Knowledge Matters: Institutional Frameworks to Govern the Provision of Global Public Goods

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The provision of global public goods (GPGs) has been extensively discussed in recent years. This chapter focuses on institutional frameworks for generating the knowledge that is needed to make decisions about the provision of these goods. Currently, there is a lack of knowledge about both needs and solutions. Collective goals are unknown because individuals and communities can only form preferences if they are conscious of the actual issues at stake, and of the way they impact on their own individual situation, the situations of others, and those of future members of the society. Hence, this lack of knowledge is not only linked to a revelation problem as in traditional problems in public good provision. It is due to the fact that most citizens and economic agents do not have an explicit preference for goods as "conceptual" as global biodiversity, global public health, peace, and global economic security. This is partly because it is complex to assess how these GPGs impact on individual situations. The solutions are also unknown, both because the most efficient means of dealing with an issue are unclear, and because diffusion of the relevant knowledge is problematic. This is due to the limited scientific understanding of the problems and of the design and implementation of relevant institutional and organizational solutions, as well as to the limited diffusion of existing knowledge. It also occurs because the provision of these goods is interrelated and partly conflicting (e.g., development and biodiversity), leading to conflicts among interests. Such conflicts may hinder the revelation of information and the circulation of knowledge.

Thus, this chapter seeks to analyze the specific coordination needs of the generation of knowledge about global problems of GPG provision, and their possible solutions, by focusing on the involvement of different types of organized communities at different levels of governance. The chapter is structured as follows. In the next section, we develop an

analytical framework aimed at establishing a link between the processes of collective decision making (in matters of GPGs) and performance in terms of knowledge generation. This leads us to highlight the various trade-offs among alternatives in matter of governance. We point out in particular that the various processes of decision making—which can be chosen for reasons other than their performance in terms of knowledge generation—have different abilities to generate knowledge in general, and also different abilities to produce the various categories of knowledge. We discuss, in particular, the production of knowledge aimed at delimiting and weighting issues and knowledge about socio-technical solutions to address these issues. Our framework is then used in a normative way to identify the institutional solutions that will best ensure the production of the various types of knowledge needed to ensure the efficient provision of GPGs. We also develop our analysis and show how our framework can be operationalized, both to be tested, and to yield real world recommendations. In the final sections, we apply our analysis to a set of case studies from the field of environmental governance.

A Knowledge-Generation Perspective on Alternative Decision-Making Mechanisms

What is needed is a framework for the assessment of alternative forms of decision making that focuses on their ability to generate knowledge so as to make more balanced choices thanks to a better knowledge of stakeholders' preferences, and to make more efficient choices thanks to a better knowledge of available solutions and of their conditions of implementation.

Our aim is to remain realistic by being able to compare the actual decision/governance principles that are under debate, while remaining parsimonious in not making our analytical categories excessively complex. For that purpose, our approach in this chapter will be based on a total cost approach, in the spirit of Ronald Coase's (1937) attempt to take into account not only the costs of production but also the costs of coordination. We therefore attempt to assess the relative efficiency/cost performance of alternative knowledge-generation processes, including a broad set of indirect costs generated by the creation and functioning of both formal and informal social and political institutions. First, we propose criteria to assess the efficiency and the quality of the knowledge-generation processes. Then, we categorize alternative processes of decision making (alternative governance regimes) in global governance.

Criteria for Assessing Knowledge-Generation Processes

As Foray (2004) has pointed out, knowledge is a good characterized by three main features. The first is uncontrollability, which means that knowledge is not available for one purpose only. The future uses of knowledge cannot usually be anticipated. Even if it emerged by targeting a goal, different users can employ a piece of knowledge in different ways. Second, knowledge is cumulative. New knowledge draws from the recombination of ideas and/or the criticism of past ideas. Third, knowledge is a non-rival good. From this vision we can highlight four dimensions that will enable us to assess the performance of an institutional arrangement in the generation of knowledge:

1. Knowledge generation can be evaluated on the basis of the *adequacy* of the resulting knowledge for the specific purpose of providing solutions to GPG-related problems. Adequacy can be understood as the degree to which the knowledge allows actors to solve actual problems. In addition, adequacy is a quality of knowledge that is perceived by actors as relevant—salient in the sense of Mitchell et al. (2006, 15)—to their decision making.

2. The ability of a process of knowledge generation to encourage *disclosure* and/or revelation is essential, because this enables the production or new knowledge (by a combination of uncontrollability and cumulativeness). In this respect, for instance, the obligation to disclose information publicly (either in the scientific world of in the realm of industrial property [patents]) can be considered efficient, given that other users can benefit from this knowledge.

3. The *speed of knowledge generation* matters, because it levers the production of knowledge (due to cumulative effects) and therefore increases the stock of available knowledge.

4. Like any other non-rival good, *access to knowledge* once it has been produced is essential. Thus, the ability of a process of knowledge generation to make knowledge available to the widest number of potential users (and therefore its costs of access, which encompass both the price of the knowledge and the costs incurred in using it, such as learning efforts and complementary investments) have to be considered.

These four criteria refer to potential benefits. However, an assessment should also consider the balance between costs and benefits. Two sources of costs differentiate the alternative decision making processes. First, there are the costs of the resources dedicated to the generation of knowledge.

These include, in particular, whether the process leads to a duplication of effort, and whether it relies on the existing stock of knowledge. Second, the costs of coordination among the parties involved in the process of generating knowledge should be taken into account.

Thus we will assess alternative ways of making decisions about global public goods on the basis of six criteria, namely their ability to: (i) generate adequate knowledge, (ii) encourage disclosure and revelation (to maximize spillovers), (iii) speed up the generation of knowledge, (iv) allow widespread access to knowledge, (v) use the available cognitive resources efficiently, and (vi) reduce the costs of coordination among those involved in the production of knowledge.

The Key Dimensions of Collective Decision-Making Mechanisms

A governance mechanism consists of a decision-making mechanism and enforcement capabilities. Because we are focusing on knowledge generation we will only consider the properties of the decision-making element. Our typology of governance mechanisms relies on two classical dichotomies that have been extensively studied in the social sciences. First, we compare centralized and decentralized decision-making mechanisms. This distinction is relevant in both a national and an international context, in which each level of governance has particular advantages and disadvantages (Karahan, Razzolini, and Shughart 2002; Bache and Flinders 2004). The second dichotomy is between contract-type mechanisms based on self-interested individuals (exclusive interests) and mechanisms that are based on social and communitarian logics with individuals oriented toward a collective outcome (inclusive interest). This dichotomy between actors' orientations has also been studied previously, for instance by Scharpf (2000) in his overview of actor-centered institutionalism. As discussed in chapter 1, these alternative principles of the orientation and delegation of decision making lead to four models of collective interaction, which have long been recognized in the social sciences (see Figure 13.1).

This characterization of the possible decision-making mechanisms (covered in more detail in chapter 1) should be broadened to include two other issues key to the GPG debate: the influence of the scope of the decision-making process and the organization of decision making. These dimensions lead to alternative modes of accountability between decision makers and stakeholders. The first issue is important because of the global character of the problems being considered, and the fact that

individuals are already organized in many types of communities, although the global community is not yet fully organized. Therefore, various types of sub-global communities exist in which individuals develop their strategies to have an impact on the provision of public goods in general and global ones in particular. The second issue is important because of the increasing role of non-state actors in the global arena (see Bohman 2004 and chapter 2 of this volume), and the existence of various processes by which either isolated individuals—that is, citizens—or members/representatives of various types of organized communities interact in decision-making processes related to public goods. This leads to various patterns of knowledge generation. The following four dimensions allow us to compare the principles according to which collective decision making is or can be organized at the level of the "global society":

1. *Scope* refers to the size of the community affected by the resulting order or decision. More precisely it refers to the community whose interests are (primarily) taken into account when decisions are made or when regulatory principles are decided. This community can tend toward openness and globalism (i.e., wide scope), or it can be local and closed (i.e., narrow scope).

2. The notion of *orientation* refers to the (primary) motivations of individuals who interact to make collective decisions and/or to implement an order. Does the mechanism aim at dealing with individuals who consider above all their own individual interests (exclusive) or with individuals who also take the collective interest into account (inclusive)?

3. The *organization* of the decision making refers to the explicit design of a collective decision-making process. When the decision-making process is not explicitly designed, collective decisions simply result from the spontaneous aggregation of individual choices and from social adjustments among individuals. Organization increases the efficiency with which interdependences are managed. Moreover, it increases the accountability of the decision makers because, as stakeholders or the representatives of stakeholders (who delegate decision-making powers to them), the relative role of each decision maker is clear. When interdependences are managed spontaneously, the accountability of the actors is expected to be less. Indeed, their actual impact on the decision making is unclear, and the relationship between them and the stakeholders is not easy to establish. Their actions result in facts and information, not in collective choices and organized knowledge

4. The notion of *delegation* refers to the fact that collective decisions can be either centralized in the hands of a limited number of individuals, or decentralized in the sense that each individual is able to express an opinion and have an impact on the final decision. In the first case there is either explicit delegation of decision making (as in hierarchies and constitutional states) or a kind of spontaneous delegation by which leaders emerge who are followed by other members of a community (without any explicit attribution of the right to make collective decisions). In the second case, there is neither explicit nor implicit delegation of the rights of decision making, and the process remains decentralized in the hands of members of the communities.

These four dimensions are all continuums: scope can concern communities of any size from two people to all of humankind. However, their main features can be distinguished on a dichotomous basis by considering the two extremes of each of them. It must be clear, however, that this is just for didactic purposes. When actual decision-making mechanisms are considered, it is more meaningful to speak of more and less centralized processes than of centralization and decentralization.

These four categories refer to different trade-offs between costs and benefits:

- The scope dimension covers mechanisms that have to manage more (wide) or less (narrow) heterogeneity, and therefore result in higher or lower costs of decision making. These mechanisms lead to solutions that have larger or smaller possible economies of scale, and more or less consistency, due to the appropriate management of interdependencies (see Brousseau and Raynaud 2011).
- The orientation dimension compares the maximization of individual (exclusive) and collective (inclusive) welfare as drivers of decision making.
- Along the organization dimension we suggest that organized decision making guarantees accountability and is cheaper, faster, and more conclusive (in the sense that a decision is clearly made). However, spontaneous processes can lead to more innovative decisions and more efficient adaptations to heterogeneous and evolving needs, since they allow more freedom.
- The delegation dimension contrasts decentralized mechanisms that economize on agency costs with centralized mechanisms that minimize the duplication of effort and allow decision makers to specialize.

This way of describing alternative (de facto) decision-making mechanisms in matters of global governance allows us to compare sixteen different models of coordination. Table 13.1 shows how the combination works, and we provide examples of decision mechanisms that illustrate each of these options. Note, however, that the nickname column in this table does not correspond to actors, but rather to processes of decision making. For instance, the third line, nicknamed "global self regulation," represents a situation in which global regulations result from knowledge generated through negotiations among interest groups organized in lobbies dealing with each other on a quid pro quo basis. The fifth line, nicknamed "NGO coordination," indicates a situation in which regulation results from coordination among nongovernmental organizations each promoting their own vision of the collective interest. The nicknames given to each type of governance mechanisms are used in the discussion of their relative performance below. The examples given in the last column of Table 13.1 are discussed in the second part of the chapter.

The Capacity of Alternative Institutional Frameworks to Generate Knowledge

To analyze how the various mechanisms of governance and decision making affect on the process of knowledge generation, we now review how the characteristics of a process of collective decision making (presented in table 13.1) impact on the various criteria of performance discussed above. Being interested in the analysis of actual governance issues, we find it useful to consider the generation of knowledge as a process composed of two different analytical steps: the identification and framing of problems and issues (Argyris and Schön 1996, Schön and Rein 1994); and the innovation, testing, and filtering of operational solutions. These two steps refer to the contradictory requirements of opening up and closing down in social problem-solving processes (Voß, Bauknecht, and Kemp 2006). On the one hand, problem-oriented interactions need to be opened up to take account of the interaction of diverse factors, preferences, and interests. This is necessary to produce robust knowledge and strategies. On the other hand, the selection of relevant factors, choices about ambiguous preference rankings, and a convergence of interests are necessary to make decisions and to act (compare the discussion of exploration and exploitation in March 1991). We will label the knowledge resulting from each of these steps as "framework knowledge" and "operational knowledge" respectively. Knowledge about issues tends to be more oriented toward the establishment of collective preferences than is knowledge about solutions (which includes knowledge of the most

Table 13.1
A typology of modes of governance for dealing with global governance issues

Dimension				Mode of Governance	
Scope	Orientation	Organization	Delegation	Nickname	Example
Wide	Exclusive	Organized	Centralized	Global confederation	Global Environment Outlook (UN Environment Programme)
			Decentralized	Global direct democracy	NGO involvement in the UN Framework Convention on Climate Change and Commission on Sustainable Development
		Spontaneous	Centralized	Global self-regulation	European Culture Collections standard contract
			Decentralized	Global free market	Bioprospecting
	Inclusive	Organized	Centralized	NGO coordination	Intergovernmental Panel on Climate Change (IPCC)
			Decentralized	Republic of science	Earth System Science Partnership
		Spontaneous	Centralized	Global activism	Greenpeace
			Decentralized	Emotional collective action	Al Gore's climate campaign

Table 13.1
(continued)

Dimension				Mode of Governance	
Scope	Orientation	Organization	Delegation	Nickname	Example
Narrow	Exclusive	Organized	Centralized	National government	UK Biodiversity Action Plan
			Decentralized	Local direct democracy	Local Agenda 21
		Spontaneous	Centralized	Local self-regulation	Responsible Care Initiative in the chemical industry
			Decentralized	Legal activism	Kani model of benefit sharing
	Inclusive	Organized	Centralized	Service-providing nongovernmental organizations	Carbon compensating agencies
			Decentralized	Community management organizations	Kristianstadt watershed management
		Spontaneous	Centralized	Local activist networks	Danish windmill industry
			Decentralized	Neighborhood action	Self-supplying, carbon-free communities

effective, and least costly, ways of addressing these issues); consequently, we will analyze the influence of the various characteristics of governance on the two types of knowledge separately.

Framework Knowledge

Framework knowledge is defined as the broad conceptual, epistemological, and normative perception of a problem or an issue that determines the way actors approach and think of it (Schön 1983). To go beyond this definition, we need to discuss how the characteristics of governance mechanisms can affect the various criteria of performance in matters of knowledge generation. We will therefore consider successively the influence of the scope, orientation, organization, and delegation on our six criteria of efficiency (i to vi) (see table 13.2).

The scope refers to the size of the community considered by the decision-making mechanism and therefore to its diversity: a community of wider scope will generally include more heterogeneous stakeholders. It is obvious that the wider the scope, the greater its adequacy for the global aspects of GPGs (i). Moreover, the wider the scope, the more interests and the interdependencies can be taken into account. It should therefore lead to the production of more knowledge (ii) than similar processes with a narrower scope. Here we are not taking the incentives of individuals to hide information and ideas into account, because this is not directly linked to scope, but rather to the other criteria (orientation, organization, and delegation). There is also no reason to postulate that individuals will have fewer incentives to reveal their own needs or the collective problems they identify in a wider community. Wide scope should, however, have negative effects on the speed and costs of coordination: the wider the scope, the greater the complexity of the decision, and so the slower the decision and knowledge generation processes (iii). In the same vein, the larger the number and diversity of stakeholders involved in the decision-making process, the higher the costs of coordination (vi). The number and diversity of stakeholders does not impact directly on accessibility (iv) or duplication (v), since both these criteria depend on the organization of the decision.

Orientation refers to the logic on which the governance mechanism is built. The more the decision making is oriented toward the inclusion of the interest of all stakeholders in the society, the better its adequacy with respect to the collective aspect of GPGs (i), and the greater its ability to identify relevant interdependencies among individuals and issues (ii)

Table 13.2
The performance of various governance mechanisms on generating knowledge about issues

Dimensions				Criteria					
Scope	Orientation	Organization	Delegation	Adequacy (i)	Revelation (ii)	Speed (iii)	Accessibility (iv)	Efficient use of cognitive resources (v)	Low costs of coordination (vi)
Wide	Exclusive	Organized	Centralized	+ = = =	+ - + -	- + = +	= = - +	= + + +	- = - +
			Decentralized	+ - = =	+ - + +	- + = =	= = - +	= + + -	- = - -
		Spontaneous	Centralized	+ = = =	+ - - -	- + = +	= = - -	= + - +	- = + +
			Decentralized	+ = = =	+ - - +	- + = =	= = - +	= + - -	- = + -
	Inclusive	Organized	Centralized	+ + = =	+ + + -	- + = +	= + - +	= - + +	- = - +
			Decentralized	+ + = =	+ + + +	- + = =	= + - +	= - + -	- = - -
		Spontaneous	Centralized	+ + = =	+ + - -	- + = +	= + - -	= - - +	- = + +
			Decentralized	+ + = =	+ + - +	- + = =	= + - +	= - - -	- = + -
Narrow	Exclusive	Organized	Centralized	- - = =	- - + -	+ + = +	= = - +	= + + +	+ = - +
			Decentralized	- - = =	- - + +	+ + = =	= = - +	= + + -	+ = - -
		Spontaneous	Centralized	- - = =	- - - -	+ + = +	= = - -	= + - +	+ = + +
			Decentralized	- - = =	- - - +	+ + = =	= = - +	= + - -	+ = + -
	Inclusive	Organized	Centralized	- + = =	- + + -	+ + = +	= + - +	= - + +	+ = - +
			Decentralized	- + = =	- + + +	+ + = =	= + - +	= - + -	+ = - -
		Spontaneous	Centralized	- + = =	- + - -	+ + - +	= + - -	= - - +	+ = + +
			Decentralized	- + = =	- + - +	+ + - =	= + - +	= - - -	+ = + -

+: positive impact; -: negative impact; =: neutral impact

(because revelation is facilitated). Orientation toward inclusion should also favor accessibility (iv), since decision makers presumably attach greater importance to this factor. However, more inclusiveness leads to more complex decisions because more interdependencies have to be taken into account, which tends to reduce the speed of decision making and hence knowledge generation (iii). The impact of a more inclusive orientation on the costs of knowledge generation is more questionable. Inclusiveness means that the needs and preferences of more stakeholders have to be assessed, which might raise costs. However, it could be argued that these costs are essentially dependent upon the organization of the decision making, not its orientation. A well-designed decision-making process should be able to control for most of the waste due to the potentially inefficient use of cognitive capacities and coordination costs. Because what is needed from stakeholders is information about their needs and issues, well-designed surveys and information-gathering mechanisms can easily provide the necessary information without involving all the stakeholders. Nevertheless, other things being equal, inclusiveness does demand more information gathering than exclusiveness. Moreover, those who make decisions have to absorb the knowledge and information derived from a variety of individuals and groups with differences that include divergent cognitive frameworks. This implies not only gathering and synthesizing more heterogeneous information, it also means that learning abilities have to be dedicated to the process. We therefore consider that an orientation toward more inclusion should raise the amount of resources necessary to produce the relevant knowledge to identify issues (v), although it should not directly impact on the cost of coordination (iv).

The organization of the decision making refers to the fact that collective decision making is achieved by a process in which stakeholders explicitly aggregate their individual wishes or ideas. Alternatively, collective decisions can simply result from a process of the spontaneous aggregation of individual decisions, which cannot guarantee the consideration of all individuals' preferences or contributions. Whether collective decision making is organized or spontaneous should not affect the quality of the knowledge generated (i). An organized approach allows interdependencies to be taken into account, but spontaneity enables local specificities and needs to be considered. The same type of trade-off between trends applies to speed (iii). Organized decision making relies on specialization and the development of information networks that allow quick sharing of information and knowledge and so increase the speed at which

decisions can be made; but organization does not encourage mutual adjustments and tends to rely on routines that reduce the likelihood of local innovation (unless this is explicitly the purpose of the organization), and this may reduce the reactivity, creativity, and—as a result—the speed of knowledge generation. We therefore assume that the organization criterion is neutral with respect to the speed of generating knowledge about issues and needs (iii).

However, the explicit organization of a collective decision-making process should impact positively on three other criteria: revelation (ii), accessibility (iv), and efficiency in the use of cognitive resources (v). There is a trade-off between revelation (unconventional knowledge is more likely to be revealed in a spontaneous process) and accumulation (encouraged by an organized decision-making process). But the accumulation of knowledge on the needs and interdependencies of wide and heterogeneous communities is impossible without a certain degree of organization, and on this basis we assume that greater organization of the decision-making process encourages the revelation and production of knowledge (ii). Moreover, organized decision-making relies on the specialization and development of information networks that allow information and knowledge to be shared, and so organization increases accessibility (iv). In addition, organized processes of decision making are, by definition, designed to encourage more efficient use of the existing knowledge base and of cognitive resources (v). However, organized decisions are more costly in terms of coordination (vi), because spontaneous decisions do not require coordination (but spontaneous decisions lead to poorer results in terms of generating of knowledge).

Whether collective decisions are centralized (i.e., delegated) or based on direct interactions and agreements among stakeholders should be neutral with respect to the adequacy of the knowledge generated (i), since contradictory factors come into play. On the one hand, centralization allows interdependencies to be taken into account. On the other hand, decentralization allows local specificities and needs to be considered. However, centralization has a clear negative impact on two issues. It reduces the ability to reveal and produce relevant knowledge (ii) because information asymmetries between the decision makers and stakeholders create problems of revelation and may encourage decision makers to follow their private agendas. It also reduces accessibility (iv), because only decentralization relies on knowledge sharing and mutual understanding and so requires and provides incentives for greater accessibility. The positive impacts of centralization are threefold. It acceler-

ates the speed of decision-making processes and, therefore, knowledge generation (iii). Indeed, it relies on formal mechanisms to gather information and make decisions quickly. In addition, the center can accumulate information and learn, and it is encouraged to develop its abilities to do this. Centralization also reduces the cost of making decisions (provided a relevant organization exists). By definition, it avoids the duplication of effort and tries to optimize the use of cognitive resources (v). In addition, centralization reduces coordination costs because there are fewer links to manage in a star network than in a mesh network (vi).

Operational Knowledge and Solutions

As in the previous section, we will discuss systematically how the various characteristics of governance mechanisms can have an impact on the criterion of performance with respect to the generation of knowledge about solutions to problems in the provision of GPGs. In many cases the arguments are similar to those applying to the generation of knowledge about issues. However, there are two differences. First, solutions have a more direct impact than issues on the distribution of the costs of providing GPGs among agents and on the constraints they face in accessing and using resources. Decisions and knowledge about solutions therefore have a greater effect on their individual interests. Agents' behavior thus becomes more strategic, and there are fewer incentives to reveal information that could be used against their interests or to share knowledge about solutions (since the exclusive use of this knowledge may benefit them). Second, the need to adapt solutions to their implementation contexts requires, other things being equal, more information about local contexts. This, together with the more selfish orientation of agents, creates a tension. To put it another way, when dealing with the creation of knowledge about solutions, individual interests play a greater role, and local information and individual involvement are more crucial. These factors have an impact on the properties of some dimensions of governance mechanisms (see table 13.3).

As for framework knowledge, the scope of the decision-making process has a positive influence on the adequacy (i) of the knowledge generated, and has a negative impact on speed (iii) and coordination costs (vi). Scope is neutral for accessibility (iv) and duplication of effort (v). However, it is negative for revelation (ii), for the reasons explained above. The less the scope and the closer the context of implementation (provided

Table 13.3
The performance of various governance mechanisms on generating knowledge about solutions

Dimensions				Criteria					
Scope	Orientation	Organization	Delegation	Adequacy (i)	Revelation (ii)	Speed (iii)	Accessibility (iv)	Efficient use of cognitive resources (v)	Low costs of coordination (vi)
Wide	Exclusive	Organized	Centralized	+	-	-	=	=	-
			Decentralized	+	-	+	+	=	+
		Spontaneous	Centralized	+	-	-	=	=	-
			Decentralized	+	-	+	+	=	+
	Inclusive	Organized	Centralized	+	+	-	=	=	-
			Decentralized	+	+	+	+	=	+
		Spontaneous	Centralized	+	+	-	=	=	-
			Decentralized	+	+	+	+	=	+
Narrow	Exclusive	Organized	Centralized	-	-	+	=	=	+
			Decentralized	-	-	+	+	=	+
		Spontaneous	Centralized	-	-	+	=	=	+
			Decentralized	-	-	+	+	=	+
	Inclusive	Organized	Centralized	-	+	+	=	=	+
			Decentralized	-	+	+	+	=	+
		Spontaneous	Centralized	-	+	-	=	=	+
			Decentralized	-	+	+	+	=	+

+: positive impact; -: negative impact; =: neutral impact

that the global problem is well framed), the better the knowledge generated.

The orientation of the decision-making process for knowledge about solutions is similar to that for knowledge about issues on four criteria. Inclusiveness has a positive effect on adequacy (i), revelation (ii), and accessibility (iv) and a negative effect on speed (iii). The positive effects on revelation and accessibility are strengthened in the case of knowledge about solutions, because there are strong incentives to analyze the side effects of the solutions in detail and to spread knowledge about possible solutions. There are, however, significant differences between the two analyses in the matter of costs. Inclusiveness should be neutral with respect to the efficiency of using cognitive resources (v). On the one hand, duplication tends to occur because there are similarities among local situations, while, on the other hand, marginal adaptations are required to take the specificities of local contexts into account. By contrast, inclusiveness tends to increase coordination costs (vi). At the implementation stage, it leads to the involvement of the largest possible number of heterogeneous stakeholders as they appropriate the solutions and adapt them to their own ends and preferences.

The organization of the decision-making process on solutions impacts positively on accessibility (iv) and efficiency in using cognitive resources (v). It has a negative effect on coordination costs (vi), and is neutral with respect to adequacy (i) for the reasons discussed in the previous section on the generation of knowledge about issues. However, there is a difference when the issues of revelation (ii) and speed (iii) are considered. The degree of organization in the decision-making process should be irrelevant for revelation because organization makes the identification of interdependencies more efficient (which contributes to the design of better solutions and related knowledge), while spontaneity encourages information about implementation specificities to be revealed and also favors local innovation. In fact, the trade-off is the same as that discussed above for revelation in respect to knowledge about the issues. However, since local adaptation is highly valued in the design of implementable solutions, the weight of the second dimension in the trade-off is higher for solutions than for issues. This explains why the overall effect of organization on knowledge of solutions is seen as neutral, whereas it is seen as positive for knowledge of the issues. The same reasoning applies to the speed of solutions, which should be greater with spontaneous implementation than with organized coordination. Since operational decisions require quick adjustments and adaptation to the

local context, spontaneous implementation could speed up decision making and the related generation of knowledge.

The delegation of decision making has a positive impact on the costs (v, vi), a negative one on revelation (ii) due to information asymmetries, and none on adequacy (i), as argued in the case of knowledge generation on issues and preferences. However delegation has a different impact on the speed (iii) and accessibility (iv) of knowledge about solutions than knowledge about issues. Centralization should have a negative impact on the speed of knowledge generation about solutions, while it is positive for issues. Centralization involves formal mechanisms to gather information and make decisions quickly. However, decentralized decisions can allow better adaptation of operational decisions. By the end there is less need for back-and-forth exchanges of information about implementation decisions, and so the process is quicker. The degree of centralization is neutral for accessibility (iv). On the one hand, decentralization requires and provides incentives for greater accessibility. On the other hand, centralization encourages the distribution of knowledge to end-users and its appropriate packaging.

Building an Efficient Governance Framework for the Generation of Knowledge

The analysis developed above shows how various principles in the organization of the decision-making process on the provision of GPGs may impact the ways in which knowledge generation relies on various criteria of quality and costs. The following tables sum up the analysis, showing how our four dimensions of organizational characteristics (scope, orientation, organization, and delegation) affect performance according to each of our six criteria of performance (i to vi). We use a plus sign to indicate that a dimension has a positive impact on a criterion, a minus sign to indicate a negative impact, and an equal sign when there is no specific impact. Each box contains four signs; the first shows the effect of scope, the second orientation, the third organization, and the fourth delegation. Table 13.2 presents the analysis for the framework knowledge of issues, and table 13.3 shows the analysis of knowledge about solutions.

These tables help us to synthesize the conclusions of the analysis in the previous section. Reading them column by column allows the impact of the various dimensions on each of our criteria of performance to be seen at a glance, while reading them line by line summarizes the main

effects of the sixteen governance mechanisms identified by our typology (with each line corresponding to one of these mechanisms). We will start our discussion by making some general comments on the impacts of the organizational dimensions, before describing the comparative analysis of the mechanisms.

Before going into the details, it is important to stress the limits of our analysis. We establish our comparisons by summing the positive and negative impacts on the various criteria. This implies that we are giving equal weight to each of the organizational dimensions when comparing columns, and giving equal weight to each of the criteria (i to vi) when comparing mechanisms lines. This approach is obviously open to criticism, since neither the relative importance of the various organizational dimensions nor the relative importance of the various criteria has been assessed. At this stage of the analysis of knowledge generation in decision making, we feel that nothing would be gained, either theoretically or empirically, by a systematic analysis of the production function of knowledge related to governance mechanisms. Our analysis is merely exploratory; nevertheless, we think it provides useful insights into the relative performance of alternative principles of governance. It is clear, however, that further theoretical and empirical work will be needed to confirm and refine our provisional conclusions.

Analysis of the Trade-offs

At first glance, tables 13.2 and 13.3 show clearly that there is no single best way of generating knowledge on the provision of GPGs. None of the governance mechanisms has positive ratings on all the identified criteria. A reading of the tables line by line shows that there are trade-offs among criteria of performance and that all the possible governance approaches have drawbacks. Reading the tables column by column highlights the dimensions of some of these trade-offs. It also allows the combination of organizational dimensions that gives the best performance on each criterion to be identified. These can be grouped into three categories: adequacy (i) and revelation (ii) refer to the relevancy of the knowledge produced; speed (iii) and accessibility (iv) refer to its availability; and efficient use of cognitive resources (v) and low cost of coordination (vi) cover the costs of producing knowledge.

On the basis of our categories for evaluating the knowledge generation processes (see tables 13.4 and 13.5), two general organizational effects that are independent of the type of knowledge can be identified. First, the orientation of relationships has a strong influence on the relevancy (i and ii) of the knowledge produced: inclusiveness enhances quality. Second, the delegation of the decision impacts on its costs (v and vi): centralization is cheaper than decentralization. There are also three effects that vary, depending on the nature of the knowledge. Scope has a strong influence on the relevancy (i and ii) of knowledge on issues in which wideness favors quality, but is neutral for knowledge on solutions. The same holds for the organization of the decision-making mechanism, when high levels of organization increase the availability (iii and iv) of knowledge of issues but not knowledge of solutions. However, the degree of centralization influences the availability (iii and iv) of knowledge of solutions more than that of issues, with more centralization leading to less availability.

Mechanisms of governance that are both inclusive and decentralized seem to favor the production of adequate knowledge and revelation (i and iii). However, there is clearly a quality versus cost dilemma, since the mechanisms that produce the most relevant knowledge about the provision of GPGs are the most costly. This is true for both knowledge about issues and knowledge about solutions, although the scope has to be wide to result in relevant knowledge about issues. There does not seem to be the same dilemma over availability and costs, or relevance and availability.

Generally speaking, when considering the organizational dimensions that induce the best performance, the three categories of performance seem to demand the following different organizational characteristics:

- The best mechanisms for generating relevant knowledge (i and ii) about issues have both wide scope and inclusiveness. However, the best solutions for generating relevant knowledge about solutions are inclusive and decentralized.
- The best mechanisms for producing knowledge of issues that becomes available quickly and widely (iii and iv) combine narrowness and organization. For knowledge of solutions, narrowness and decentralization should be combined.
- The best way to minimize costs is to rely on mechanisms with a narrow scope, based on exclusive interests and centralization.

It is therefore clear that the design of efficient governance mechanisms should rely on a logic of hybridization among organizational principles

based on either single governance mechanisms combining various organizational characteristics or the combination of alternative mechanisms in the same process of governance.

Comparative Analysis of the Governance Frameworks

The last step in our analysis is to proceed to a line-by-line discussion of the tables so as to compare the performance of the sixteen mechanisms of governance. A general reading of tables 13.4 and 13.5 shows that there is no single best way to generate knowledge on the provision of GPGs. Some mechanisms that are efficient in dealing with issues perform poorly on solutions, and vice versa. Moreover, some perform better according to some criteria, while being weak at others. Our categories provide a useful tool for analyzing these patterns. In the discussion that follows, we present some general features of the overall performance of the various mechanisms. Then we consider the application of our framework to a set of case studies from the field of global environmental governance.

The results of our analysis of governance mechanisms have been summarized in figure 13.1. The evaluations of each mechanism's performance over the six criteria in tables 13.4 and 13.5 were added to give a score between −2 and +2 for both knowledge generation about issues and about solutions. The figure shows the position of each mechanism on these two criteria, with issues on the horizontal axis and solutions on the vertical axis.

The basic types of governance mechanisms can be grouped into four clusters to facilitate the discussion of these general findings. Each cluster groups mechanisms with similar organizational characteristics and similar performances in knowledge generation on issues or on solutions: community-based processes (best for solutions), national and local democracy (moderately good for both issues and solutions), global organized debates (best for issues, poor for solutions) and spontaneous market-like coordination (worst for issues, poor or only moderately good for solutions). Based on these distinctions, we first discuss the cluster of global organized debates, which have been prominent in the debates on global governance. Then we turn to the clusters that show the best balanced performance for issues and solutions—that is, community-based processes, and national and local democracy. Finally, we highlight some of the features of spontaneous market-like coordination mechanisms, which seem to have the worst overall performance.

Table 13.4
An evaluation of governance mechanisms for knowledge generation on issues

Dimensions				Evaluation		
Scope	Orientation	Organization	Delegation	Relevancy (Adequacy + Revelation)	Availability (Speed + Accessibility)	Costs (Efficient use of cognitive resources + low coordination costs)
Wide	Exclusive	Organized	Centralized	0	0	+2
			Decentralized	+2	0	−2
		Spontaneous	Centralized	−2	−2	+2
			Decentralized	0	−2	−2
	Inclusive	Organized	Centralized	+4	0	0
			Decentralized	+5	0	−4
		Spontaneous	Centralized	+2	−2	0
			Decentralized	+4	−2	−4
Narrow	Exclusive	Organized	Centralized	−4	+2	+4
			Decentralized	−2	+2	0
		Spontaneous	Centralized	−6	0	+4
			Decentralized	−4	0	0
	Inclusive	Organized	Centralized	0	+2	+2
			Decentralized	+2	+2	−2
		Spontaneous	Centralized	−2	0	+2
			Decentralized	0	0	−2

Table 13.5
An evaluation of governance mechanisms for knowledge generation on solutions

Dimensions				Evaluation		
Scope	Orientation	Organization	Delegation	Relevancy (Adequacy + Revelation)	Availability (Speed + Accessibility)	Costs (Efficient use of cognitive resources + low coordination costs)
Wide	Exclusive	Organized	Centralized	−3	−2	+2
			Decentralized	−1	0	−2
		Spontaneous	Centralized	−3	−2	+2
			Decentralized	−1	0	−2
	Inclusive	Organized	Centralized	+1	−2	0
			Decentralized	+3	0	−4
		Spontaneous	Centralized	+1	−2	0
			Decentralized	+3	0	−4
Narrow	Exclusive	Organized	Centralized	−3	0	+4
			Decentralized	−1	+2	0
		Spontaneous	Centralized	−3	0	+4
			Decentralized	−1	+2	0
	Inclusive	Organized	Centralized	+1	0	+2
			Decentralized	+3	+2	−2
		Spontaneous	Centralized	+1	0	+2
			Decentralized	+3	+2	−2

I   Community-based frameworks
II   National and local democracy
III   Global debates
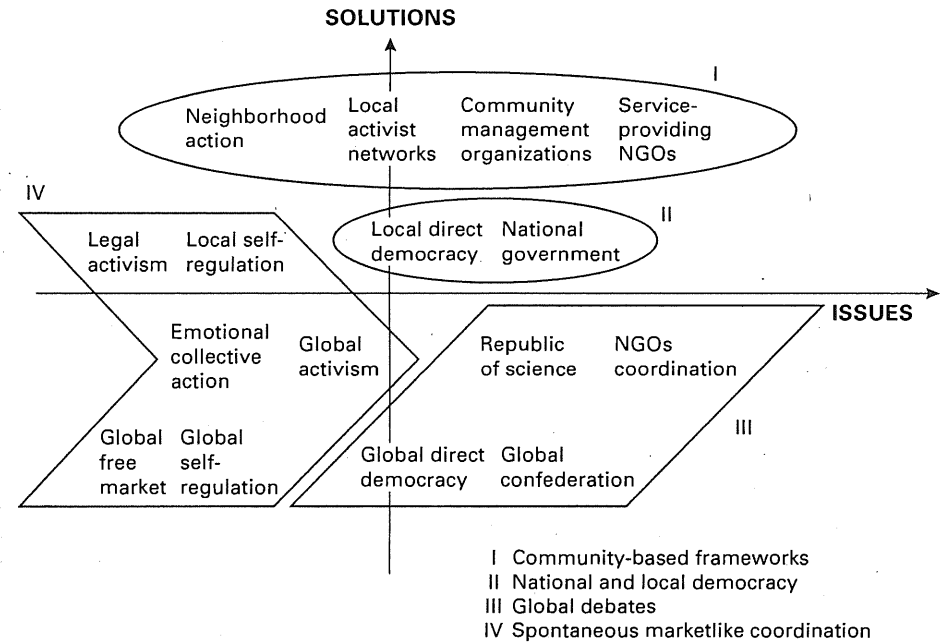IV   Spontaneous marketlike coordination

Figure 13.1
Performance of the basic governance mechanisms in generating knowledge on issues and solutions for GPG provision

Our results indicate that global organized debates have a positive effect on the generation of knowledge about the issues involved in the production of GPGs. Indeed, the cluster of mechanisms that are wide and organized are generally the best at providing knowledge about issues. This is true for NGO coordination, republic of science, and global confederation. However global direct democracy, which is also global and wide, only performs moderately well on issues, mainly due to its high coordination costs. The NGO coordination mechanism has the best overall performance on issues in this cluster. This result is especially relevant because of the prominence of this type of mechanism in global governance (for example, the Intergovernmental Panel on Climate Change, which we will discuss in more depth below).

The main weakness of global organized debates is their generally poor performance on knowledge about solutions. This weakness is also one of the major concerns raised in assessments of global debates in the literature. Key problems relating to this weakness are the difficulty of

involving citizens and communities in the debate over the more operational aspects of possible solutions to GPG provision, and the difficulty that global debates have in integrating the diversity of collective preferences at a national level when implementing worldwide agreements. National and local democracy mechanisms, which involve national governments, citizens, and communities in the debates, may therefore also be relevant to GPG provision, especially because they perform better than global debates with respect to knowledge about solutions.

Our analysis shows that two clusters of mechanisms perform equally well overall on issues and solutions. The first is the cluster of community-based mechanisms (service-providing NGOs, community-management organizations, local activist networks, and neighborhood action) in the upper part of figure 13.1. These mechanisms are based on the involvement of local communities and citizens in the debates about GPGs, and they are among the best-performing mechanisms for solutions. Community-management organizations and service-providing NGOs are particularly interesting, because they also are among the best for issues. They therefore represent the most effective governance mechanisms when the two dimensions are considered together. The second balanced cluster of mechanisms is that based on national and local democracy. These mechanisms are usually addressed in association with global mechanisms in the literature on multilevel governance. Both local direct democracy and national government are exclusive, and their main strength is their efficient use of cognitive resources and the speed of the cumulative knowledge-generation process. They perform rather weakly on revelation and adequacy when compared to global debates, but they are moderately good at issues, and perform well on solutions, so that their overall performance is balanced.

Finally, our analysis shows the weakness of spontaneous market-like coordination mechanisms for generating knowledge on global public goods. The subgroup of mechanisms embodying the principles of markets and competition and based on exclusive interests (global free markets, global and local self-regulation, and legal activism), performs among the worst on issues. The subgroup of global spontaneous and inclusive mechanisms (emotional collective action and global activism) performs badly on both solutions and issues. They are not organized in a way that encourages structured, cumulative knowledge generation, and they have major inefficiencies in the use of cognitive resources. The only spontaneous mechanisms that perform comparatively well are the local and inclusive mechanisms that we discussed above (neighborhood action

and local activist networks). Their strength on solutions stems from their proximity to direct user communities and stakeholder groups concerned with GPGs. This is a major incentive for testing the effectiveness of solutions in a way that is fine-tuned to the specificities of particular contexts.

Case Studies on Climate Change, Biodiversity, and Sustainable Develpment

In this section, we apply our theoretical argument to a set of case studies from global environmental governance, taken from the implementation of the conventions and action programs that came out of the 1992 Rio Summit. The Rio Summit was characterized by major innovations in global governance, the most prominent of which was the massive participation of civil society organizations, international federations, and other nonprofit associations in the debates. After the summit, new organizations for more systematic knowledge gathering were created, such as the Multi-Stakeholder Forum of the Commission on Sustainable Development. Three conventions, the UN Framework Convention on Climate Change, the UN Convention to Combat Desertification, and the Convention on Biological Diversity, as well as an action plan on sustainable development, Agenda 21, were the main outcomes of the Rio Summit. The issues of climate change, biodiversity, and sustainable development are all issues characterized by intense debates, conflicting and often absent collective preferences, and great uncertainty about the most appropriate solutions. Consequently, the Rio Summit and its subsequent implementation provide an appropriate collection of cases for testing our arguments.

Case Studies on Global Organized Debates on Climate Change

The **Intergovernmental Panel on Climate Change (IPCC)** and related initiatives such as the Earth System Science Partnership and the Multi-Stakeholder Forum of the Commission on Sustainable Development are examples of governance mechanisms corresponding to our category "global debate."

With the Nobel Peace Prize of 2007 awarded to the IPCC, the panel's activities have been widely acknowledged as effective and forceful in global policies (Alfsen and Skodvin, 1998; Siebenhüner 2002). Within the framework advanced in this study, the IPCC can be viewed as an NGO coordination mechanism characterized by a global, centralized,

and organized process relying on an inclusive logic (due to the prominence of scientists). Launched in 1988 by a joint initiative of the World Meteorological Organization (WMO) and the UN Environment Programme (UNEP), the IPCC's central objective is to assess the current state of knowledge on climate change, and to condense it into reports that are reviewed and approved by scientific reviewers and governmental experts. Since its beginning, the IPCC has produced four major assessment reports (concluded in 1990, 1995, 2001, and 2007) and a sizeable number of special reports and technical chapters as well as supporting materials such as guidelines and documentary material (see www.ipcc.ch). In particular the 2007 report (Intergovernmental Panel on Climate Change 2007) has been widely utilized in the media and public debates. Even political outcomes such as a decision by the heads of state of the G8 in 2007 and the EU can be linked to the findings of this report.

The outcomes of the IPCC processes are focused on the specific issues at hand, but are significantly limited in generating solutions-oriented knowledge. This reflects on the adequacy of the knowledge generated in the process. The IPCC is organized into three working groups that focus on the science of climate change (Working Group I), the impact of, and adaptation to, climate change (Working Group II) and mitigation options (Working Group III) with highly disparate processes. While the first group is dominated by physicists and atmospheric chemists, it is biologists, geographers, and ecologists who form the core of Working Group II. Working Group III is composed mostly of economists and political scientists who analyze the policy instruments for reducing CO_2 emissions. Over the four assessment reports, the products of Working Group I have gained the strongest acknowledgment and attention in the public debates. Its reports present recent research about the actual changes in the climate system and the increase in global mean temperature and sea level rise. This knowledge relates to the dimensions and characterization of the problem rather than to solutions. By contrast, solutions-oriented knowledge can mostly be found in the reports of Working Group III, and these are traditionally the most contentious of the three Working Groups' reports. Since Working Group III directly addresses governments' decision making and measures to achieve ambitious policy goals, governments have been critical of its work. In addition, different ethical and paradigmatic positions among the authors have furthered a tendency toward the lowest common denominator. The disagreements among scientific experts, and in particular among those who are in the government, has lead to weak formulations and a tendency to describe policy

options rather than to be prescriptive. In contrast to most national assessments (and other global assessment processes such as the Global Environment Outlook), IPCC's Working Group III has refrained from any clear suggestions or recommendations for the international negotiation process or for domestic climate policies. It restricts its reports merely to the description and analysis of possible policy instruments. In this respect, IPCC is a good illustration of the scores for the NGO coordination model in our theoretical framework.

In 2001 the **Earth System Science Partnership** (ESSP) brought together four formerly separate international research programs—the World Climate Research Programme (WCRP); the International Geosphere-Biosphere Programme (IGBP); DIVERSITAS, an international program of biodiversity science; and the International Human Dimensions Programme on Global Environmental Change (IHDP)—which exemplify our model of republic of science decision making. The aim was to acknowledge the systemic linkages between the subsystems of the Earth, namely the climate, the biosphere, the oceans, and socioeconomic systems, as one large interconnected system. The ESSP structures the related research fields by formulating science plans, organizing research programs, and exchanging information with funding agencies. It clearly illustrates the republic of science model that is characterized as wide, inclusive, organized, and decentralized. While its constituent programs have clear governance structures, the ESSP itself is loosely centralized: there is only a weak central coordination unit, and most research activities are conducted and coordinated in a decentralized manner.

The adequacy of the ESSP's knowledge-generating process can be described as good in raising issues and in analyzing problem dimensions. However, it is weak with regard to solutions. Its programs concentrate on original research that focuses on understanding the functions of the earth system and the influence of humans on them. However, solutions-oriented research is almost absent from all the constituent programs except the IHDP (where human actors are analyzed with regard to their ability to solve global environmental problems). Thus the documents produced by the ESSP are mostly analytical and rarely address solutions; nor do they formulate policy recommendations. More generally, the link to the policy world is difficult, and few of the projects have well-developed science-policy interactions or a wide audience in the policy realm.

In addition, the ESSP processes are comparatively slow. Most of its core projects operate with a time horizon of about ten years. A full

project cycle starts with a scientific plan that formulates central research questions and describes crucial avenues for research in the field. The drafting, review, and adoption of such a plan usually takes about eighteen months before the project itself is officially launched. In subsequent years, researchers are called upon to contribute to answering the questions through individual research projects. In addition, the plans are communicated to funding agencies to raise interest and give an impetus to the formulation of funding strategies. The intention is that, at the end of the ten-year period, the final results of individual research projects will be presented and synthesized with respect to the overall research questions.

The **Global Environment Outlook** (GEO) reports, published by the UN Environment Programme every two to five years, provides an example of a global confederation (UNEP 1997, 2000, 2002, 2007). It gives an overview of the environmental problems of the world and formulates directions for future policy action in fields of particular need. With this objective, it is global in scale, even though it is structured according to geopolitical regions with their own specific structures and policy challenges. The reports are drafted by a limited number of researchers and UNEP staff located in the different regions. In addition, UNEP and its experts strive to include external expertise in the process of drafting the chapters and in the review process. While the core authors invite some other scientists to articulate their views in regional workshops and try to include them in the report, a larger number of external experts are approached to review and comment on the final drafts of the report. However, when compared to the IPCC, the number of authors and reviewers involved (about 200) is low. These authors include scientists, experts nominated by governments, policy practitioners, and representatives of UN organizations. Since the process is monitored by UNEP, the preparatory team is not free of the exclusive interests of the national governments represented in UNEP's Governing Council.

Knowledge generation within the GEO process is well organized, since it consists of a well-defined sequence of consultancy workshops with governments and other experts to identify crucial questions and information needs in the policy world, followed by intense drafting and assessment work by the authors, and the review and publication process. It is also centralized since UNEP serves as the focal organization that pulls together all the contributions and regional chapters and forms it into one document.

UNEP's Global Environment Outlook provides a comprehensive insight into the most pressing environmental problems on Earth, and provides directions and policy options for policy makers. It is a document that contains knowledge that is considered highly relevant not only for policy makers but also for NGOs, scientists, interested individuals, and open-minded business representatives. While it has had considerable success in highlighting specific environmental problems and the need for action, the GEO also contains stronger statements about political decision-making needs. The authors clearly mark their key messages and use much stronger language about solutions and the political action required than the IPCC documents. Like the IPCC reports, however, the GEO avoids formulating policy recommendations. The smaller number of authors leads to less revealed knowledge than is found in the IPCC reports.

It is worth pointing out that the GEO documents are accessible to all interested groups. They are written not only for scientific audiences but also for informed lay citizens, policy makers, and other interested people. In addition, they are made broadly available through the Internet and book publishers, as well as in a shortened version particularly aimed at children. This level of accessibility partly contradicts the predictions drawn from our conceptual framework. Low accessibility was expected due to the exclusive character of the process. However, the partly inclusive character of the UNEP process (which has a mandate to raise awareness of environmental problems) explains this.

The **Multi-Stakeholder Dialogue** (MSD) in the Commission on Sustainable Development (CSD) illustrates the global democracy model. The CSD was set up after the 1992 Rio Convention to implement the objectives of the Agenda 21, the action plan for implementing sustainable development. In 1997 the MSD was created as a unique participatory model that allowed major groups and governments to engage in a global dialogue on specific sustainable development issues. In 2001 a total of 3,000 organizations (and thus many more individual representatives) were accredited as "observers," with the right to participate in CSD meetings, to submit written statements at their own expense, and to set up informal events and meetings at the discretion of the chair.

An overall assessment of the MSD shows rather weak performance in knowledge generation on GPGs, but some strengths in the revelation of issues, although there is a tendency for NGOs to compete for attention and access to the decision-making arenas (Mori 2004). In particular, established NGOs attempt to exclude newcomers, because it might

decrease their influence. Moreover, the various NGOs and associations have very different objectives in participating in the forum, ranging from lobbying by business associations to more open exchanges of views on issues of collective interest to find common ground. This has led to a process of negotiation and compromise rather than to a cooperative process aimed at creating better knowledge. It also has a negative impact on the speed and accessibility of the outcome. The main strength of the model is the capacity to reveal new knowledge on issues. Involvement in the MSD is highly organized and aims at the greatest possible representativeness. Equal participation is ensured by the steering group. Hence a lot of new issues can be brought to the attention of decision makers, and the MSD has been assessed as a unique way to involve major groups in reviewing the progress that is being made on sustainable development in the different member countries. However, the propositions made at the MSD are not guaranteed to be included in the chair's summary. Hence the connection with final decisions remains weak.

Case Studies on Multilevel Governance for Sustainable Development

The global debates discussed in the previous section have been criticized for their weakness in dealing with major differences in national collective preferences and for excluding nonprofit organizations and citizens from the effective decision-making and the more operational phases of the implementation. Multilevel governance frameworks involving national and local democracy and community-based frameworks have been proposed as alternative approaches, and we discuss how they are able to cope with these criticisms from the knowledge-generation perspective we have adopted.

Agenda 21 resulted in a multi-stakeholder process under the umbrella of the CSD. It was conceived from the outset as a multilevel initiative, and it had an important local component: Local Agenda 21 (LA21) is generally considered a major innovation because it is one of the few international processes that also addresses governance at the local municipality and community level. One of its goals is the direct involvement of citizens and citizens' groups in decision making about sustainable development. As such, this innovative process is a good illustration of a systematic attempt to implement local direct democracy.

One example is LA21 in the United Kingdom, which was conceived as an essential component of the UK Biodiversity Action Plan. Here we will discuss the particular case of LA21 in Norwich, a rural town of around 130,000 inhabitants in in eastern England (O'Riordan 2001).

The adequacy of the knowledge produced by LA21 in Norwich has been much criticized: a large proportion of it reflected the contributions of the different vested interests, especially the local authorities, who framed the process in terms of the need for continued and reliable economic growth rather than sustainability per se. Some of the environmental issues, including a reduction in traffic in the town center and preserving the town's heritage, were primarily considered under a "quality of life" heading. The process therefore only highlighted a narrow range of issues.

However, the LA21 process in Norwich did have a positive impact on the accumulation of knowledge and on improving access to knowledge, thanks to the involvement of citizens. Even though it was narrowly framed, it did massively increase the opportunities for deliberation on sustainable development. Moreover, the LA21 action plan has been reviewed each year through the development of sustainability indicators and through an annual conference at which progress is reported and assessed, and new issues are raised. Overall, it can therefore be said that LA21 increased the speed and accessibility of the knowledge-generation process.

The UK Biodiversity Action Plan (UKBAP), mentioned above and discussed in more depth in chapter 14, is a good illustration of the characteristics of national government initiatives. Under UKBAP, data on species and habitats in the United Kingdom has been gathered in a systematic way since 1994, and target-based action plans based on the data have been developed. UKBAP is considered a prime example of a modernist (reductionist and rationalist) approach to environmental management (Adams 1997), and, as such, it is a good example of our category of centralized and organized governance devices.

From a knowledge-generation perspective, the main drawback of UKBAP is the adequacy of the knowledge it produces on GPGs. It has adopted a narrow view, focused mostly on separate species and habitats, which can easily be reported by individual information providers, and reflects the local concerns of the various partners. This is in sharp contrast to the approach promoted by the international epistemic community, which views ecosystems as being composed of highly interdependent entities and interconnected levels of organization. However, the main strength of the UKBAP has been to effectively coordinate a wide range of individuals and organizations, including experts, and both governmental and nongovernmental organizations. Moreover it has increased the use of the available knowledge by implementing a single reporting system able to deal with very long lists of species and habitats. This has been a

major improvement over the veritable cottage industry of single-species NGOs which used to compete for public attention in the United Kingdom. In sum, UKBAP has made substantial progress in its principal knowledge-generating activities: prioritization (of species and habitats), planning (of targets and activities), and monitoring (of inputs and the achievement of targets). This in turn has helped to frame and consolidate the more local, dispersed initiatives of environmental associations and community organizations in the field of biodiversity monitoring and assessment. It has resulted in useful knowledge about the implementation of actions plans, although it has not contributed significantly to developing the knowledge base on stakes and issues.

Case Studies on Community and Citizen Involvement in the Use of Natural Resources

The third cluster shown in figure 13.1 consists of community-based processes. These are among the best performers for generating knowledge on solutions, but their performance on issues is more varied. We illustrate the four types of mechanisms in this cluster by first discussing the service-providing NGO model and community management organizations, which are characterized by explicit organization of the decision making and have the best overall performance. We then focus on the mechanisms based on spontaneous citizen involvement, which are less good at generating knowledge, especially knowledge of issues.

To a large extent, **carbon compensating agencies** can be considered as forms of organized local activism that are illustrative of service-providing NGOs. These agencies run projects to avoid carbon emissions or buy certified emission reductions under the clean development mechanism of the Kyoto Protocol of the UN climate convention. Many of them have an NGO background, or are still run as NGOs, and were constituted in an inclusive spirit in the sense of our framework.

As expected, this mode of governance performs well in developing adequate knowledge on solutions (e.g., on ways of organizing travel in a more carbon-friendly manner). These agencies aim to find new solutions to compensate for CO_2 emissions. However, their (relatively) narrow ends mean that they do not tend to contribute to the development of knowledge on issues (e.g., on the contribution of traveling to global warming). Carbon compensating agencies simply attempt to raise public awareness of the problems of carbon emissions generated by travel, and by flying in particular. Being interested in attracting "customers," they rely heavily on the Internet to spread information about the problems of CO_2 emissions, and the solutions they propose to deal with the issue. While duplication of effort among carbon compensating agencies in the generation of knowledge on solutions could be significant, due to potential competition among them, their inclusive orientation means that in practice it is quite low. The agencies cooperate among themselves, are often comparatively transparent, and implement quite similar solutions.

A more decentralized form of community and citizen involvement, which is especially relevant to GPGs such as climate change mitigation and biodiversity conservation, is the provision of ecosystems management services through collaborative management organizations. A case in point is the **Kristianstad watershed** in southern Sweden (Olsson et al. 2007). The Kristianstad watershed is one of Sweden's most productive agricultural areas, and it also contains one of the largest groundwater reserves in northern Europe. Since 1989 a collaborative approach to management has been in place in part of the watershed, which has evolved into the adaptive comanagement system of the broader Kristianstad Vattenrike Biosphere Reserve (KVRB). This system relies on a social network of concerned individuals and organizations and a multi-member organization, the Biosphere Office, which plays a key role in facilitating and coordinating the collaborative process to maintain the ecosystem services of the area. In particular the Biosphere Office has been able to facilitate information flows, identify knowledge gaps, and create nodes of expertise of significance for ecosystem management.

The inclusion of a broad range of organizations in the social network and in the Biosphere Office has led to the GPG aspects of the project being taken into account, even though its official scope is local management of the watershed. Through the networking of a set of existing organizations and actors, the learning process has been able to produce a set of cross-cutting concepts, such as landscape management, that reflect the mix of local and global issues at stake. The main strength of the decentralized collaborative mechanism resides in its capacity to enhance the revelation and accessibility of relevant knowledge. The Biosphere Office has been active in involving disparate actors (from local farmers to international nature conservation associations) in collective decision making, organized around clusters of topics of common concern. However, the other side of the coin is the high coordination costs induced by the decentralized nature of the project, and the slowness of the learning process because of the need to manage a complex set of independencies among the actors.

An illustration of the contribution of local activist networks to knowledge generation is provided by the **Danish windmill industry** (Smith 2006). Danish windmills were developed in the 1980s by a network of local activists with the help of farmers, and the industry became economically sustainable by selling electricity through local cooperatives. Lessons learned through years of user involvement in testing designs and techniques have led to major improvements. The success of this innovation is illustrated by the fact that today the knowledge produced in these local networks is used by the national government and major private corporations. As a result, the Danish windmill industry has grown from its initial grassroots and became a world leader in the sector.

In terms of our framework, the Danish windmill industry is an example of a centralized process, because of the important role of leader-activists, which centralized the available knowledge on technical issues and on social feasibility. However, because of the absence of an explicit mechanism of decision making about knowledge production, it can also be characterized as a spontaneous process.

In terms of knowledge generation, the activists' network operates very differently for issues and for solutions. First, the development of knowledge on solutions has clearly been successful. Based on the locally available and already well-tested motor technologies in the farming industry, reliable and workable solutions have been effectively elaborated. However, because of the spontaneous character of the knowledge-generation process, a big gap remains between the issues identified by the activist network and a comprehensive approach to the energy problem. In particular, in the absence of an organized mechanism, the scaling up of spontaneous grassroots innovations can be problematic and does not necessarily reflect the idiosyncratic framing of the problems as they were initially understood. An appropriate illustration of this issue is the giant 2-megawatt offshore wind-turbine sites in northwestern Europe; these sites are an outgrowth of the windmill industry, but they do not necessarily have the same environmental and energy effects as community-based windmill cooperatives.

A focus on (local) solutions rather than on (global) issues—which are taken as a given—also characterizes our last case study: **self-supplying, carbon-free communities.** Over the past decade, several local communities in Europe have adopted carbon-free supplies of energy. They generate 100 percent of their electricity from renewable sources such as wind, biomass, or solar energy. Because of the fluctuation in wind and solar energy, all such communities need either biomass or hydropower as backup technologies to ensure a continuous supply of electricity. While they remain connected to the national grid, they produce as much electricity as they consume. Several of the German 100-percent carbon-free communities, such as the energy village of Jühnde in Lower Saxony, have developed from research projects. However, the initiatives are in most cases spontaneous because they do not follow a general pattern and are not organized according to a general plan. Such initiatives correspond to neighborhood action in our theoretical framework.

Neighborhood action can take many different forms, and local and public authorities usually only facilitate coordination among local actors. Most efforts at knowledge generation are dedicated to apply existing (technical) solutions in local contexts. Within any one community, knowledge generation and sharing is generally rather efficient, but there are no guarantees of efficient translation or accumulation of knowledge across communities. Also, since the knowledge generated is mostly technical and specific, it is not easily accessible to third parties, either lay citizens or outside specialists. A network of carbon-free communities seems to be emerging, which might encourage more effective generation of knowledge and coordination of efforts in the future. Nevertheless, the high level of decentralization and low level of formalization of these local spontaneous initiatives has a structural tendency toward the duplication of effort.

Case Studies on Market Approaches and Global Activism

In this last section, we will examine case studies from the category of governance mechanisms—a category that is generally the worst at generating knowledge about issues, while also being poor (or at least only moderately good) at enhancing collective cognition on solutions. Among the market-like coordination mechanisms, we first discuss those that are worst on issues or solutions. Then we turn to examples of local self-regulation and global activism.

Bioprospecting agreements, as envisioned in the 1992 Convention on Biological Diversity, constitute a clear example of the global free-market mode of governance in respect of environmental resources. These agreements constitute an example of a "Coasean" solution to compensation for environmental externalities (Coase 1960). By granting property rights on biological resources to local communities and national organizations, these agreements assume that monetary compensation for the use of these resources by private companies will provide financial income to

the owners and be an incentive for increased stewardship for biodiversity. Since the Convention many bioprospecting contracts have been signed (Rosenthal, Beck, and Bhat 1999; OMPI 2001), but many of them have failed to deliver on this promise.

From the point of view of the adequacy of the knowledge about biodiversity it generates, this mechanism is rather poor. It tends to concentrate on the most accessible and already revealed knowledge, without a structured and systematic large scale (scientific) effort to analyze the natural milieu and the knowledge available in traditional communities. With the exception of some cases (such as Costa Rica) in which there has been major government involvement in establishing an inventory of biological resources in biodiversity hotspots, the knowledge produced by bioprospecting contracts has focused on identifying compounds by the "blind" screening of large quantities of biological materials, and has not addressed the complexity of interdependencies between the different levels of organization of coupled human and ecological systems. Moreover the sharing and spillover of this knowledge tends to be poor. There is no organized coordination among the main knowledge providers, and no efforts have been made to involve scientists, government branches, or local communities (beyond the extraction stage). As a result, these actors do not systematically investigate the issues that could contribute to the overall knowledge base. For instance, no research is done into the most sustainable way to exploit a particular bio-resource, once it has been discovered. This has even led to the depletion of valuable compounds identified in the natural environment. The privatization of knowledge and the decentralization inherent in the contracting logic leads to duplication of effort, with no mutual learning from parallel experience. The only advantage of the logic of bilateral contracting seems to be speed. The spontaneous, decentralized mechanism allows quick-fix methods for working on potentially interesting molecules to emerge, although the quality of the knowledge generated by these agreements between companies and communities is often very poor.

Local legal activism is often presented as a way to alleviate some of the negative aspects of the pure market solution in the field of bioprospecting. However, except for its local character, it shares a lot of the characteristics and weaknesses of the global free market. A well-studied example is the widely acclaimed **Kani model of benefit sharing**). This was the first case in which payments were made to holders of traditional knowledge for a successfully developed pharmaceutical product. The agreement resulted from the incidental discovery of the therapeutic

properties of a small herb by a group of scientists from a botanical garden who were visiting the Kani tribe in southern India. The scientists took the lead in negotiating a profit-sharing deal between their employer, the local community, and an Indian pharmaceutical company. As with the global-market mechanism, the only real advantage of this approach to generating knowledge on GPG provision is that it provides incentives for the speedy exploitation and development of the most accessible knowledge. However this case is really just an example of a windfall effect. The knowledge was only revealed by chance. Even though it resulted in benefits to the local community, the activist intervention did not seem to have much impact on knowledge generation.

Another way of improving bioprospecting agreements can be found in governance based on global self-regulation. The idea here is to have coordination on the user's side of the biomaterial in order to prevent a race to the bottom between the laboratories that are competing for new biomolecules. A recent example of such an attempt is the drafting of a standard agreement for transfers of biomaterials in the **European Culture Collections' Organization** (ECCO). The main advantage of this mechanism is the building of a common library of bio-resources, which then becomes a platform for liaison between the biological hotspots in the South, and the users, mainly industrial clients and academic researchers located in the North. In spite of this major improvement in access to genetic resources, ECCO does not address the main negative aspects of the bioprospecting logic that lead to a focus on the extraction of single biomaterials that are no longer understood in relation to their context. By definition, an *ex-situ* collection can only contain a small fraction of the knowledge that exists in the natural environment.

The chemical industry's **Responsible Care Initiative** provides an example of local self-regulation. Nowadays, almost all large chemical manufacturers of the world are involved in this initiative, which was originally launched in Canada. It is a voluntary undertaking that requires participating firms to comply with a set of fundamental environmental, health, and safety norms, coordinated by national chemical industry associations. No state authorities or other societal groups were involved in the establishment and implementation of the rules, and compliance is voluntary (Gunningham 1995; King and Lenox 2000). Despite its global coordination, the Responsible Care Initiative leaves most decisions to local firms and their plant operators. This is why it is discussed as an example of local self-regulation. Like other self-regulation initiatives, this

one implicitly aims to preempt more public and mandatory regulation, and it seems to be quite successful in that respect.

The knowledge generated within and through the Responsible Care Initiative is mostly focused on solutions to the problems of chemical factories, their employees, and their neighborhoods. The Initiative does little to address more generic problems, such as health risks due to the massive spread of chemical substances, or the environmental problems due to an accumulation of these substances in the soil, air, rivers and oceans. It concentrates on solutions for individual plants. Most of the knowledge that is revealed and shared among participants is technical. Since this knowledge is related to industrial processes, confidentiality issues are important and knowledge-sharing among firms is limited. The same is true of stakeholder dialogues. There are severe limitations on what and how much knowledge is shared, including the sharing of scientific knowledge with academic communities. Progress reports on the initiative itself are rather broad and do not go into detail. Thus knowledge diffusion occurs in a slow and filtered way that hinders spillovers and encourages the duplication of effort.

Greenpeace is well known to the broader public through its media campaigns and spectacular protest activities. Its climate-change campaigns are an example of our global-activism model of governance. Greenpeace is well equipped to raise public awareness about global environmental problems and to promote solutions. Through its centralized decision-making structure, it is able to act quickly and to diffuse new insights rapidly. It does not need to discuss and coordinate content at great length with numerous stakeholders, and it relies on the mass media to have an emotional impact on public opinion. However, Greenpeace is not a research body, and it rarely produces original knowledge on either the issues or the solutions. Moreover, it does not stimulate the production of new knowledge by stakeholders. Its target is really the public, not organizations or networks. It is worth noting that Greenpeace's national and local campaigns are better than its international campaigns at promoting solutions and raising awareness about particular environmental issues. Access to the mass media is the difference. Although local branches often cannot afford to finance large media campaigns, they can use their networks to support specific practical solutions (such as CFC-free refrigerators and tend to focus on cooperation-oriented activities aimed at dealing with issues by proposing solutions to the actors.

Global climate-change campaigns by **individual advocacy** (emotional collective action) have similar insufficiencies. For instance, between 2000 and 2008, the former U.S. vice president Al Gore organized a U.S.-focused, but globally active campaign to combat climate change. The campaign, and the activities of Al Gore and his team, emphasized providing knowledge on the dimensions, causes, and impacts of climate change. They did not generate new knowledge as such, but they packaged and disseminated existing knowledge. Whether this action aimed at raising public awareness will have a long-term impact on collective incentives to deal with climate change remains open to question. In the short run, it is clear that campaigns such as those by Greenpeace and Al Gore tend to ride the crest of the wave of established public opinion, rather than transform it. Radically new ideas usually have difficulty finding their way to a wider public.

Conclusion

This chapter has considered the global governance of global public goods. We have pushed further the idea that knowledge matters, and that institutional design also has an impact on cognitive capabilities. We have therefore sought to better understand how efficient alternative institutional solutions actually are in generating knowledge and in ensuring its distribution so that well-informed citizens can take collective decisions.

To analyze how alternative decision/governance mechanisms affect the process of knowledge generation, we have reviewed how the characteristics of the collective decision-making process impact on the various criteria for its performance with regard to knowledge generation. Since knowledge about issues is different from knowledge about solutions (the first being oriented toward the establishment of collective preferences, while the second is oriented toward the search for the most effective—and least costly—ways of addressing these issues), we analyzed the influence of the various characteristics of governance on the two types of knowledge separately.

Generally speaking, when the organizational dimensions that induce the best performances are considered, the three categories of performance require the following different governance characteristics:

• The best solutions for generating knowledge on issues associate wide scope and inclusiveness, while the best solutions for generating

knowledge on solutions are characterized by inclusiveness and decentralization.

· The best solutions for producing knowledge of issues that is quickly and widely available combine narrowness and organization; for knowledge of solutions, they combine narrowness with decentralization.

· The best way of minimizing costs is to rely on processes with a narrow scope, based on exclusive interests and centralized forms of knowledge generation.

It is therefore clear that the design of efficient governance mechanisms should rely on hybridization among governance principles based either on mechanisms combining various logics of decision making or on the combination of alternative mechanisms in the same process of governance.

When assessing the best overall performances on generating knowledge on issues and solutions, our analysis shows some contrasting effects. First, scope has a strong influence on the provision of knowledge on solutions: narrow scope is always preferable to wide scope, irrespective of the other organizational characteristics. Second, the best solutions for generating knowledge on issues are characterized by organized decision making, independent of the scope. Finally, the most balanced solutions for knowledge of both issues and solutions are characterized by narrow scope, inclusive orientation, and organized decision-making.

Methodologically, this chapter has built a framework for assessing the trade-offs between quality, relevancy, and cost in the overall performance of different governance mechanisms. Two methodological principles have emerged from this framework. First, the best balanced overall performance is not the result of a linear combination of organizational characteristics on single criteria, but a complex integration of several contrasting effects and trade-offs. There is no direct extrapolation from reasoning on single criteria to a multi-criteria analysis. Second, our analysis has proven to be a good heuristic for discovering and identifying some of the gaps in governance mechanisms that have very good performance on one criterion only. An important challenge that we have identified in this context is the need to combine these mechanisms with other institutional frameworks. The particular design rules for these hybrid mechanisms cannot however be known in general, but will depend on their fit with individual situations.