carling/tanzfull.html.

Case Study 10.6
Lines of stone

Most of the inhabitants of Yatenga Province, in the north of Burkina Faso, live from farming, mainly by growing millet and sorghum on small plots. However, the province experiences frequent droughts and has suffered serious environmental degradation over many decades. External agencies' attempts to control water run-off and soil erosion date back to the 1960s and 1970s, but these early efforts were unsuccessful.

In 1979, Oxfam began a pilot project to encourage the construction of simple bunds (*diguettes*) along contour lines. Local farmers found that these stone walls-cum-embankments were effective in trapping water and preventing soil erosion. Sorghum planted along the *diguettes* grew better than sorghum planted further away.

To be effective, bunds have to follow contour lines precisely. In a community-based activity, sophisticated surveying equipment was out of the question. The project therefore copied a very simple technological device, developed in Senegal: a ten-metre transparent water tube, attached at each end to a wooden pole. By matching the water levels in the tube to measuring marks on the poles, held upright, contours could be identified accurately. The water tube technology was cheap and learning to use it was easy. It enabled local farmers to take control of planning and siting the *diguettes*.

After a three-year pilot phase, the project attempted more widespread replication. By 1984, about 500 farmers in over 100 villages had been trained to use the water tube and build *diguettes* – mostly with rocks, sometimes using brushwood or live vegetation. Poor farmers were keenest to take part and more willing than the richer farmers to work collectively.

In the following year, the project, renamed the Projet Agro-Forestier (PAF), was handed over to local staff. It began a more broad-based programme of agricultural support to complement the *diguette*-building. This included encouraging production of compost, establishing tree nurseries, rearing livestock, the introduction of a revolving loan scheme for grain, and other training and research activities. By 1992, PAF was working in ten districts, had trained 5,000 farmers and was reaching 160,000 people indirectly through the village groups that it supported.

(continued)

Case Study 10.6 *(continued)*

Most households in the villages covered by PAF built *diguettes* in some of their fields. Evaluations showed that construction of *diguettes* improved crop yields by 10–90% depending on location and other factors, with increases of around 40% being relatively common. A wider variety of crops was also being grown.

The project's expansion was not without problems. *Diguette*-building is labour-intensive and requires tools such as wheelbarrows and pickaxes. Farmers regarded transporting stones as the largest problem. Increased *diguette* construction used up locally available rocks, forcing farmers to travel longer distances to find them, and there were sometimes conflicts between villages over rocks. Regular maintenance was needed, especially in the wet season.

N. Atampugre, *Behind the Lines of Stone: The Social Impact of a Soil and Water Conservation Project in the Sahel* (Oxford: Oxfam, 1993).

mitigating drought, such as soil and water conservation, multi-cropping and growing indigenous drought-resistant crops. All of these are clearly linked to improving food security, and hence livelihoods.

Case Study 10.7 gives an example of an integrated technology–livelihoods approach in the context of rapid-onset disasters. Another example is the work of a Bangladeshi NGO, the Jamuna Char Integrated Development Project (JCDP), which supports communities living on the *chars* (islands) in the Jamuna River. One of JCDP's main risk reduction activities has been to give financial and technical support to farmers to plant a particular kind of reed. The reeds, which can grow as high as 20 feet, are an indigenous species well suited to the sandy soils of the *chars*. They are useful in hazard mitigation because they collect sediment swept down by the river, thereby adding to the land and helping to protect riverbanks. They support livelihoods because the stems can be used for fuel, roofing and in making fences, while the leaves can be eaten by domestic animals. Land planted with them becomes fit for cultivation by some other crops within 2–3 years. Reeds grown on the *chars* are also sold to buyers from other parts of the country.[17]

Case Study 10.7
Supporting livelihoods while reducing disaster risk

Since 1994, the Vietnam Red Cross has planted and protected nearly 12,000 hectares of mangroves in the north of the country. These submerged coastal forests are effective buffers against the winds and sea surges generated by typhoons (cyclones) and storms. They now protect 110km of the 3,000km sea dyke system that runs along the coastline.

Planning and protecting the mangroves has cost $1.1m, but has helped reduce the cost of dyke maintenance by $7.3m per year. When Typhoon Wukong struck in October 2000, there was no damage to the dykes behind the mangrove forests, whereas in the past waves would often breach coastal dykes and flood poor families' land.

The Vietnam Red Cross also estimates that the livelihoods of 7,750 families have benefited from the project. Poor households are chosen to plant and protect the mangroves, each being allocated 1–5 hectares to manage. The mangroves grow to 1.5 metres in height within three years. Once the forests are established, the families involved earn money by selling the crabs, shrimps and molluscs that live there.

IFRC, *World Disasters Report 2002,* p. 95; I. Wilderspin, Presentation to Netherlands Red Cross International Conference on Climate Change and Disaster Preparedness, The Hague, June 2002.

10.2.10 Technology and socio-economic change

Technology is not static. It is constantly changing, adjusting to new ideas and skills, and to socio-economic pressures. These forces often bring about improvements, but the results of change are not always positive.

Housing provides many instances of this. Traditional wooden housebuilding styles in the Indian Himalayas are often more resilient to earthquakes than more modern designs or modifications. Builders may be less familiar with the modern forms of construction, and the reduced use of wood in building may also be due to increasing demands for it for other purposes.[18] In general, modern building methods are only as good as the builders who use them. Where builders are not adequately trained in the use of such methods, or

construct awkward hybrid buildings using a mix of traditional and modern techniques, there is a strong likelihood of those buildings failing if struck by hazards such as earthquakes or cyclones.

Advanced technology can be undermined by social, economic and political pressures. Modern apartment blocks were prominent among the buildings that collapsed during the Turkish earthquakes in 1999 and the Gujarat earthquake in 2001. Construction methods and building standards should have been sufficient to ensure that they did not fail, but standards and regulations were not enforced. Where demographic and economic pressures are intense, and government mechanisms weak, as in these cases, regulatory systems may prove inadequate.

10.3 Chapter summary

- Project planners and managers need to make informed choices about the most appropriate technologies for risk reduction in particular contexts.
- So-called 'appropriate' or 'alternative' technologies are well-suited to local-level application and community management.
- Such technologies can use a range of materials that are easily obtained locally (such as stone, wood, earth), recycled materials and living trees and plants.
- Traditional technologies are often well-adapted to prevailing hazards.
- Even relatively simple and inexpensive technological innovations may be beyond the reach of many poor households, so thought must be given to financing mechanisms.
- Supposedly appropriate technologies may have little impact if local people are not involved in choosing and developing them.
- Protection of public infrastructure and lifeline facilities should usually be left to governments and international agencies, but there are many ways that local-level projects can protect local infrastructure.
- Small-scale technological interventions can have a significant impact through wider replication and other forms of scaling up.
- Chances of success and sustainability are greatly improved if technological interventions for risk reduction can also directly improve poor people's livelihoods.

Notes

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