(defined for a given level of expected loss) need attention and are defined as active, whereas those below the line have a lesser priority and are defined as inactive. Again, the decision to address a risk is made based on an accepted level of expected loss. The higher the expected loss, the less likely the risk will fall above the threshold line. The inactive risks are not abandoned in the analysis; they are continually monitored in the event that they could become active with time.

To analyze and prioritize community risks, the community-owned vulnerability and capacity assessment (COVACA) methodology (Greene 2007) starts with creating awareness among the participants of key community needs (e.g., food, energy, shelter, and health), how those needs have been affected when various hazards and disasters have occurred in the past, how the community responded to those past events, and what the current key threats in the community are. Once those key threats are named, the next stage is to identify their causes and impact, existing community coping mechanisms, how to identify early warning signs, and how to develop and implement a mitigation plan at the grassroots level. The detailed steps recommended in this methodology can be found in the second part of Greene's report, entitled "COVACA Instruction Manual."

Risk Management Strategies

Various strategies can be developed to reduce or eliminate the impact of risks and change the risk environment. The goal is not to eliminate the risks but rather to reduce or eliminate their drivers. After all, when drivers do not exist, risks are not created. For a given risk, four strategies are possible (Smith and Merritt 2002):

- *Avoid* the risk by reversing decisions that could cause the risk (abandoning the project might be an option);
- *Transfer* the risk (or impact) to another party that may have a better potential (knowledge, resources) to tackle the problem;
- Create *redundancy,* thus reducing the effect of the risk event by providing parallel solution paths and backup options; and/or
- *Tolerate* the risk but at the same time *mitigate* the risk/impact and risk/impact drivers (to make it less severe) by developing a *prevention* plan (which works on reducing risk and risk drivers), a *contingency* plan (which works on impact and impact drivers), or a *reserve plan* (in which risk occurs and losses need to be covered).

As an example, Table 10-5 lists various strategies to handle the risks outlined in Table 10-2 for the Peru project. The four strategies mentioned require a substantial amount of advocacy work, which can take multiple forms, such as education, adoption of construction codes and best practices, and regulations.

Table 10-5. Management Strategies for Various Risks for Project in Iquitos, Peru

Risk Type	Response Strategy	Strategy Description	Responsible Individual	Pricing Strategy	Cost of Mitigation	Trigger Events
Severe weather	Avoid	Low impact and low probability do not affect project adversely	None			
Labor issues	Accept	Low impact and low probability do not affect project adversely	None	Contingency	$100	Cultural disagreements
Fuel price	Transfer	Create fuel price contract regarding price inflation between consulting firm and NGO	Planning team member	Pass through	$70	Global and local inflation rates increase
Donor funds	Mitigate	Draft contractual agreement between donor and consultant	Planning team member	Contingency	$100	Financial disagreement with donor
NGO conflict	Accept	Maintain open channels of communication or secure contracts with NGO	Planning team member	Other		Operational disagreement with NGO
Political turmoil	Accept	Medium probability, so maintain contact with local liaisons	Planning team member	Other		Political instability leads to NGO withdrawal
Community rejects new behavior	Mitigate	Use of participatory approaches to ensure community acceptance	All parties	Contingency	$500	Community support for project is lost

Source: Bottenberg et al. (2012), reproduced with permission.

According to Smith and Merritt (2002), once a risk management strategy is selected, an action plan needs to be outlined to implement the strategy. The action plan has four components: (1) an objective, (2) ways of measuring whether the objective has been achieved, (3) a time line toward completion, and (4) a designation of who is accountable. Challenges, the assumptions associated with implementing the action plan, and the potential for unintended consequences and cascading effects should also be included. In general, the action plan consists of tangible and nontangible actions. The former tends to be more objective, whereas the latter involves more policy issues.

Furthermore, to carry out the action plan, resources and knowledge are needed. The resources and knowledge available in the community, which can be related to the community capacity, dictate to great extent what levels of risks can be handled, which DFID (2002) calls the *risk appetite*.

Monitoring and Evaluating Risks

Risk management is a dynamic process because the risk drivers, risks, and associated impact are likely to change over time. Therefore, a need exists to develop indicators to monitor progress as discussed with capacity development and using the SMART acronym. As the project goes on, all activities are evaluated as to whether they are risk neutral, risk enhancing, or risk reducing.

The monitoring indicators need to (1) measure progress in the action plan leading to risk reduction, (2) identify any losses associated with the risks, (3) measure the effectiveness of the methods and action plans used to handle the risks, (4) indicate the emergence of potential new risks and/or issues (risks that are 100% certain) that may require new action plans, and (5) terminate action plans on risks that can be considered as closed. As remarked by Smith and Merritt (2002), the closing of an action plan may occur when (1) the risk event was prevented from happening, (2) the time component of the risk has passed, and (3) the risk event happened and has been managed accordingly.

10.4 Project Impact Assessment

Related to risk analysis is the issue of project impact assessment at the local, regional, and global levels. This is an issue that is regularly addressed on engineering projects in Western countries. According to the International Association for Impact Assessment (IAIA 2013), it is "the process of identifying the future (prospective) consequences of a current or proposed action. The 'impact' is the difference between what would happen with the action and what would happen without it."

That difference is often hard to measure, especially quantitatively, because it is easier to determine the contribution of a project in a qualitative anecdotal

manner than it is to attribute an outcome to a specific project activity. This is especially true when trying to quantify the impact of a specific activity (e.g., transportation; pollution; water, sanitation, and hygiene; agriculture; tourism; or construction) on public health. This quantification is less of a challenge when looking, for instance, at the effect of construction activities on infrastructure development. Engineers are more familiar with the latter.

Important aspects of project impact assessment that have received a lot of attention in developed countries include the health impact assessment (HIA) and the environmental impact assessment (EIA), which deal, respectively, with the effects of projects on human health and on the biophysical environment (Birley 2011). Both HIA and EIA need to be communicated to the community in the form of public meetings before the project and as it unfolds. It is a participatory process that is unfortunately not often included in small-scale development projects. The HIA and EIA can also be initiated by the community and can force outsiders to be more transparent (Conant and Fadem 2008).

As remarked by the IAIA, the EIA is

> *a requirement in most countries in the world. It describes how a project will affect people, the environment (air, water, land, and biota) and any negative and harmful consequences of the project such as population relocation, impact on traditional cultures and livelihood, spiritual tradition and historical heritage. In some countries, there are often both national/federal and state/regional EIA systems and regulations.* (IAIA 2013)

Health impact assessment is closely linked to health risk assessment (HRA), which looks at the impact of health-related risks and builds on the health needs assessment, which is integrated in the project appraisal phase.

In addition to the EIA and HIA, other impact assessments may need to be conducted about specific social, cultural, economic, and institutional issues. They can be conducted in parallel or integrated into one assessment study because of their overlapping nature. As remarked by Muscat (2011), being aware of various forms of project impact is critical in projects that have potential to induce conflict between different groups. According to Muscat, engineers may want to account for issues such as the following:

> *Is the project located near borders between rival groups? Will the location and design of irrigation channels impinge on divisions between different ethnic (or religious, etc.) groups? Is a project affecting areas inhabited by indigenous people? How will this affect design, cost, negotiation, and implementation? Will there be fair compensation payments/projects for people negatively affected?* Muscat (2011)

Project managers must use precaution to ensure that local and/or national regulations are also respected as projects unfold. In the absence of standards and

regulations, which is often the case in the developing world, every effort should be made to minimize project impact using best practices that have had a proven record in the developed world, and which could be adapted to the situation at stake. This process also provides a unique opportunity to train local stakeholders about the importance of project impact and even influence in-country regional and national policies.

10.5 Chapter Summary

Risk analysis and management are integral parts of sustainable community development projects. Risks exist in communities before implementing projects; some are related to natural hazards and adverse events, whereas others are not natural. These risks are supplemented with additional ones related to project execution. Often the first identified risks may feed into the later ones and may enhance project-induced risks. In some cases, cascading risks can occur. In general, risk is about what could go wrong in a project. That simple issue, along with how project-related risks affect communities and their environment, should be addressed along each step of the proposed project implementation plan outlined in Chapter 8.

Methods for risk analysis and risk management are available in the risk management literature. They have been used in various industries and by development agencies. Many of these methods can be used to quantify or qualify risks in the developing community environment. In all cases, they need to be supplemented with methods to monitor and evaluate risk over time because risks do not end upon project completion.

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11

Community Resilience Analysis

11.1 About Resilience

In physics and engineering, resilience refers to the ability of a material to return to its original equilibrium after being disturbed. The concept of resilience as the ability of something to bounce back has been extended metaphorically to other nontechnical disciplines in social and psychological sciences (Norris et al. 2008; Zolli and Healy 2012), where the something could be an individual, a community, an ecological system, or an infrastructure facing disturbance (e.g., hazard, disaster, or trauma). In that context, resilience is understood by some researchers as *ability* or a *process* rather than an outcome, and *adaptability* rather than *stability* (Norris et al. 2008). Others see resilience as an outcome (Kahan et al. 2009) or as both process and outcome (Cutter et al. 2008).

This chapter explores the resilience of developing communities to risk associated with adverse events. It is an extension of the previous two chapters that dealt with capacity, vulnerability, and risk. Because of adverse events of various magnitudes and scales, communities face various risks that may affect their existence and quality of life and the well-being of their members. The events can vary from being local to crossing geopolitical borders. The consequences of those events can be immediate or long lasting. Their impact and probability of occurrence can be represented on a risk heat map, such as the one shown in Table 10-3. In some cases, there may be multiple events or the events may lead to secondary events.

Furthermore, compared with events in the developed world, adverse events in the developing world do not have to have high probabilities of occurrence and high impact to be important to communities. As seen in Chapter 2, it does not take much for people who try to step out of poverty to fall back into it because of their lack of initial capacity. Whether the consequences of events are tolerable or not depends largely on how ready communities are to face such events using their *coping resilience* and their capability to adjust to new conditions using their *adaptive resilience*. Building and maintaining both forms of resilience depend

greatly on development, as long as it does not create unexpected consequences that could negatively affect the livelihood of communities. Examples include "consumption, overuse and destruction of natural resources; population growth; use of marginal lands; urbanization; pollutants; hazardous products; and misguided development projects" (UW-DMC 1997).

The concept of resilience has received a lot of attention in the developed world, especially in regard to major hazards and disasters. For instance, in the United States, various initiatives have been launched to promote a culture of resilience at the national level, a review of which can be found in a report published by the National Research Council (NRC 2012) entitled "Disaster Resilience: A National Imperative." At the international level, several initiatives on resilience are underway, such as the Hyogo Framework for Action (UNISDR 2007) launched in 2005 by the United Nations, which is designed to engage governments in developing global strategies at the national or regional level.

The main problem with such global strategies is that they do not always specifically address the challenges faced at the community level, which is of interest here. And if they do, they assume a certain baseline of inherent community capacity that is often nonexistent in the developing world. It is not that developing communities cannot be resilient. The challenge is that it takes them a tremendous amount of effort to build capacity in such a high-risk and low-capacity environment, which is often constraining rather than enabling. In general, it should be remembered that developing strategies for community resilience and putting them into practice in that context is more difficult than in the developed world.

The concept of resilience can mean different things to different people and organizations. Some see resilience as a global concept, whereas others consider different types of resilience, such as economic, social, institutional, infrastructure, or environmental. Various definitions of community resilience to hazards have been proposed in the literature (NRC 2012). They usually encompass four basic tenets: mitigation, preparedness, response, and recovery. In this book, community resilience is defined as "the ability to prepare and plan for, absorb, recover from, or more successfully adapt to [actual or potential] adverse events" (NRC 2012). Another way to look at resilience is the ability to cope with adverse events (or challenging conditions) and adapt to a *new normal*.

The literature on community resilience also calls for communities to develop *project* and *process* mitigation strategies that may be local and/or part of larger regional or national frameworks. Project mitigation involves *tangible issues* in the community that can be addressed using structural measures, such as the alteration of the built and natural environment, infrastructure (local and global) development and retrofitting, and the implementation of economic measures. However, process mitigation involves *intangible* issues related to institutional and individual behavior to reduce risk. This type of mitigation may include

nonstructural measures, such as the adoption of building and construction codes, exploration of better options for land use (zoning), use of natural barriers, education of communities and individuals, reduction and elimination of inequalities, the adoption of governance and policies, climate adaptation, and meeting of immediate, medium-term, and long-term health needs. In general, both project and process strategies must be developed for a wide range of adverse events that the community is likely to experience and must be adaptable to various community needs, sizes, and types.

In general, the literature on resilience seems to recommend that civil society needs to play a more active role by engaging individuals, households, communities, and local governments (e.g., mobilizing social capital) in decision making through participation, collaboration, and collective action toward resilience building. Communities need to be more proactive by being able to map their own strengths and weaknesses. A framework based on such principles is the community-owned vulnerability and capacity assessment approach mentioned in Chapter 10 (Greene 2007).

It is important to note that abilities, skills, behaviors, and attitudes are needed at the community level to do the following:

- Convey that mitigation measures before an event determine what happens after an event,
- Mobilize all key actors along with outsiders to the community,
- Communicate community risk and uncertainties,
- Put structural and nonstructural measures in place, and
- Respond and recover from an event.

Such community attributes rarely exist, even in the developed world. In view of such complexity, more often than not, communities faced with the prospect of adverse events prefer the status quo of not changing what they are doing, or of using makeshift approaches rather than developing new comprehensive ones. This method may work for a while, until a major event strikes.

In the United States, several strategies have been proposed to make individuals and communities become more aware of (1) disasters and their effects; (2) the need for preparation; and (3) the decisions that need to be made during and after an event (e.g., strategies developed by the San Francisco Department of Emergency Management, the Aidmatrix foundation, and the Community and Regional Resilience Institute). They acknowledge that community resilience cannot rely only on government and external aid and that collaborative actions between bottom-up actions and top-down actions need to be developed, while protecting the most vulnerable. According to the Communities Advancing Resilience Tool (CART) proposed by Pfefferbaum et al. (2011), community resilience encompasses four interrelated domains:

- Connection and caring, which is about relatedness, shared values, participation, support systems, equity, justice, hope, trust, and diversity;

- Resources, which includes various forms of capital (e.g., social, economic);
- Transformative potential, which covers data collection and analysis of various forms of capital; and
- A fourth domain specific to the vulnerability that the community is facing (e.g., violence, epidemic, water, sanitation, shelter, or food shortage).

The lack of motivation of communities in the developed world to put into action a culture of resilience, despite clear evidence that such culture would pay off many times over (NRC 2012), occurs in part because there is "no simple 'blueprint' for constructing resilient communities" (Norris et al. 2011) and that people perceive risk and respond to it differently. Another reason is that building resilience takes time and requires dealing with substantial tangible and intangible issues in acquiring human and economic resources. Furthermore, the research community studying resilience does not seem to have an agreed-upon strategy. For some researchers, community resilience can be broken down into subcategories that are addressed separately. For instance, Cutter et al. (2010) consider five forms of resilience: social, economic, institutional, infrastructure, and community capital resilience. Others only consider physical resilience and social resilience. Tierney (2008) considers four resilience domains: technical, organizational, social, and economic. One common denominator in all these approaches is that they emphasize the idea that resilience is about community-acquired capacity in its many forms. But they fail to take into account the relationship among the various categories of acquired capacity and any associated synergy.

Clearly resilient communities, characterized by increased capacity and decreased vulnerability, are less at risk to see their acquired level of development erode away and are better prepared to embrace more development. As seen in Chapters 9 and 10, both capacity and vulnerability can take multiple forms: institutional, human resources, technical, economic and financial, energy, environmental, social, and cultural. According to the Tearfund (2011), they involve various issues: individual, social, natural, physical, and economic. Understanding how these various categories (and others more specific to each community) interact in a systemic way at the community level during normal and new normal conditions after an adverse event is critical to building resilient communities and developing risk strategies to cope with hazards (Sherrieb et al. 2010).

11.2 Resilience to Major Hazards and Disasters

One cannot talk about sustainable community development and the resilience of developing communities without addressing the vulnerability of poor communities to major hazards and disasters, which are extreme adverse events. There