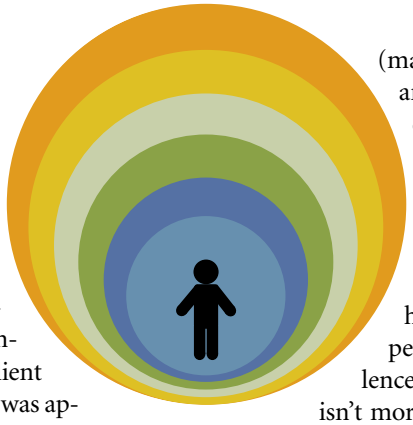
Whether on the road or confronting economic, natural, or health risks, local conditions can pose obstacles to proactive risk management.

CHAPTER 2

Beyond the ideal: Obstacles to risk management and ways to overcome them



Missed opportunities for good risk management

Nearly every year, Mumbai is hit by heavy rains, and for years, reports have spelled out precisely what to do to reduce the risk of flooding. Twenty years ago, a master plan (the Brimstowad Report) provided a list of recommendations to make the city more resilient to floods, and nearly $200 million was approved to implement the plan. But 12 years after the report was published, in 2005, only a fraction of this sum had been spent. Then an exceptional monsoon event hit the city. Almost half the average yearly rainfall fell in a single day, leaving in its wake more than 400 deaths and extensive damages to buildings and infrastructure. After the 2005 devastation, the government established a fact-finding committee (the Chitale Committee) to investigate the causes of the disaster and propose solutions. Perhaps not surprisingly, their recommendations were very similar to those of the Brimstowad Report. These measures were supposed to be implemented by 2015. But as of 2012, only about one-fourth of the 58 projects in the 1993 Brimstowad Report had been completed, while the tendering process for four major projects had not even begun.[1] The city remains highly vulnerable to the heavy rains that occur almost every year, despite well-identified solutions to reduce the risk (photo 2.1).

As in Mumbai, many crises—in many countries, in many sectors, and at many scales—are repeated that could have been prevented or at least mitigated (map 2.1). Significant progress in risk analysis has been made in recent decades, thanks to new tools such as remote sensing and satellite imagery, better weather forecasting systems allowing for more reliable warning, new epidemiological knowledge to better target public health interventions, and more experience about how to deal with violence or macroeconomic crises. Why isn't more being done with this knowledge? As the Mumbai story illustrates, even the first "no brainer" actions such as cleaning up the drainage system are sometimes challenging to implement. To cite some other distressingly common examples: Hand washing is unquestionably a good investment in good health; nevertheless, individuals often fail to do it. Early warning systems provide a cost-effective means of mitigating the damage from natural hazards, with benefits exceeding costs by a margin of four to one at the global level, but investment in and implementation of early warning systems remain limited.[2] There is widespread and vigorous consensus on the damage caused by excessive risk taking in the financial sector, but implementing strong regulations has proven difficult. On the other hand, sometimes too few risks are taken, as when firms are reluctant to take on the risk of innovation for new products or technologies, when farmers do not shift to planting more productive seeds, or when banks refuse to finance viable but risky economic activities. In all these cases, desirable steps to manage risk are not taken, leading to an excess of risk taking or an excess of prudence.

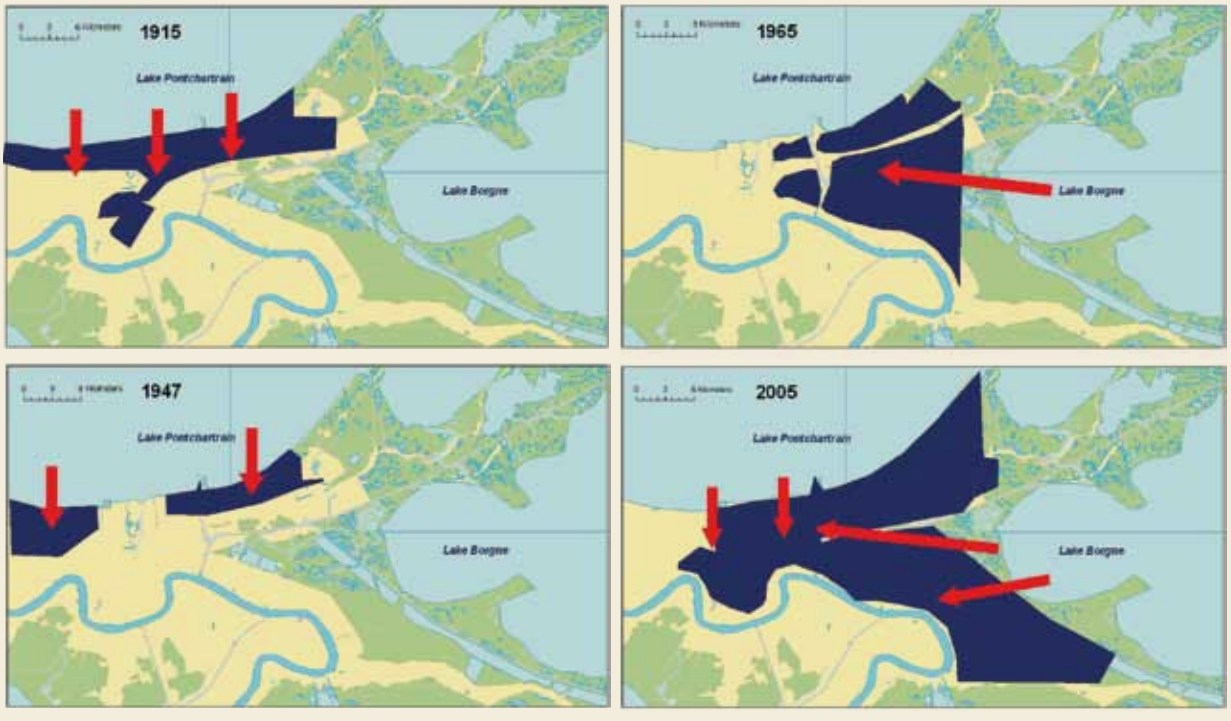
PHOTO 2.1 Difficulties implementing known and even low-cost solutions. Cleaning clogged drainage systems would mitigate the risk of flooding. However, such well-identified and cost-effective solutions often fail to be implemented. The Mumbai case illustrates a common problem (as seen in this picture from Jakarta).

This lack of action suggests that the risk management framework introduced in chapter 1 is an ideal and that its implementation, in practice, is impaired by a number of obstacles. The main ones include lack of resources and information, biases in behavior, and constraints that can be traced to social norms, market failures, and governance shortcomings. Fortunately, public action can help alleviate these constraints, especially by focusing on cost-effective interventions and general capabilities, improving coordination across levels of government and between the public and private sectors, and aiming for robust and adaptive policies in areas of deep uncertainty (glossary 2.1).

A public risk management strategy involves more than simply identifying and assessing risks. Indeed, the mere existence of a risk—even a large one—does not mean that public action is necessary. If individuals and firms are taking this risk based on an informed assessment of its potential costs and benefits and are able to cope with the consequences, there is no reason to prevent them from doing so. On the other hand,

MAP 2.1 ***Crises repeat themselves in the absence of effective prevention***

Flooding has resulted in widespread damage in New Orleans for more than 90 years.



Source: Grossi and Muir-Wood 2006.
Note: Red arrows indicate the breaches in the levees. Blue areas indicate areas flooded by hurricanes.

GLOSSARY 2.1 ***Economics terms used throughout the Report***

Asymmetric information	A situation in which one party in a transaction has more or better information than another party.
Adverse selection	A situation in which asymmetric information leads agents with privileged information to try to select products and services on advantageous terms, possibly skewing the transaction in their favor.
Common-pool problem	The problem that arises when individuals overuse common resources to which they have unrestricted access.
Coordination failure	A situation in which decision makers reach an outcome that is inferior because they are unable to jointly choose strategies that would result in a preferable outcome.
Deep uncertainty	A situation in which parties to a decision do not know or cannot agree on the key forces that shape the future, the probability distributions of the main variables and parameters in their models, or the value of alternative outcomes.
Moral hazard	A tendency for people to act less responsibly when they are protected from the harmful consequences of their behavior.
Myopia	A lack of long-range perspective in thinking or planning.
Principal-agent problem	The problem that arises when agents pursue their own goals, even when doing so entails poorer outcomes for the principals on whose behalf the agents are supposed to act.
Time inconsistency in policy	A situation in which policy makers announce policies in advance to influence the expectations of private decision makers, but then have an incentive to follow different policies after those expectations have been formed and acted upon.

Source: WDR 2014 team.

public action is needed if individuals and firms cannot manage a risk or its consequences properly. That is the case, for instance, if they take a risk without the proper information, if they cannot manage the consequences if the risk materializes into losses, or if the people or groups taking on the risk are not the same ones who would be affected by the loss.

Accordingly, the development of a public risk management plan should be based on the identification, prioritization, and correction of practical obstacles to risk management. This chapter therefore presents a typology of these obstacles, as shown in diagram 2.1. It suggests a methodology to prioritize the obstacles that require public action, starting with "soft" options based on institutional arrangements, communication and information campaigns, and behavioral approaches, and then looking at costlier approaches such as providing public goods (like dikes and drainage systems).

Many crises that occur repeatedly could be prevented with existing means—but even simple "no brainer" actions can be challenging to implement.

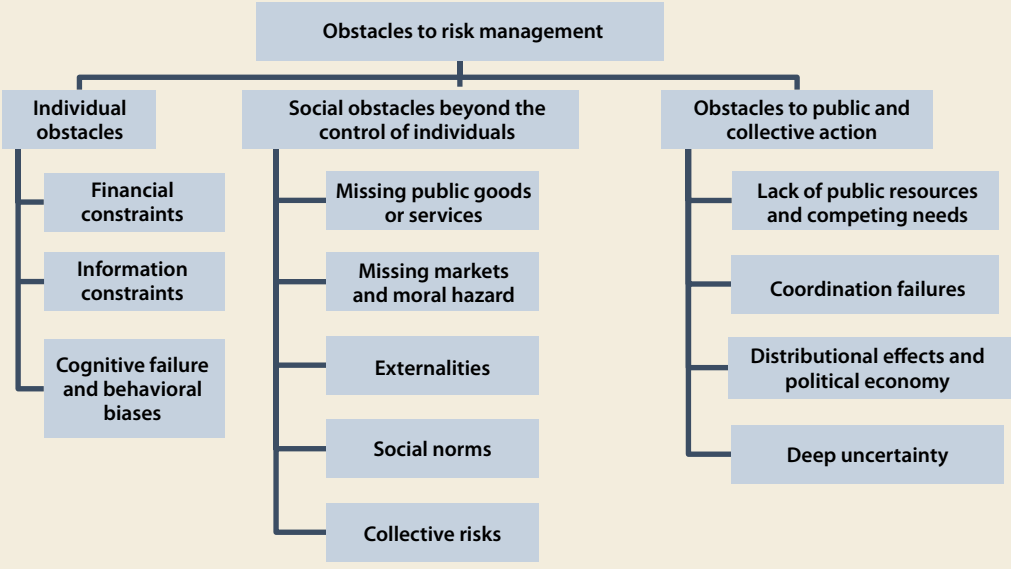
Why aren't people better at managing their own risk?

Ideally, people, firms, and organizations would manage the risks that are within their own capacity. They are best placed to estimate which risks are worth taking (such as moving to the city to find better-paying jobs and better public services) and which ones are too costly if things go wrong. Yet they face many obstacles in their assessment of and preparation for risk.

People may lack information and resources

Financial constraints. Lack of income, assets, and resources often hinders risk management, especially for the most vulnerable in developing countries. Even though some options for risk management are cheap or even almost cost-free (driving safely), others can be expensive. People would prefer to live in earthquake-proof houses, but the construction costs may be too high. Even when a risk mitigation investment is cost-effective from an economic perspective, people or firms may find it difficult to finance because of large up-front costs and limited access to credit. Households that have limited resources and are therefore more vulnerable to risks and more severely affected by losses may face poverty traps. Because of this higher vulnerability, they cannot accumulate the necessary resources for protecting themselves from further losses in the future (see chapter 3). These

DIAGRAM 2.1 *Individuals, firms, and countries face many obstacles in managing risks*



Source: WDR 2014 team.

effects may even occur at the macro level, when, for instance, immediate reconstruction needs after natural disasters crowd out longer-term development investment at the community or regional level.

Information constraints. Information may exist but may not be available to or known by the people who have to make risk-related decisions. For instance, only 31 percent of people living in areas prone to flooding in the United States were aware of this risk, and only 33 percent knew that federally backed flood insurance was available, a 2010 survey by the Federal Emergency Management Agency revealed.[3] Investors and banks may not have the knowledge to evaluate a loan application regarding innovative projects, leading them to reject profitable projects and thus constraining creative risk taking and innovation.[4]

Progress has been made in making information more widely available in many areas. New information and communication technologies help people access complex information from nearly anywhere on the planet. Data collection and access remain insufficient, however. Because information has aspects of a public good, it is underprovided by private actors; thus states have a large role in producing and disseminating it. Some countries have not made sufficient efforts in this direction, notably where data are not available for free—or not available at all. Hydrometeorological services, for example, often have to rely on revenues from the sale of data to strengthen and maintain their observation networks. As a result, the cost of one meteorological observation in Europe varies from zero (in Slovenia) to 0.40 euros (in Romania).[5] Costly data restrict access to valuable information and reduce the social benefits that are derived from them.[6]

People struggle to translate knowledge into action

Individual decision making in practice can veer quite a long way from the basic, idealized assumptions of economic theory, such as the "maximization of expected utility." To the extent this gap is linked to individual preferences and values, it is not a reason for public action. But part of the gap stems from the limited time and capacity people have to process information on risks and to decide which risk prevention measures they will implement. As a result, they sometimes make decisions that go against their own interests and preferences; this latter issue may justify public action.

A variety of studies shed light on just how inconsistent and incomplete people can be in their evaluation of risk (box 2.1). People are biased toward the status quo and tend to choose the default option. For

BOX 2.1 *The irrational, the uncertain, and the short-sighted: Some classic experiments reveal surprises about people's behavior*

A well-established economics concept known as expected utility theory holds that people try to maximize their expected gains. Yet in practice, when faced with risk and uncertainty, people behave differently, some classic experiments show. The first experiment reveals that people are very averse to uncertainty. They value a gain that is a "sure thing" more than one that is uncertain, beyond what would be predicted by the theory. In this experiment, individuals must choose between different lotteries, shown in table a. In the first choice, most people (65 percent) chose the first option. In the expected utility framework, this means that the benefit (or "utility," in economic terms) of winning $4,000 is larger than four-fifths (20 percent versus 25 percent) of the benefit of winning $3,000. But in the second choice, most people (80 percent) chose the "sure thing," even though in the expected utility framework this would mean that the benefit of winning $4,000 is *lower* than four-fifths of the benefit of winning $3,000 (80 percent versus 100 percent)—a direct contradiction of their first choice. This aversion to uncertainty—beyond what risk aversion in the expected utility theory would suggest—may be one reason behind the underinvestment in innovative projects and entrepreneurship, relative to other forms of more secure income.

The second experiment reveals that people are not able to process differences between small probabilities and so consider all low-probability events to be equally likely (table b). In the first choice, participants can select from two lotteries, each of which provides the same expected payoff. An overwhelming majority (86 percent) selected Lottery 2. This shows that, in general, people's decisions account not only for the expected outcomes but also for the associated probabilities. However, the second choice shows that they do not do so when probabilities are very small. As in the first choice, expected payoffs are the same for both lotteries, and the probability associated with the lower payoff is twice as high as for the higher payoff. In the second choice, however, the majority of participants opt for the choice with the higher payoff, rather than the choice with the higher winning probability. These results show that people treat high and low probabilities differently, which may explain why people are less likely to make investments to reduce the risk of low-probability events at the margin (such as investing to reduce the risk of a building collapse in an earthquake) or to make desirable trade-offs between different low-probability risks.

A third experiment shows how people's decisions depend on what they consider "the default situation." Again, people are asked to choose from two lotteries. This time, the chances of winning or losing are equivalent, but the amounts that can be won or lost differ. First, they are given $1,000 and must choose between definitely winning another $500 or having a 50 percent chance of winning another $1,000; 84 percent of the respondents select the sure outcome. Second, they are given $2,000 and they must choose between definitely losing $500 and having a 50 percent chance of losing $1,000; 68 percent of respondents select the latter lottery. Respondents react differently to the two choices, even though they are perfectly equivalent.

This experiment illustrates the role of the reference points. It also shows that individuals are often risk averse with gains and risk seekers for losses. Depending on whether the reference point is the best possible outcome (and the only possibility is a loss) or the worst possible outcome (and the only possibility is a gain), individuals will make different choices. Insurers have known for a long time that people are more likely to buy insurance if their reference point is the occurrence of a disaster.

a. People are averse to uncertainty in a way that contradicts expected utility theory

	First choice		Second choice	
Lottery properties	**Lottery 1**	**Lottery 2**	**Lottery 1**	**Lottery 2**
Lottery option	20% chance of winning $4,000, 80% chance of winning nothing	25% chance of winning $3,000, 75% chance of winning nothing	80% chance of winning $4,000, 20% chance of winning nothing	100% chance of winning $3,000
% of participants who choose the lottery	65	35	20	80

b. People treat high and low probabilities very differently

	First choice		Second choice	
Lottery properties	**Lottery 1**	**Lottery 2**	**Lottery 1**	**Lottery 2**
Lottery option	45% chance of winning $6,000, 55% chance of winning nothing	90% chance of winning $3,000, 10% chance of winning nothing	0.1% chance of winning $6,000, 99.9% chance of winning nothing	0.2% chance of winning $3,000, 99.8% chance of winning nothing
% of participants who choose the lottery	14	86	73	27

Source: WDR 2014 team based on Kahneman and Tversky 1979.

PHOTO 2.2 A preference for large voluntarily chosen risks compared with small externally imposed ones. People may take on large risks for their hobby (such as high-altitude mountaineering); however, they may find a much smaller risk to be unacceptable if it is imposed on them by others (such as the construction of a chemical plant in their neighborhood). © Gordon Wiltsie/National Geographic

example, the proportion of organ donors in countries where being a donor is the default choice (and people must opt out if they do not want to be donors) is nearly 60 percent higher than it is in countries where people must opt in to become donors.[7] People usually attribute a higher weight to rare events, but they also simply neglect the possibility that very rare ones will occur.[8] Individuals disregard the possibility of very bad futures, possibly because of the stress created in thinking about them.[9] There is also a difference in how people weight the individual risk they chose for themselves (when they drive, hike, or skydive) and the collective risks that are imposed upon them (when a chemical plant is built in their neighborhood): even if the benefits are similar, the level of risk is usually perceived to be higher when risks are imposed or when individuals feel they have little control over these risks (photo 2.2).[10] To account for this difference, the French government recommends that the cost-benefit analyses for investment in transport safety value one death avoided in public transport 50 percent higher than one death avoided in individual car accidents (1.5 million euros versus 1 million euros).[11]

People, including policy makers, make many decisions in the face of risk by using heuristics (rules of thumb) or by following social norms, instead of making deliberate calculations to identify the best option.[12] People use risks they consider similar to guide their decisions. That is why the "availability" of similar risks can explain why people care more about some risks and less about others. For example, because of their experience with the mad cow disease crisis, Europeans may be more concerned than Americans about nontraditional food production techniques, including genetically modified crops.[13] Education and communication campaigns and the provision of information in a form that individuals can easily process are thus key elements of a risk management strategy. That is why driving rules are learned not only in a theoretical setting but also through mandatory driving instruction, to the point where they become at least partially automatic.[14]

People are often overconfident about avoiding loss: they think they are able to drive safely under the influence of alcohol, and they think they can manage a flood and do not need to evacuate. They also have short memories about catastrophes, they discount the future too much and in inconsistent ways, and they fail to account for avoided losses that are not observable. After Hurricane Katrina hit New Orleans in 2005, the number of U.S. households with flood risk insurance increased more than three times more rapidly than observed in previous years. However, the average cancellation rate remained unchanged, at approximately 33 percent a year, suggesting a short effect of the disaster on household behavior.[15] A simulation-based study shows that the primary motivator of decisions to invest in protection is the size of losses already experienced, not losses that were avoided.[16] This tendency leads to a "paradox of protection": when protection against frequent events suppresses losses for an extended period of time, vigilance and risk awareness decrease. That leads to insufficient maintenance of protective measures and high investments in risky areas, resulting in future losses (and losses of increasing scale) if protections collapse or are overwhelmed by an exceptional event.[17] This lack of consistency in decision making is not unique to risk management; it also explains why individuals have so much trouble meeting their own objectives (such as a New Year's resolution to exercise more). It is why people often try to create irreversibility in their choices, by raising the cost of failing to reach their objectives (such as paying a high annual fee at a gym).[18] In many developing countries, this search for irreversibility also helps explain why people save "in kind." For instance, people protect their savings from capture not only by their extended family but also by themselves by slowly advancing the construction of a house each time resources become available, even

though this practice is a very inefficient and risky way of saving.

These biases in behavior have consequences for the design of effective risk management policies. Excessive discounting of the future, short-sightedness (myopia), and the tendency to stick to the default option can, for example, explain insufficient saving where individuals are allowed to opt into a retirement saving scheme. The biases can also explain why flood insurance reaches large penetration only in countries where it is compulsory or during short periods of time following disasters. These biases can justify specific interventions, from tax incentives to compulsory enrollment in insurance or pension schemes. In this context, conditional cash transfer programs (for instance in Mexico and Brazil) have proven to be highly successful in helping individuals managing their health risks. By requiring compliance with certain behavior—such as adhering to a prescribed vaccination schedule for children—in order to receive a monthly cash transfer, such programs create a direct monetary incentive for taking socially and individually beneficial actions to reduce risk, such as medical treatments and checkups. Thus such programs can overcome the constraints discussed above (from resource and information constraints to behavioral biases and a tendency to postpone nonurgent medical checkups indefinitely); they thereby help reduce health risks for vulnerable individuals, their households, and their wider communities.

Obstacles beyond the control of individuals hamper their risk management

Missing public goods and markets, and even social norms, may prevent people from managing their own risk taking. Above and beyond individual risks, some risks are systemic and therefore cannot be managed without collective action.

Individuals must cope with market and government failures

Missing public goods and services. Public goods and services that provide an essential foundation for people's risk management are often missing. From the point of view of investors, for instance, risk can be managed only if contracts can be enforced, which requires the rule of law and an effective judiciary. Health insurance is of little use if poorly regulated health care providers are not competent or if the right medicine is not available. The low quality of road infrastructure is responsible for a fraction of the higher rates of traffic deaths observed in developing countries. In Poland, the number of crashes at "black spots," where accidents are frequent, decreased by 35 percent when danger signs were posted.[19]

Many risk-related decisions rely at least partially on basic infrastructure. The landfall of Hurricane Katrina in New Orleans in 2005 illustrates both the success of a road-traffic evacuation plan—the evacuation was quicker and smoother than previous ones for inhabitants who owned a car—and the failure to evacuate the population that relied on public transportation.[20] The lack of sanitation infrastructure is a major obstacle for individuals to manage their own health risks. For instance, in India open defecation and the absence of sanitary facilities in poor households have been shown to be a key reason for child stunting.[21] Stunting can have a significant impact on adult health, productivity, and economic prospects, and thus on development opportunities. Accordingly, as long as sanitation infrastructure is not provided, individual behavior changes and development programs such as child nutrition interventions are likely to have limited positive impacts. This example illustrates a general point: the importance of providing basic infrastructure as a basis for the success of further individual and collective risk management policies (photo 2.3)

Complicating matters, some people may be excluded from public services for risk management

PHOTO 2.3 Good infrastructure is needed for people to manage their risks. Thanks to a national project, people in Woukpokpoe, Benin, have gained access to safe, clean water, which enables them to manage health risks more effectively.

because of their gender, ethnicity, political affiliation, or lack of education or literacy. In Peru, for instance, legal proceedings are held only in Spanish, while many farmers speak only Quechua and Aymara, making it difficult for them to rely on the judiciary system to protect their rights and manage their risks.

Missing markets and the problem of moral hazard. Missing markets and instruments, such as insurance and hedging markets, are key obstacles to people's ability to manage risk. Even where instruments exist, they may be plagued by market failures. Insurers offer low-deductible (and higher-premium) policies to satisfy clients with high risk aversion. In Israel, however, it has been shown that "bad" drivers who have more accidents chose these policies more than average drivers. This is a classic case of adverse selection. The fact that people who are more vulnerable are likely to buy more insurance than individuals who are less vulnerable—and that insurers lack information about who is and is not more vulnerable, and thus cannot charge more to riskier customers—increases the cost of insurance for everyone, creates affordability issues, and limits the benefits from risk sharing.[22] The state may need to intervene to promote the creation of markets and instruments and to regulate them in a way that supports individuals in their management of risk.

Identifying risks is not enough: the obstacles to risk management must also be identified, prioritized, and addressed through private and public action.

Not all risks can be covered, however. Nonmonetary losses, such as health and psychological impacts or personal objects and photographs lost during floods or fires, can rarely be fully compensated. After the Bihar floods in India in 2008, for instance, the elderly suffered from depression more often than they did before the floods.[23] Even if all impacts could be compensated, doing so would remove all incentives for individuals and firms to mitigate risks themselves and would increase both adverse selection and moral hazard (the fact that insurance reduces the incentive for people to protect themselves against risks) and would therefore magnify losses.[24] It is thus rarely optimal to cover losses completely, which is why private insurers and public schemes (or mixes through public-private partnerships) always include a deductible that limits the amount of coverage.

Externalities. The actions of some actors may increase risks for others or reduce their incentives to manage their own risk. Overuse of antibiotics by some may make some harmful bacteria more resistant to treatment, threatening the health of all.[25] A firm that introduces a new chemical may create health risks to others, while reaping most of the financial benefit. Disasters cause indirect losses that create externalities.[26] In November 2012, for instance, Japanese automaker Honda cut the factory hours of its U.S. auto assembly workers in Ohio because it could not get parts from Thailand, affected at the time by large floods. Socially optimal risk management in one production unit (as in Thailand) should take into account these supply chain effects and the impact of interruptions in production on the ability of client factories to create value added. Such far-ranging consideration is not normally the case, however, leading to insufficient risk management. Cases like these highlight the need to design and implement public actions (like regulation) or collective action (like supply chain management) to ensure that individual incentives are aligned with collective objectives. The response to the 2011 earthquake and tsunami in Japan offers examples of such collective actions, with clients providing their suppliers free assistance to help them restore their production as quickly as possible.[27]

Social norms. Individual behavior regarding risk management is embedded in social norms, which can present obstacles to risk management—or facilitate it. For example, use of a face mask while sick prevents transmission of disease; in Asia, but not elsewhere, wearing a mask is a commonly followed social norm. By contrast, the "stigma of failure" is a social norm that works against innovation and entrepreneurship. To counter it, some governments and private institutions are rewarding innovation and risk taking, even when it fails: for instance, through the creation of prizes (such as India's Tata Group award of an annual prize for the best failed idea), or tax write-offs for research and development. Specific policy approaches may be necessary when lawmakers challenge a well-established social norm. In the United States, police at first opposed enforcing rape and domestic violence laws, until complementary measures changed social norms (such as "shaming penalties" for rape and portrayals of male violence against women as "cowardly" or "unmanly").[28] Changes in social norms can have many origins and channels. Lobbies and interest groups use communication

campaigns to change perceptions about prevailing social norms. Marketing companies, seeking to maximize sales and revenues, use advertising campaigns to shape perceptions about products and services. Sometimes these campaigns come at the expense of risk management: for example, by encouraging eating and drinking habits that are detrimental to good health. In contrast, public health policies have had great successes in changing norms to improve hygiene and prevent diseases with sanitation or hand washing. Sometimes, changes in norms have unexpected drivers. *Telenovelas* (televised soap operas) in Brazil have had a large influence on fertility choices. The different life styles and ideals presented in the shows have influenced social norms, with a measurable impact on people's behaviors (photo 2.4).[29]

PHOTO 2.4 Changing social norms. *Telenovelas* in Latin America have changed social norms by exposing people to different lifestyles. © Globo Marcus

Some risks are collective by nature

Some risks are systemic—and therefore collective—by nature. Financial crises or economic slowdowns can be managed only at the country or even international level. When industrial policies are implemented to support a technology or a sector, a country takes a macroeconomic and fiscal risk that is socialized at the national level. If the technology or the sector fails, the loss is shared by all taxpayers. Furthermore, in an increasingly interconnected world, many risks, such as pandemics or financial crises, are now global. In all these cases, risk must be managed collectively, using public goods and services such as protective infrastructure, health care systems, financial regulations, and macroeconomic management. Many natural risks, especially in areas of geographically concentrated infrastructure and high density, also call for collective management. Because of various synergy effects, economic production and infrastructure tend to agglomerate geographically, often in at-risk zones such as coastal areas or river flood plains.[30] Moreover, protection infrastructure is "lumpy," meaning that it cannot be increased continuously and progressively—it often consists of a complex system (such as multiple rings of dikes and pumping stations) and it requires planning, is expensive with large up-front costs, and usually covers large areas. As a consequence, individuals or firms cannot provide hard protection to their houses or production facilities independently of what is put in place at the collective level. Thus managing natural risk is at least partly a collective issue.

In cases requiring collective action, the definition of the acceptable level of risk needs to be made at the social level, through a political process. Even though policy makers often claim that "disasters are unacceptable"—especially after a catastrophe—canceling all risks would be prohibitively costly. Thus a certain amount of risk must be accepted.[31] Defining an acceptable level of risk is difficult because of the complexity of some issues (box 2.2) and because preferences, values, and beliefs may differ widely. Some individuals are more risk averse than others and may prefer a more precautionary approach. Individuals use their "world views" as cognitive and emotional filters that influence how they perceive and act with respect to risky situations, and as a way of simplifying decision making. Working in a cultural theory setting, a study classified U.S. individuals according to three fundamental world views—"fatalist/hierarchical," "individualist," or "egalitarian"—and showed that these views largely explain people's preferences concerning many technological and environmental risks, such as nuclear energy, genetically modified crops, and climate change.[32]

Because factors that influence how people process information about risks are embedded in fundamental beliefs, judgments about these risks can differ markedly within a country and even more across countries. At the international level, strong disagree-

BOX 2.2 *Strengthening the interaction between experts and policy makers to improve risk management*

Many risk assessments are based on a classic risk matrix that represents the potential impact of an event on the horizontal axis and its likelihood (probability of occurrence) on the vertical axis. The risk can be considered "intolerable" if its likelihood and potential impact are too high; "acceptable" if both factors are low enough; or "tolerable," in the sense that it is not desirable to suppress it, but it nevertheless needs be managed or reduced (figure).

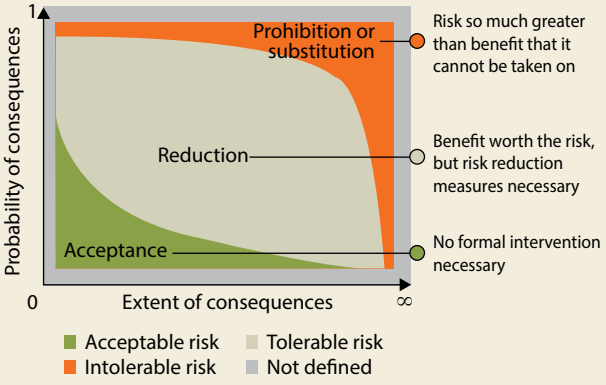
Scientists and other experts alone cannot define what risks are acceptable; they lack legitimacy to do so. Nor can policy makers by themselves define what risks are acceptable; they usually lack technical expertise. Thus closer and better interactions between science and policy are needed to codefine what is acceptable, tolerable, and intolerable.

Different countries have introduced different institutional systems to reach these definitions, in line with their political culture. Some countries (the United States) use what is referred to as an "adversarial" system, in which there is an open, procedure-based, and transparent confrontation of viewpoints, and the outcome is determined through a legal process. Other areas (parts of southern Europe) rely on a "patronage" system, in which a public entity is in charge of assessing risks, relying on in-house experts and processes, with little public scrutiny and participation. Finally, a "consensual" or "corporatist" approach is more common in northern Europe, based on closed-door negotiations between regulators and stakeholders, with little public control and the aim of creating compromise.

The adversarial system is better able to manage uncertainty and ensure accountability; however, this system is also very costly, may exclude some stakeholders, and is not able to benefit from collaboration and information exchanges between the regulator and the regulated private actors. In the U.S. system, for instance, regulation tends to occur only after the damage is done. Lawsuits for damages cost U.S. industry 1.9 percent of GDP ($180 billion) annually, in contrast to the United Kingdom, which has a more consensual system, and where liability costs industry less than 0.5 percent of GDP.[a]

Recent work suggests the existence of considerable flexibility in the type of risk regulations that can be implemented, regardless of the political and legal culture.[b] Regulatory instruments are disseminated and hybridized to make them appropriate for different country contexts, helping improve risk regulation globally.[c] In practice, most countries have tried to adapt risk regulation instruments to their cultural and institutional settings, in an effort to balance the cost and the transparency of their risk management institutions.

A risk matrix can be used to map hazards according to their probability and impact



Source: WDR 2014 team adapted from Renn and Graham 2005.

Source: WDR 2014 team based on Renn and Graham 2005.

a. Loewenberg 2006.
b. De Francesco 2012.
c. Wiener 2013.

ments over acceptable levels of risk have led to trade disputes involving high-uncertainty risks such as beef hormones, mad cow disease, and genetically modified crops. An in-depth comparison of risk regulations in the United States and Europe highlights the role of cultures and world views on risk management practice, as well as the complexity of the matter, with European governments showing more risk aversion than the United States for some risks (beef hormones), but less for other risks (mad cow disease).[33] The difficulty in defining an acceptable level of risk in a given context means that prescriptive recommendations concerning risk management are very sensitive issues and need to be issued with caution.

Defining a social level of acceptable risk is also difficult because of differences in individual or collective sensitivity. Such differences are particularly important for health issues; some individuals are far more sensitive to pollutants than others, for instance. Investigating health effects of one type of air pollution (particulate matter), a study concluded that the most susceptible people (those in the 99.9th percentile) would feel negative effects at exposures only 0.2 to 0.7 percent of the level that would induce the same effects in people of median susceptibility.[34] In the presence of such heterogeneity, designing homogenous regulations is challenging and highly dependent on considerations of equity (especially when sensitivity is correlated with other social factors). The selected regulation is also unlikely to satisfy all individuals. The same problem exists at the international level. For instance, the international community committed to avoid "dangerous climate change" as long ago as 1992, through the United Nations Frame-

work Convention on Climate Change. Countries have very different exposures and vulnerabilities to climate change, however, and thus have different views of what a "dangerous" change is, making it more difficult to reach an agreement on greenhouse gas emission reductions (see chapter 8).[35]

Why aren't states better at filling in the gaps?

Countries—or the international community—could do much to help people overcome obstacles to their management of risk, and these actions can be very cost-effective and supportive of development and poverty alleviation, as discussed in chapter 1. Correcting market failures and other social obstacles to realign the incentives of individuals with the goals of society is one of the main roles of governments and local authorities. Yet this help often does not happen, or it happens in a very imperfect way that can make risk management counterproductive or excessively costly. States face large obstacles themselves and have competing priorities that do not focus on managing risks and fostering resilience. First, decision makers and policy makers, as individuals, are susceptible to the biases that have been described earlier. For instance, they tend to have short memories and have a short-term bias, they tend to misestimate low probabilities, and they use rules of thumb and social norms instead of rigorous risk assessments to make many decisions. But obstacles to public action go beyond the obstacles to individual decision making, and include many other government failures.

Defining a government failure is difficult, however.[36] A government failure can be defined as a situation where the government does not operate in the public interest—that is, the interests of the taxpayers and the users of public services—but in the interests of "narrow interest groups who are able to exploit a privileged position for their own benefit."[37] This definition links government failure with capture by interest groups. Here, four broad categories of government failures are discussed. The first is linked to *insufficient resources and capacity* and to the involuntary implementation of government actions that are less desirable than what could be achieved. The second is related to *coordination failure* (within government or between public and private actors), including policy capture, such as a government that is manipulated by an interest group to introduce regulation that is detrimental at the social level. A third category is linked to *political economy issues* and voluntary decisions by the government to favor a subset of the population at the expense of the rest and for its own benefit (for example, a government provides protection to an industry in exchange for political support, or a regulation is captured by the regulator). A last category is linked to *uncertainty and the impossibility of identifying clear-cut solutions to a problem*—regardless of the capacity, resources, and goodwill of the government—because of lack of knowledge concerning the appropriate course of action; this situation is referred to as deep uncertainty and is discussed further later in this chapter.

Lack of resources and technical capacity hampers public policy

Resource and capacity constraints to pursue risk management can be a serious barrier to public action. The expensive disaster risk preventions that have been implemented in developed countries (such as flood protections in the Netherlands) are out of reach for many similarly threatened developing countries (such as the Arab Republic of Egypt, Bangladesh, or Vietnam). This gap is largely the result of financial constraints, including the lack of financial instruments appropriate for long-term investments with large social returns but limited cost recovery.[38] But it is also connected to the existence of many competing needs in developing countries, from health and education to infrastructure development. In addition, technical capacity is often lacking in developing countries, particularly so in countries where the public sector has well-identified difficulties in retaining its talented and skilled workers. The competencies needed to analyze risks and identify relevant management actions may thus be inaccessible even for governments willing to act.

Lack of resources may weaken institutions and impede enforcement of rules, which in turn may lead to poorly designed or implemented risk management policies. For example, the inability of government to enforce property rights and land titles has a negative impact on risk management: households with precarious tenure risk eviction and are unlikely to invest in risk-mitigating investments such as flood-proofing and earthquake-proofing their houses. They are also unable to use their home as collateral to obtain credit to finance such investments. Corruption often thrives amid weak institutions and is an obstacle to public risk management: for instance, when contractors do not respect building norms for public buildings in earthquake-prone cities. As illustrated in chapter 4, community-based solutions can help in instances when governments

and local authorities are unable or unwilling to manage risks. Where school construction does not respect building norms because local authorities are unable to enforce them, the involvement of the community—and the parents who will send their children to the school—may be a solution. In situations where enforcement and compliance are weak, more effective enforcement of existing building norms can potentially have significant benefits. For instance, insurance experts estimate that insured losses in the United States from Hurricane Andrew in 1992 could have been reduced by 25 percent if building norms had been fully enforced.[39]

Lack of resources not only influences what can be achieved but also the type of solutions and measures that are desirable. For risk management, as for other productive investments, the "best" technology depends on the relative scarcity of production factors. In developing countries where capital and skilled labor are scarce and unskilled labor is underused, risk management solutions will necessarily be different from those selected by more developed countries where capital is cheap and labor is expensive. In particular, risk management strategies are likely to be based more on hard infrastructure (large dike systems) in higher-income countries. The appropriate risk management actions also depend on institutional and enforcement capacity. Where enforcement capacity is limited, strengthening building norms may worsen the situation. Increasing compliance costs can increase the number of noncompliant, high-vulnerability buildings, with an impact on aggregate risk larger than the risk reduction from more-resistant, compliant buildings.

Coordination failures impair risk management

Coordination failures between different state agencies may also hinder risk management. Horizontal coordination is needed to ensure that actions from different ministries are consistent and synergetic. For instance, the ministry of finance may create and regulate a health care insurance system, but the usefulness of the insurance will depend on the availability of competent health care providers, a responsibility of the health ministry. Vertical coordination is also crucial because risk management must be shared across different levels (from the neighborhood to the country and the global communities). A public-private insurance scheme (regulated by the ministry of finance at the national level) cannot be designed independently of the implementation of risk reduction measures such as land use plans and building norms at the local level (a task often led by local authorities). In the absence of cross-scale regulations, a "public moral hazard" may emerge, if local authorities rely on national support in case of disasters, reducing the incentive to implement preventive actions.[40]

Coordination is also required between public and private actors. The impact of a flood is highly dependent on the ability of private actors to reallocate resources and the ability of utilities and transport companies to restore basic services. The impact of epidemics is dependent on the ability of companies and organizations to maintain operations with a reduced workforce. In sectors where states often rely on private sector expertise (cyberattacks, finance), public-private cooperation is a critical ingredient in the design of a strategy. Such cooperation is often difficult to establish because of differences in culture and work habits, issues related to privacy and commercial secrecy, risks of capture and rent-seeking behaviors from private actors, and lack of incentives on both sides. The recent financial crisis illustrates the difficulty regulators face in determining the best course of action when their main advisers—professionals from the financial sector—have a large stake in the decision (see chapter 6).

To promote and improve coordination, multiple stakeholders need to be involved in decision-making processes for risk assessment and implementation (box 2.3). Stakeholder involvement is useful not only to disseminate information and increase the acceptability of risk management policies; it is also a means of enhancing the technical quality of the analysis and ensuring that risk management strategies are reasonable and well developed.[41] A collective approach allows the transfer of risks to the actors that are best able to manage them—for instance, because of their access to knowledge and resources. In the management of natural disaster risks, for example, a set of promising initiatives has been implemented to improve coordination, based on the creation of multiministry bodies in charge of information exchange and coordination. The responsibility for risk management is located in the highest office (the prime minister's or president's office) in about 25 percent of the countries and in a central planning or coordination unit in 10 percent of them.[42] In Peru, the responsibility for disaster risk management resides in a new agency within the president's office and is therefore able to coordinate across ministries. The time and resources consumed by coordination actions should not be underestimated, however, and the cost of doing so may be important in countries where

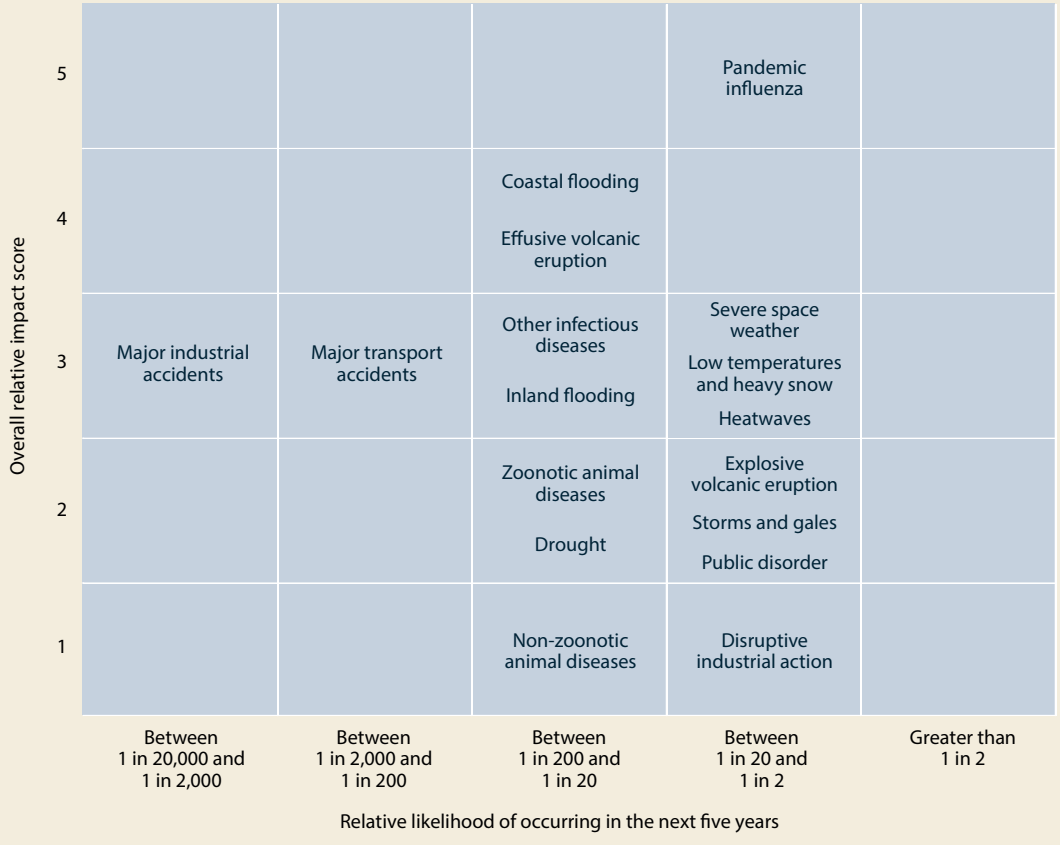
BOX 2.3 *Institutions to improve risk management: National risk assessments*

National risk assessments (NRAs) to improve policy related to preventing and planning for crises and emergencies have been conducted in the United Kingdom and in the Netherlands since 2005 and 2007, respectively.[a] In both countries, NRAs are used to assess the main risks faced by the country, regardless of the type and origin of risk (natural, technological, terrorist, other). They are based on similar approaches: identifying risks, generating scenarios, assessing the probability or plausibility and impacts of the risks, and constructing a national risk matrix. The matrix in the figure summarizes the main risks and organizes them according to their likelihood (x-axis) and severity of impact (y-axis).

Several major benefits emerge from conducting such an assessment. First, it helps with coordination and cooperation across ministries and organizations, thus avoiding "silo" effects. Ministries in charge of one risk (for instance, the ministry of health, for epidemics) have found that the NRA helped them mobilize other ministries to provide information and design their own response plan (for example, the ministry of education needs to set up a response plan to cover the event of many teachers becoming sick). Second, it anticipates trade-offs, helping to avoid conflicts between stakeholders during a crisis. In the Netherlands, that is the case during floods, when several regions compete for access to limited resources needed for emergency management. Third, it helps involve new actors. The private sector has a key role in risk and crisis management, and NRAs have been used to involve them in the development of risk management strategies. Finally, an NRA influences the distribution of resources dedicated to managing different risks.

Following a similar approach, the government of Morocco is considering a multirisk approach. With the support of the World Bank and the Global Facility for Disaster Reduction and Recovery, Morocco has conducted risk assessments in three key areas: natural disaster risk, volatility in commodity prices, and risks in the agricultural sector. The country is seeking to adopt an explicitly integrated approach to assessing its key risks and is now beginning to develop options on how best to mitigate the identified risks, including through developing a national risk management strategy and supporting institutions.

The United Kingdom has adopted a comprehensive risk management framework



Source: Cabinet Office 2012.

Source: WDR team based on Vastveit 2011.

a. Ministry of the Interior and Kingdom Relations 2009; Cabinet Office 2012.

public resources are scarce. That is particularly the case where the public sector struggles to attract skilled and motivated workers.

Political economy problems hinder risk management

Political economy obstacles. Even when resources are available, politicians may be reluctant to devote them to risk management because the costs of risk management are immediate, concentrated, and observable, while the benefits are longer term, distributed more broadly, and often less visible. When regulating the use of new chemicals or the development of a new area, for instance, public decision makers have a strong and immediate influence on the revenues of one or a few firms (when regulating chemicals) or on the value of people's assets (landowners).[43] Affected firms and people will naturally tend to oppose any constraint and be very vocal about it. On the other hand, the people protected by the regulation—people negatively affected by pollution or future buyers of apartments in the newly developed areas—are often not aware that the regulation may eventually protect them and therefore rarely support it. Even more complicated are cases such as climate change, where beneficiaries are not born yet, because the benefit from risk management extends over the very long term (see chapter 8).

The existence of dispersed interests is a classic issue in institution building and is responsible for many government failures, especially when public goods are concerned.[44] Policy trade-offs are often determined by the ability of various interests to organize themselves: for instance, through lobbying organizations. Evidence shows that increasing transparency and providing a voice to dispersed interests help avoid capture by interest groups and improve policy decisions.[45] These political issues have beset many well-known efforts to control risks, such as those relating to asbestos, lead paint, and tobacco. These cases show that powerful lobbies can block health regulation even in the presence of well-established scientific evidence of negative health impacts. They also demonstrate that nongovernmental organizations, scientific organizations, and citizen associations play a key role in bringing these issues to the public and creating broad support for regulating these risks.[46] Risk management is thus more likely to be efficient where strong civil society organizations are able to conduct independent risk audits and assessments and to communicate their results to the wider public. To make these possible, however, the government should ensure free access to data; free dissemination of results through media, the Internet, and social networks; and some legal protection for whistleblowers. Many countries provide protection for individuals who report alleged dishonest or illegal activities that have been occurring in a government department or private company or organization (in the United States, the first whistleblower law was passed in 1863). Recent progress in this direction has been achieved by many countries, including Jamaica and India.

Lack of well-accepted indicators for risk. The lack of well-accepted indicators for risk makes it difficult to measure the performance of decision makers and to hold them accountable for their risk management choices. Controlling and coordinating the delivery of public services is difficult when the potential for competition in quasi-markets—that is, markets created and organized by the government to create competition among public service providers—is limited and when the quality of the service is not easily observable.[47] Health care is a common illustration of this problem: service quality is not directly observable, and results can evolve over the long term and are always very uncertain. Risk management is no different: while forgone profits and lost jobs from a chemical firm can be measured and published, the reduction in risk from banning some potentially carcinogenic product cannot be easily measured. In general, the fact that disaster relief is immediate and pertinent while prevention is less visible and more difficult to measure makes it impossible to enforce the accountability of decision makers, leading to biased spending decisions toward less cost-effective ex post action.

The long horizon of risk management actions and the lack of indicators mean that it is also difficult to use competition to control public risk management. In theory, competition across localities should be an incentive to risk management: localities often rely on local taxes on economic activity, and the risk level can be a determining factor for a private actor who wants to invest in one locality or another. But the risk level is often not directly observable, and decades can pass before a good risk management action translates into a lower risk level. Competition can thus hardly be used to discriminate between good and bad risk management. In such a context, regulatory approaches have high potential.[48] One promising option is the creation of national risk boards in charge of conducting risk assessments and assessing the quality of risk management of various agencies

and organizations (including local authorities and their land use plans) through risk audits and benchmarking (see box 2.3; see also the "Focus on policy reform" at the end of this Report). Risk assessments could be used to create indicators that would help populations reward risk-sensitive policy making; they would also trigger risk-based competition across agencies and localities to encourage good risk management. National risk boards could also help with vertical coordination issues, by mitigating the public moral hazard created by the national support to affected subnational entities.

Preference for one policy in advance but another when the time comes to implement it (time inconsistency). Sometimes after a shock or crisis, a government will have an interest in acting in a way that contradicts its commitments before the event. To cite a recent and major example: to avoid excessive risk taking in the financial sector, the government may promise not to bail out bankrupt financial institutions; but if a large financial institution does go bankrupt, the government will have an interest in bailing it out, regardless of its previous commitments. These incentives reduce the credibility of the entire strategy and create a strong moral hazard issue. These problems are amplified by the lag between the short period of many political mandates and the longer period needed for risk management results to be observable. Disaster relief can even be used opportunistically, by being distributed close to an election or targeted to areas that vote for the ruling party.[49]

Distributional problems. All risk management policies redistribute wealth and power; at their worst, they can harm the poorest and the most vulnerable, raising important equity concerns. For instance, increasing building construction costs to improve earthquake and flood resilience may make it even more difficult for inhabitants of informal settlements to obtain decent housing. In Jakarta, flood- and earthquake-proofing a typical home costs $3,100, on average, only slightly less than the annual per capita GDP in Indonesia.[50] Even excise taxes on cigarettes, an efficient tool to prevent young people from starting smoking and protect them from addiction, have been criticized for their cost to the poor.[51] Complementary policies may be needed to mitigate these negative effects, and the risk management policy mix may need to include redistributive measures to be accepted by a majority and not harm the poorest.[52]

In this context, conditional cash transfers have proven to be able to deliver both distributional benefits to the poor, as well as positive impacts in terms of risk management. The Bolsa Família Program in Brazil, for instance, has not only been a main driver for significantly reducing inequality and extreme poverty in recent years but has also improved individual risk management. The underlying idea of the program is to provide poor households with monthly cash transfers that are conditioned on compliance with certain risk management behaviors, such as completing health check-ups, monitoring growth of children, or pursuing adequate care for pregnant women. The program has been able to achieve compliance rates for these health conditionalities of close to 100 percent, thereby significantly improving the management of health risks of 11 million poor households.

Under deep uncertainty, policies need to be robust in a large range of possible scenarios, and able to be revised as future circumstances warrant.

Uncertainty is sometimes severe

Sometimes, information about how to manage risks does not exist, and decisions involve a condition known as deep uncertainty. These cases occur when experts cannot agree on which models to use (disagreement on how to transfer the results of analyses of the health impact on animals to human beings, for example); on the probability distributions of key uncertain parameters (the probability of a long period without economic growth); or on the values of alternative outcomes (the acceptability of a total loss of the Amazon forest in the event of significant climate change).[53] In such cases, it may be impossible to define a probability for alternative outcomes, or even to identify the set of possible futures (including highly improbable events—like the famous "black swan").[54] Or it can be impossible to reconcile different views through a common estimation of probabilities of different outcomes. A situation of deep uncertainty is different from a situation of "large uncertainty," in which different actors can agree on the probabilities and values of different outcomes, even if the range of possible outcomes is very broad because knowledge is limited. In situations of deep uncertainty, different stakeholders or experts can have divergent opinions and may not even agree on

the existence of large uncertainty. These situations lead to gridlock and lack of consensus, strong political opposition to any action, and therefore to paralysis. They are particularly difficult to manage when large and irreversible damages are possible, when decisions cannot be postponed until more information is available, and when policy or technical options are "brittle": that is, very sensitive to small errors in design.

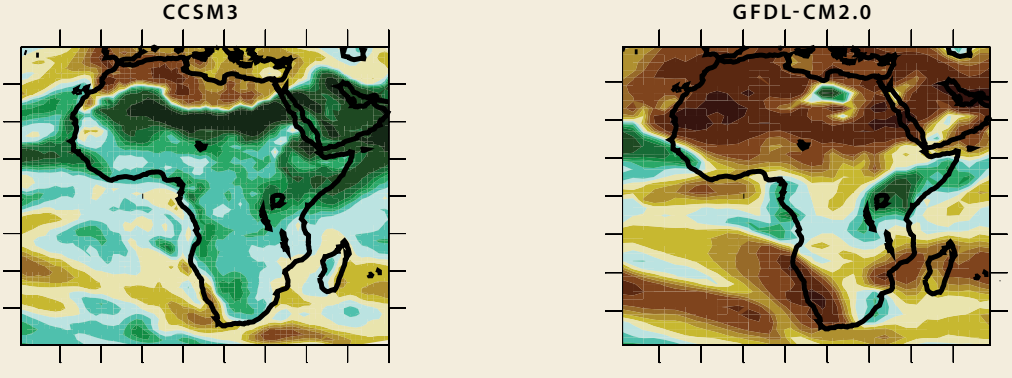
To further complicate matters, uncertainty surrounds not only the risk itself, but also the risk management measures that are implemented and their efficiency and side effects. In practice, anticipating all consequences of risk management policies is impossible, and some policies may have unacceptable side effects or create other risks. The Koka reservoir in Ethiopia illustrates this problem: it was built to store water for agriculture and improve food security, but its impact on the mosquito population and thus on health was not anticipated: as a result, malaria case rates within three kilometers of the reservoirs are 2.3 times as great as for those living six to nine kilometers from the reservoir.[55] Around micro-dams, malaria prevalence is as much as 7 times greater than in the rest of Ethiopia.[56] Such side effects cannot always be avoided and need to be monitored and managed.[57]

Uncertainty is especially deep in "emerging risks" or in areas where scientific uncertainty is the greatest (genetically modified crops, hydropower dams, nuclear energy, climate change). A common example is the uncertainty about future changes in local climates. Different scientific teams develop simulations of climate systems that differ in their technical implementations, but these climate models are based on the same widely accepted laws of physics. And while these models agree on the large patterns of climate change, they can point in opposite directions at the local scale and for some parameters. For example, depending on the model, rainfall in West Africa could increase or decrease by 25 percent by the end of this century (map 2.2). Such uncertainty is clearly an obstacle to the design of water infrastructure able to deal with floods and droughts in the region. The experts' ability to forecast future energy demand has also been disappointing,[58] and few anticipated the rapid technological developments that have occurred in medicine, energy, or information and communications technology.

There are many other examples of cases where experts cannot agree on the assumptions that lie at the heart of their analysis, and thus reach results that cannot be reconciled (a situation labeled "dueling certitudes" by economist Charles Manski). These examples include the evaluation of the fiscal consequences of health care reforms—with large uncertainties concerning how medical practice will evolve—and the impact of various policies to reduce cocaine consumption.[59] In these cases, different stakeholders can rarely come to agreement on the "most likely" future on which planning should be based, or on the "most likely" consequences of a given action. Moreover, doing so would be dangerous if future risks and events deviate from this most likely case.

A special case of deep uncertainty that can paralyze action is regulatory and policy uncertainty (see chapter 5). Firms working on renewable energy tech-

MAP 2.2 ***Deeply uncertain futures: Different climate models project very different changes for precipitation in Africa***



Source: IPCC (Intergovernmental Panel on Climate Change) 2007.
Note: The maps show simulations from two different climate models. The brown areas indicate decreases in annual precipitation. The green areas indicate increases in annual precipitation.

nologies, for instance, are dependent on environmental regulations and policy-determined carbon prices. They are highly vulnerable to policy reversals, and this uncertainty is a major obstacle to taking risk and innovating.[60]

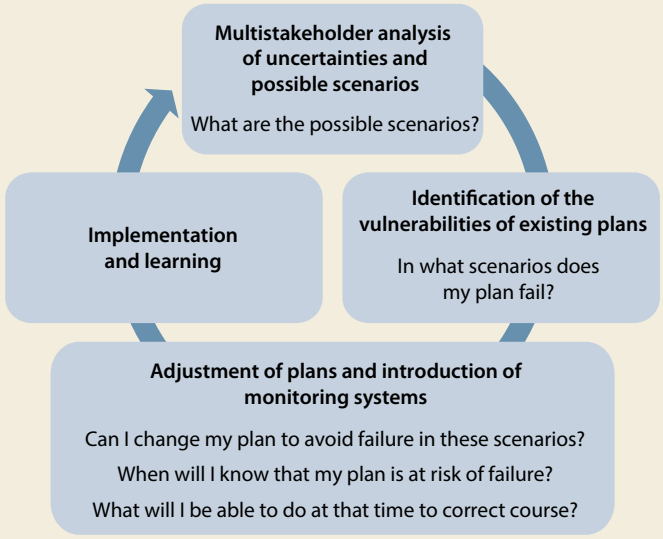
In situations of deep or large uncertainty, many traditional methods for decision making under uncertainty are difficult to apply. And many well-identified biases toward overconfidence and against the provision of estimates of uncertainty become particularly dangerous.[61] Alternative tools are useful for communicating the presence and degree of uncertainty and for finding compromises, more consensual solutions, and options that are less brittle and more acceptable for stakeholders with different beliefs and values. In these cases, it is preferable to implement adaptive and robust policies that lead to acceptable outcomes in a large range of scenarios and that can be revised when new information is available or when the context changes.[62]

Many methodologies have been proposed for designing such policies, and the best approach depends on the context.[63] "Robust decision making" is one of these methodologies. The iterative process, by which multiple stakeholders can identify vulnerabilities and options to reduce them, and then implement them with appropriate monitoring and revision using new knowledge, is shown in diagram 2.2. Its advantage is that all actors do not have to agree on what is the most likely future and on the value of different possible outcomes before a decision is discussed. Moreover, it helps identify the uncertainties that do *not* matter for a given decision, thus focusing the process on what is most important (box 2.4). This approach also explicitly recognizes that different actors have different values and beliefs, and it makes the influence of these values on the decision much more apparent than with other methods (such as the cost-benefit analysis, in which values and preferences are captured in complex valuation techniques). As a result, it helps create a dialogue among stakeholders and facilitates reaching an agreement on solutions that are more widely acceptable.

Above all, decision makers should avoid plans that are designed for the most likely outcomes but that increase the vulnerability to less likely events. Huge dikes built to guard against tsunamis and typhoon storm surges may encourage investment in coastal areas and increase vulnerability to exceptional events that exceed the design level of the dikes.[64] Taking into account extreme cases requires defining a set of scenarios—including low-probability, high-impact ones—and evaluating the robustness of plans and projects in these cases. Often low- or zero-cost options that reduce vulnerability in these extreme scenarios can be identified and implemented. For example, an early warning system is useful even when all floods are supposed to be prevented by hard protections.

A balance needs to be struck between the plausibility of scenarios and the need to explore the range of possible, if uncertain, events. This balance is difficult to define (as illustrated by applications of the precautionary principle, discussed in box 2.5). Decision makers have a tendency to be too conservative in their assessment of what is possible and plausible. The U.K. national risk assessment deals with this issue through the use of "reasonable worst-case scenarios," but there is no objective way of designing such scenarios, and subjective judgment will always be necessary. This subjectivity implies that the development and selection of scenarios must be done by policy makers working closely with experts (see box 2.2).

DIAGRAM 2.2 ***An iterative process of decision making to prompt robust action in the face of uncertainty***



Source: WDR 2014 team.

Putting it all together: A policy sequence

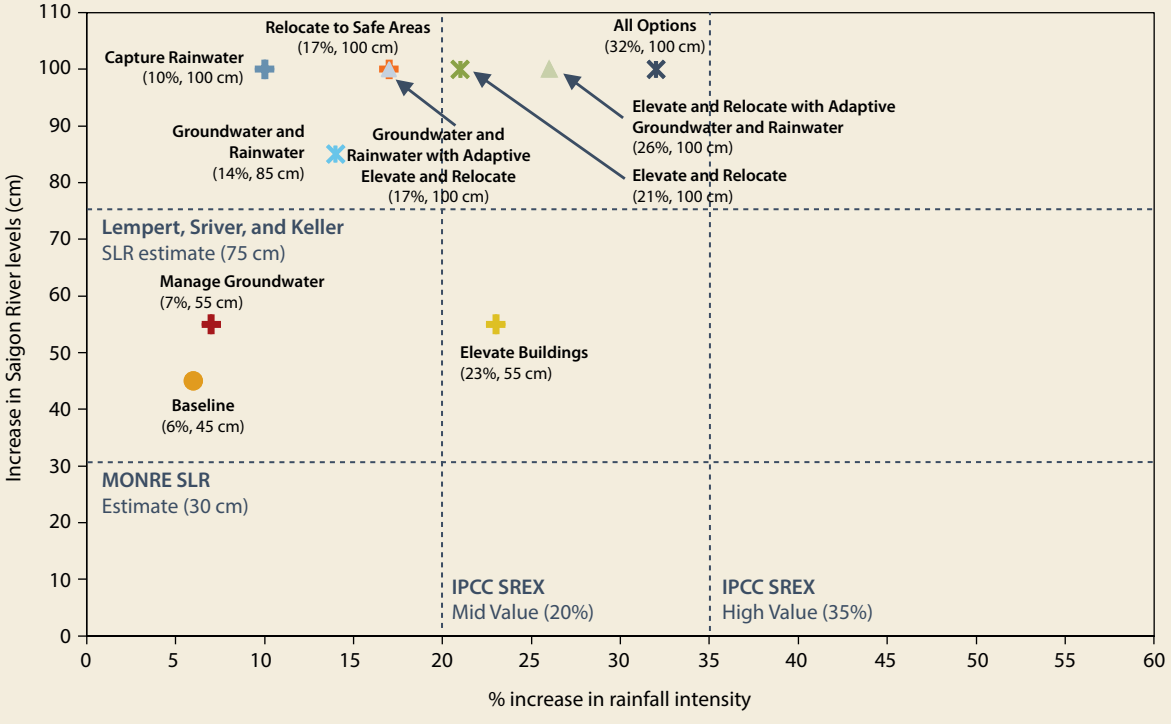
Diagram 2.3 presents a set of screens that aid in analyzing a risk in a given context, starting from the assessment of risk itself. But designing effective public policy must go beyond risk assessment, to analyze

BOX 2.4 *Applying a robust decision-making methodology to deal with the risk of flooding in Ho Chi Minh City*

Ho Chi Minh City, a low-lying and fast-growing metropolis of 7.4 million people, faces significant and growing flood risk. The city's planners are seeking to implement an integrated flood risk management strategy. However, many factors that would affect their choice of strategy are deeply uncertain, such as future population, economic growth, and the effects of climate change on rainfall and the sea level. In partnership with Ho Chi Minh City's Steering Center for Flood Control, researchers undertook a demonstration project to analyze how robust decision making (RDM) could improve flood management, using the Nhieu Loc-Thi Nghe canal catchment area as a case study. The analysis explored 12 different risk management portfolios, each consisting of combinations of options such as raising homes and retreating from low-lying areas. Each portfolio was simulated in 1,000 scenarios, where each scenario consisted of up to six different assumptions about socioeconomic development and climate change in the future.

The RDM analysis found that the current infrastructure plan reduces risk in best-estimate future conditions. Moreover, this plan is robust to a wide range of possible future population and economic trends; the uncertainty surrounding these aspects is therefore not a problem for designing a flood protection system. However, the current plan may not be sufficiently robust to plausible impacts from climate change. Relying exclusively on the currently planned infrastructure ("baseline") would keep risk below recent levels only if rainfall intensities increase by no more than approximately 5 percent and if the Saigon River rises less than 45 centimeters (figure). Various scientific estimates suggest that both these thresholds may be exceeded by mid-century. The RDM analysis considered additional measures to ensure risk reduction for increases in rainfall intensity of up to 35 percent and increases in the level of the Saigon River of up to 100 centimeters. The cost of these measures could be reduced if the city implements an adaptive plan, which adds some measures now and more in the future if needed. The results of the RDM analysis allow policy makers to evaluate robustness gains of certain strategies, and consider the associated trade-offs against their risk preferences and available budgets. Overall, the findings suggest that these additional actions would significantly improve the robustness of Ho Chi Minh City's risk management plans.

Various risk management strategies, and their robustness to increases in river levels and rainfall intensity



Source: WDR 2014 team based on Lempert and others 2013.

Note: Different estimates of potential rainfall and river levels in the figure are indicated by the blue dashed lines. MONRE = Ministry of Natural Resources and the Environment (Vietnam). SLR = sea level rise. SREX = IPCC special report (IPPC 2012).

BOX 2.5 *Precaution in the face of risk: Striking a balance between costs and benefits with the precautionary principle*

Precaution in the face of risk has been formalized in many countries in the form of a "precautionary principle." Three versions of the principle, in increasing level of stringency, have been identified by Wiener and Rogers:

- "Uncertainty does not justify inaction" (it is possible to regulate without full scientific certainty).
- "Uncertainty does justify action" (regulations are required when there is a possibility of danger).
- "Uncertainty requires shifting the burden and standard of proof" (potentially risky activities are prohibited until the proponent of the activity can prove it poses no risks or acceptable risks).

Implementation of the precautionary principle may be either explicit or implicit. German laws have mentioned the *Vorsorgeprinzip* since the 1970s, and France introduced the precautionary principle in its national constitution in 2005. In the United States, the concept of "precautionary actions" is regularly mentioned in court decisions and in laws and regulations. For instance, the Environmental Protection Agency banned leaded gasoline in the 1970s, when the benefits of doing so were still unclear; this measure is now known to be cost-effective and responsible for decreasing the number of children with lead-related learning deficits in the United States. But the United States has not adopted an overarching precautionary principle for all regulation; since the late 1970s, every U.S. president has instead required impact assessments of the benefits and costs of regulation. The precautionary principle is recognized at the international level: for instance, by the 1992 declaration of the United Nations Conference on Environment and Development.

The European Union (EU) seems to be following the first version of the principle in some areas. The Maastricht treaty (1992) states that EU policy on the environment "shall be based on the precautionary principle" (Art 130R). A communication from the European Commission published in 2000 states the following: "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." The communication provides implementation guidance, designed to ensure that the precautionary principle does not lead to paralysis or self-contradiction: the measures it recommends are supposed to be *temporary* (and to include a plan to collect the information needed to conduct a more classical risk analysis); *proportional* (the threat must be "serious" and the measures "cost-effective"); based on *significant evidence* of the existence of a risk ("full certainty" is not necessary, but the threat needs to be credible); and based on an *assessment* of benefits and costs.

Putting the precautionary principle into practice has been difficult in some cases. Precaution can prevent some risks but can also pose new risks as well as economic costs. Debates over the precautionary principle have been heated at times (such as when critics perceive high costs, low risks, or disguised trade protectionism). But the reality of actual application in policy making has been quite diverse, within the United States and the European Union and elsewhere, suggesting that concerns about costs and risks are shaping real policy choices. These issues also suggest that more learning, and an iterative process, are needed about how to apply and put into operation a precautionary approach, especially in lower-income environments.

Source: WDR 2014 team based on Charnley and Rogers 2011; European Commission 2000; Wiener and Rogers 2002; Wiener and others 2011.

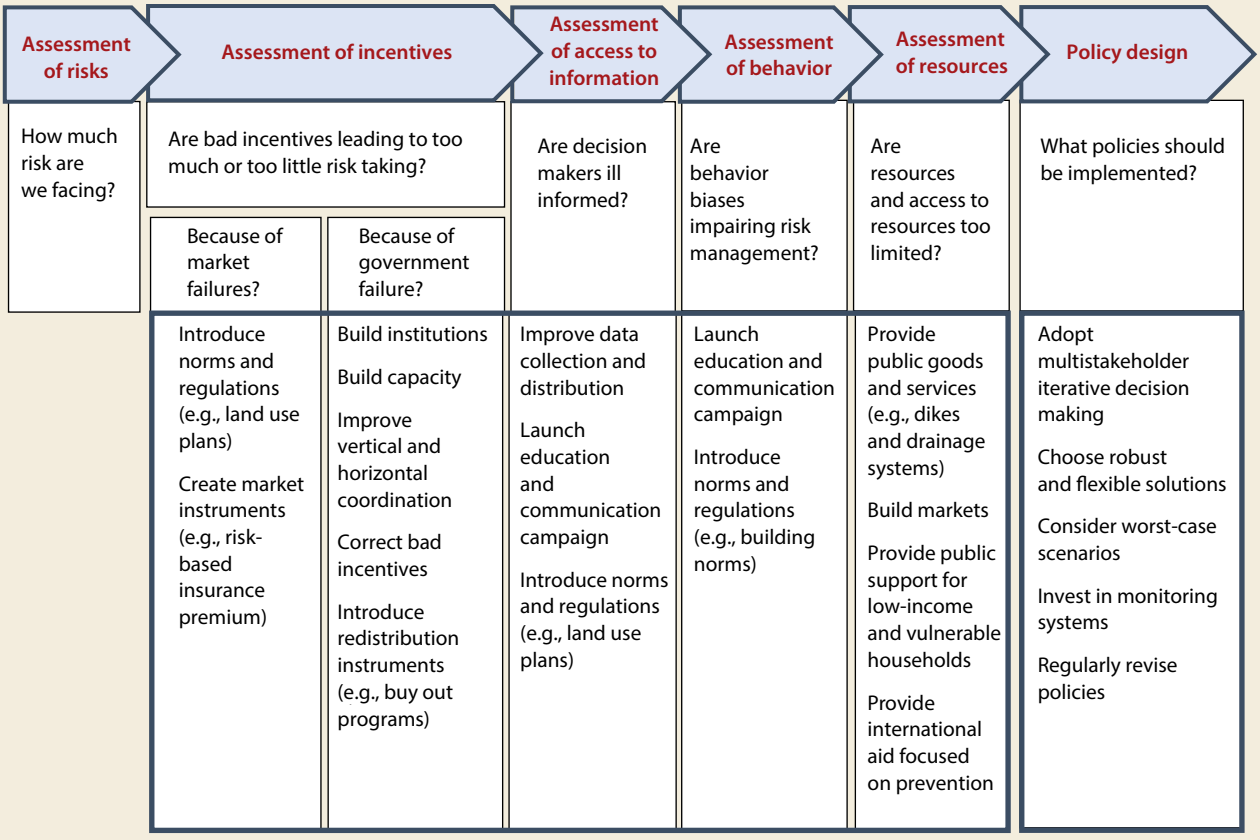
the obstacles to risk management that are described in diagram 2.1 and discussed earlier. A sequence that policy makers might consider in conducting a risk management analysis follows:

1. Individuals and firms may fail to manage risks because decision makers (private or public) face incentives that are distorted toward too much or too little risk taking. These situations need to be identified and corrected as a priority, since other measures are unlikely to be effective in the presence of bad incentives.
2. If incentives are correct, then providing good information is critical to improving the quality of decisions.
3. Sometimes, correct incentives and good information are unable to trigger a change in behavior. Specific measures are required to correct cognitive failures and behavioral biases.
4. Stakeholders may be willing to improve their risk management, but may be unable to do so because they lack resources. In this case, the provision of additional resources—directly or indirectly—would help.

This sequence is only an example: in practice, the second, third, or fourth of these considerations could happen first or at the same time as the others. However, applying these screens in that order can help identify critical gaps that need to be addressed first and reveal early in the process relatively low-cost interventions that are highly effective (such as correcting incentives through market instruments or better coordination).

In theory, these measures to correct incentives should pay for themselves over time, since they correct externalities and market and government failures. But in the short run, costs may be high, and over time, there may be tough trade-offs, large dis-

DIAGRAM 2.3 *A set of screens for assessing obstacles to risk management, and formulating policy responses*



Source: WDR 2014 team.

tributive impacts, or high political costs (when some actors oppose the measure). A low or negative aggregate cost does not mean that a policy is easy to implement. Complementary measures may be needed to cope with political obstacles or with negative side effects over the short term.[65] Other measures will be more costly (such as direct investment in building dikes), and they can be considered at a later stage.

A way past the obstacles: Choosing policy priorities

How can policy makers build a strong foundation for improved risk management over time? Given the obstacles they face, they must make hard choices. They must be practical in these choices. Their choices sometimes must be second-best: less than ideal, and more limited than desired.

In making those choices, policy makers should choose steps that can be taken now but allow for improvements later. This practical approach leads to specific priorities, building on the five policy principles discussed at the end of chapter 1.

Be realistic

Keep it simple. Simple risk management instruments should be preferred when capacity is low, even though they may be less efficient in theory. Simple regulations, for instance, may be easier to enforce than sophisticated (and theoretically more efficient) approaches based on market instruments. An example is car insurance in South Africa, where a fuel tax helps pay for third-party insurance for motor vehicles. Such an approach provides a simple and efficient way of compensating accident victims in a

weak institutional environment where enforcing compulsory car insurance is difficult.[66] Selecting solutions that are appropriate for local capacity and resources is particularly critical to ensure that risk management does not cause unnecessary harm and excessive costs or create new risks through unintended negative policy consequences or political economy backlash.

Tailor technology to local circumstances. Adoption of the most recent vintage of technologies can help developing countries manage their risks. Technology transfers can help: for instance, by making available globally the most recent drugs and vaccines. What is required, however, is not a simple technology transfer but the adaptation of technology to fit local needs and social norms and constraints and to thus maximize adoption (see spotlight 1). Successful innovations in risk management in developing countries have often relied on modern technologies, but always through a complex process of adaptation. The Bangladesh hurricane early warning system, for instance, combines modern hurricane track forecast technologies with low-tech, locally designed communication tools, including handheld bullhorns, bicycle-mounted loudspeakers, and house-to-house contacts.[67]

Concentrate on low-hanging fruit and win-win solutions. Relatively low-cost interventions that are highly effective should be favored. Cleaning the storm drains in Mumbai helps flood control. But beyond that, it improves health and hygiene and even the quality of life in neighborhoods, leading to a virtuous cycle. Removing bad incentives can be extremely efficient and relatively inexpensive, even though it may not be easy to do. For instance, reforms can target fossil fuel subsidies that promote energy-inefficient transport and heating and thus increase health risks from local air pollution. Strengthening the *capabilities* that are generally useful to manage risks of different natures is particularly cost-effective.[68] For example, the ability to manage large-scale evacuation is the same whether the reason is a flood or a technological accident, as is the capacity to scale up cash transfers rapidly after a shock, whether the shock is a natural hazard or an economic crisis.

Build a strong foundation for improved risk management over time

Create institutional arrangements when the need for them is obvious in everybody's mind—such as after a disaster—and that cannot be easily reversed when the memory of the event has disappeared. Doing so helps prevent some of the negative consequences of people's short memory about risk and disaster and compensates for the implementation issues related to political economy challenges. While policy makers should not wait to initiate such institutional changes until a contingency occurs, the increased public awareness in such a situation will increase the momentum and support for institutionalizing best-practice risk management. For instance, the Netherlands reacted to the 1953 floods by implementing local maximum acceptable flood risk levels; these limitations are fixed by law, making it harder for people to disregard flood management as time goes by.[69] The creation of a national risk board is an option to create an irreversible institutional change that incentivizes long-term risk management and helps coordinate risk reduction actions.

Start with soft measures that change incentives or make them more effective. Hard measures (such as dikes) or complex risk-sharing mechanisms are very unlikely to be efficient and sustainable if incentives are distorted toward too much or too little risk taking. Obstacles to risk management related to incentives need to be identified and corrected as priorities, through institutional reforms and economic instruments (from regulation to market instruments), to communication and information campaigns, and behavioral approaches. Starting with soft measures can correct for a bias in risk management toward hard and capital-intensive solutions—even when cheaper and more flexible institutional solutions are available.

Choose flexible solutions and build in learning. To cope with uncertainty and differences in beliefs, values, and sensitivity, policy makers should aim for robust policies that may not be optimal in the most likely future but that lead to acceptable outcomes in a large range of scenarios and that are adaptive and flexible: that is, policies that are easy to revise as new information becomes available. More learning, and an iterative process of monitoring and learning, is needed about how to apply risk management approaches, especially in lower-income environments.[70] One way to maximize learning is to learn from other domains where experience is systematized and internationalized. An example is the International Civil Aviation Organization, a specialized agency of the United Nations that defines the protocols for investigations of aviation accidents and

shares the results, ensuring that everybody can benefit from the mistakes of the others. "Learning from Megadisasters," a knowledge-sharing project sponsored by the government of Japan and the World Bank, collects and analyzes information, data, and evaluations on the Great East Japanese Earthquake of March 11, 2011, with the aim of sharing Japan's knowledge on disaster risk management and post-disaster reconstruction with other countries vulnerable to disasters. Improving the ability of the international community to share information on risks—from health and road-accident risks to large-scale disasters—would be a useful input into the design of more robust strategies (see chapter 8).

Notes

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